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## Addressing ecological light pollution at a national scale.

(Poster)

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Natural sources of lighting are a major environmental cue that help structure ecological systems, yet these are undermined by artificial lighting which disrupts key processes such as migration, pollination and reproduction. Despite knowledge of diverse impacts and a huge shift towards LED street lighting, conservation practitioners are struggling to respond. We present key findings from a research collaboration between the University of Bern and the Swiss Federal office for the Environment, which aimed to identify practical ways to reduce the ecological impacts of artificial lighting. This project involved a review of the data available on Swiss lighting, a review of the known impacts of artificial lighting on national priority species, and spatial modelling to identify particularly light-sensitive locations. Undertaking such an analysis at a national level had the advantage of bringing the data and research gaps into sharp perspective. We found that in practice, the data used by local governments to manage lighting is typically a database of lamp locations, which also includes entries for lamp type, wattage and height. No national lamp inventory exists, and records for all private sources of lighting (associated with hospitals, commercial and industrial areas) are missing. Other sources of information such as VIIRS satellite data are occasionally used, but only as a broad emission indicator. Some attempts have been made at aerial night photography, but images remain uncalibrated and therefore useful primarily as indicators of bright lighting locations. Nothing is known about the impacts of artificial lighting on the majority of species identified as priorities for nature conservation in Switzerland. Bats are the most well studied group, followed by birds. What was striking was the focus of studies on species reactions to individual point sources of light. In many cases, no information was provided on lamp type, height, luminous flux, wattage, or proximity to the ecological receptor. This is a serious deficiency, as practitioners will inevitably struggle to apply these research results, to identify which locations should be prioritised for mitigation. When considering the responses of these species to natural lighting cues, a range of papers were identified which highlighted the use of the setting sun to calibrate internal compasses or to trigger feeding, and the response to lunar lighting cycles. As a practical response to these deficiencies in lamp data and applicable research, we developed three spatial indicators covering the national extent which reflected three mechanisms by which species might be exposed to lighting. The first identifies priority habitats immediately adjacent to bright emissions, the second uses visibility analysis to identify light polluted viewsheds and the third identifies habitats where natural lunar cycles in sky brightness are undermined.

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## Regeneration of deciduous trees – Variable success of moose exclosures in central Sweden

(Poster)

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Repeated browsing by moose (*Alces alces* L.) may prevent tree saplings from reaching the canopy. Due to the large population of moose in Sweden and their preference for certain deciduous tree species (*Populus tremula* L., *Salix caprea* L., *Sorbus aucuparia* L.), there is concern for insufficient replacement of mature trees of these species, with consequent negative impacts on the associated biodiversity. To aid recruitment of deciduous trees, forest companies and conservation authorities have set up a number of exclosures in central Sweden during the last 20 years. The aim of this study was to evaluate the outcome of these exclosures, in terms of 1) the number of saplings, 2) the proportion that were browsed, and 3) the height of the tallest individuals. Study areas included 7 forest stands with fences (3 of which were burned prior to fencing) and 3 stands with log barriers. Three wind throw areas were also included as a type of natural exclosure. Controls were placed outside each exclosure. Due to the heterogeneity in the study design, each forest stand was treated as an individual study in the analysis. The most evident result was that 8 out of 11 fences were currently broken, and the rest had been repaired. Overall, there was great variation in how successful the exclosures were, but there were some trends: The number of saplings of birch, aspen and rowan was sometimes high, whereas willow was always present in low numbers. Birches were few in the wind throw areas. The proportion of browsed individuals was generally quite large both inside and outside the exclosures, and increased with age. The overall proportion browsed across all study areas appeared to be similar for aspen, willow and rowan, whereas birch seems to be of relatively minor interest. There was also a tendency for all species to have a higher proportion of browsed individuals outside the exclosures, where the variation was also slightly smaller. In general, there was a tendency toward taller saplings inside the exclosures, at least for aspen and rowan, and there was no consistent difference between exclosure types. Rather, there seemed to be a general increase in sapling height with age. The positive trend for especially aspen and rowan inside as compared to outside the exclosures stems mainly from the two oldest fenced sites which are both located in production stands, and might thus be a result of the fencing or an artefact of previous clearings. The small size of the log barriers limits their potential, and wind throw areas are not an alternative for human construction. Fences can potentially be successful in limiting moose browsing and enabling recruitment of deciduous trees, but it requires regular monitoring and maintenance.

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## Local forest continuity – important for species-rich *Micarea* lichen communities, but less so for decomposers

(Poster)

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Fragmentation has a negative effect on forest continuity, i.e. availability of a suitable habitat for the target species over a time period (1). The dependence of wood-inhabiting fungi on landscape level continuity is well acknowledged, but the role of local continuity has remained unclear. We explored the effects of local forest continuity (microhabitat and stand level) on the diversity of fungi inhabiting standing dead trunks of Scots pine (*Pinus sylvestris* L.). Specifically, we studied the species richness and community composition of decomposers and *Micarea* lichens. The study included 70 trunks in 14 forests in central Finland with varying state of continuity. We assessed the detailed history of each study trunk with dendrochronological methods to estimate microhabitat continuity. Dead wood diversity and past management intensity (number of cut stumps) were used as estimates for stand continuity. Altogether, we recorded 107 species (91 decomposers and 16 *Micarea* lichens) with 510 occurrences. To study the effects of environmental variables, we used generalized linear mixed models for species richness, and Bioenv-analysis and Nonmetric Multidimensional Scaling for community composition. None of the variables explained species richness of decomposers, but there was a positive correlation between *Micarea* species richness and the time since tree death. The results for community composition analyses were rather tentative. Nevertheless, the community composition of decomposers was best explained by dead wood diversity, and for *Micarea* lichens, the community composition was mostly determined by the combined effect of years from tree death, site, and dead wood diversity. Our results are in line with those of previous studies suggesting the restricted significance of local forest continuity for wood-inhabiting fungi. However, species-rich *Micarea* lichens communities seemed to depend on standing pines that have been available over long periods after their death. Local forest continuity might be more important for rare specialists (e.g. on veteran trees), and therefore, future research should focus on such species.

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## Various responses of ground beetles in natural versus anthropogenic edges

(Poster)

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Worldwide fragmentation and loss of natural habitats increase the occurrence of habitat edges that are transitional zones between adjoining ecosystems or habitats. Once created, edges are distinguishable by their maintaining processes: natural vs. continued anthropogenic interventions (forestry, agriculture, urbanization). According to our history-based edge effect hypothesis (Magura et al. 2017), dissimilar edge histories are reflected in the diversity and assemblage composition of their inhabitants. Testing this hypothesis, we evaluated available information on ground beetles (Coleoptera: Carabidae) in forest edges. A meta-analysis based on 39 publications showed that the diversity-enhancing properties of edges significantly varied according to their history. Forest edges maintained by natural processes had significantly higher species richness than their interiors, while edges under continued anthropogenic influence did not. The filter function of edges was also essentially different, depending on their history. For forest specialist species, edges maintained by natural processes were penetrable, allowing these species to move through the edges, while edges still under anthropogenic interventions were impenetrable, preventing their between-fragment dispersal. For species inhabiting the surrounding habitats (open-habitat and generalist species), edges created by forestry activities were penetrable, and such species also invaded the forest interior. However, natural forest edges constituted a barrier and prevented the invasion of matrix species into the forest interior. Preserving and protecting all edges maintained by natural processes, and preventing anthropogenic changes to their structure, composition and characteristics are key factors to sustain biodiversity in forests. Anthropogenic edges may contribute to the loss of biodiversity; thus, the restoration of edges under continued anthropogenic intervention is an urgent task in conservation management. Promoting habitat heterogeneity, and reducing the contrast between these edges and the surrounding habitats (softening the edges) to encourage movement of forest specialist species through the edges are crucial tasks during restoration.

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## Impact on species diversity of macroinvertebrates of the alien Gammarid *Pontogammarus robustoides* in the Daugava river and its reservoirs

(Poster)

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During the last decades European waters are subject to the influx of alien species mostly from North American and Ponto-Caspian regions [1]. Amphipods are the most commonly occurring and successful invasive invertebrate organisms that are able to change diversity and community's structure of the local species. One of such organisms is Ponto-Caspian Gammarid *Pontogammarus robustoides* [2]. This is one of the alien species that has rapidly increased its distribution range not only by European water ways and invasion corridors, but also by introduction in the 1960s for increasing of fish feed resources in Latvia and Lithuania. In this research we investigated *P. robustoides* impact on species diversity of macroinvertebrates in upstream of Lielupe river and Daugava river and its reservoirs. Samples collected in Lielupe river were taken into account only for a comparison of the influence of native species, because species of alien gammarids were not found there. Quantitative sampling of gammarids and other macroinvertebrates was done in the littoral part of the river From May to September in 2016 and 2017. Handle net (25 x 25 cm, 500 µm) was used as equipment for sampling. For the estimation of diversity there have been calculated Shannon index, Simpson index (inverse) and effective number of species (conversion of Shannon index). Results of research showed that *P. robustoides* affects in a negative way or reduces the diversity of species. Values of Shannon index ranged from 0.23 to 2.22, with average value 1.22, in the habitat with alien species. Whereas, this index values ranged from 0.86 to 2.51, with average value 1.91, in the habitats of native gammarids (*Gammarus pulex*, *Gammarus varsoviensis*) where *P. robustoides* was not detected. Simpson index represent similar results and pointed to the dominance of one or some species in habitats of *P. robustoides*. Average value of this index in alien gammarid habitats was 0.52, but in habitat with native gammarids – 0.77. A tendency was observed that the number of effective species decreased with a larger number of *P. robustoides* specimens, what could not be observed in habitat with native gammarids.

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## Mycorrhizal fungi in wood-pastures

(Poster)

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Traditional rural biotopes such as wood-pastures are species-rich environments that have been created by low-intensity agriculture. Their amount has decreased dramatically during the 20th century in whole Europe due to the intensification of agriculture. Wood-pastures host some fungal species that prefer warm areas and are adapted to semi-open conditions, but still very little is known about fungi in these habitats. We studied how management, historical land-use intensity, present grazing intensity, time since abandonment, and stand conditions affect community composition of ectomycorrhizal fungi. We found that the proportion of broadleaved trees, soil pH, and soil moisture are the major drivers of the communities of ectomycorrhizal fungi in boreal wood-pastures. Management, grazing intensity or historical land-use intensity did not have any effect. To conclude, present stand conditions are the most important factors to evaluate when planning the conservation of ectomycorrhizal fungi dependent on semi-open forest habitats.

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## Is climate change litigation sustainable?

(Poster)

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A Dutch court recently found against the Dutch State for having failed to do enough to fight climate change. In the ruling, issued in June 2016, a district court of The Hague allowed the claim filed by the environmental organization Urgenda, arguing that the Netherlands was infringing the principle of sustainable development, among others. Such a departure of the standard of conduct expected from the Dutch state amounts to negligence, according to the court decision. Such a case has had a huge influence, not only in the Netherlands but internationally, and not only from a political perspective but also from a legal one. By considering the Dutch State guilty of not doing enough to achieve the internationally agreed goals in order to fight climate change, this ruling has automatically become a leading case of comparative environmental case law and a pattern or model template for similar lawsuits brought in other countries (such as the *Klimaatzaak* case in Belgium, the claim of Greenpeace Norge and *Natur og Ungdom* in Norway, or the claim of a Pakistani lawyer before the Lahore court, among others). Interestingly enough, one of the basis on which several of these claims are grounded is the principle of sustainability (or sustainable development). Indeed, sustainable development is one of the very cornerstones on which Urgenda's activity is based, according to its bylaws. The poster exposes the meaning and scope of that principle in the context of environmental liability litigation in general and climate change litigation in particular. Taking the Dutch ruling a starting point, it inquires to what extent sustainability may or should induce or provoke changes in the present environmental liability law. In particular, it explores whether, and to what extent, tort liability may be established for having failed to keep up to the sustainable development principle and how this idea may have an impact on the practical application of the existing liability regimes. To that regard, attention is paid to several legal systems from a comparative perspective. It is concluded that the real impact of the Urgenda decision may eventually turn out to be smaller than initially expected.

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## Eliciting stakeholders' preferences towards numerical control of invasive alien mammals: a factorial survey approach with the Eastern cottontail (*Sylvilagus floridanus*) in Italy.

(Poster)

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Management schemes for invasive mammals that may involve direct shooting of animals must possess two fundamental attributes for working: being attractive for voluntary hunters, who often replace professional gamekeepers, and being accepted by the general public, which would otherwise delegitimize agencies. Traditionally, surveys are adopted to elicit the management preferences of these two stakeholders and to inform policy-makers. However, they suffer from social desirability bias and factorial surveys, where respondents evaluate hypothetical scenarios describing alternative management options, are supposed to be a more effective tool. We tested the effectiveness of factorial surveys to measure the preferences of citizens (n=144) and hunters (n=134) towards various control schemes for invasive Eastern cottontails (*Sylvilagus floridanus*) in Italy. Each factorial survey included a fixed number of management scenarios for cottontails, characterized by a fixed number of dimensions whose levels were assigned at random. Hunters declared whether they would have engaged in the various scenarios, while citizens rated their acceptability. Hunters were more prone to engage in control schemes for cottontails if these included shooting, rather than trapping, and if evidence of cottontail impacts over native wildlife or croplands was provided. Factorial surveys might be an effective tool to elicit their management preference for control schemes for invasive mammals in Europe. On the other hand, the attributes of the management scenarios did not affect their acceptability by citizens. This might underlie the existence of complex factors affecting the evaluation of wildlife management schemes by laymen, like Wildlife Value Orientations or negative emotions towards wildlife killing. Future research, combining qualitative in-depth research, structured questionnaires and experimental stimuli will be needed to provide further insights about them.

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## Conservation, local well-being and ecosystem services inside the Bwabwata National Park

(Poster)

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On a global scale, high biodiversity areas show a large overlap with the indigenous people's traditional territories, hence approaches in biodiversity conservation shifted from exclusion to involvement of local people into conservation management.

The hunter-gatherer Khwe San people, living inside the Bwabwata National Park (BNP) in Namibia, are involved in the national Community-Based Natural Resource Management (CBNRM) programme. For the sake of nature conservation, own-use hunting is banned, and gathering activities are restricted, depriving the Khwe to benefit directly from ecosystem services and to utilise their Traditional Ecological Knowledge (TEK) and practices. Meanwhile, the community earns CBNRM-generated income from trophy hunting and tourism concessions, however, whether the monetary benefits outweigh the loss of provisional and cultural ecosystem services is still in question.

Our research aims to reveal (1) the main constituents of local well-being (2) and the importance of provisional and cultural ecosystem services among those constituents by utilising the Photovoice method. Photovoice is a participatory photography method consisting of multiple processes by which participants can identify, capture and reflect on specific topics within their community (Wang & Burris 1997). We have conducted Photovoice sessions in three villages involving 24 local participants. A photovoice session consisted of a full-day basic photography training, four days of photo capturing on the research topic, followed by individual semi-structured interviews with the photographers and a focus group discussion with the wider community. The visual data and the transcribed interviews were thematically analysed following the structure of ecosystem services and well-being constituents in the Millennium Ecosystem Assessment Framework (MEA 2005).

The photos and related narratives highlighted the importance of the provisional and cultural ecosystem services in the local well-being of the Khwe. Food, medicine, traditional crafts and traditional practices were most commonly represented on the photos. Participants stressed *the insecurity of resources* and *the impaired freedom to access and use natural resources* as negatively influencing their well-being.

Our results showed that monetary benefits of CBNRM are not able to redeem the restricted access to provisional and cultural ecosystem services. Furthermore, it comes with a cost in local well-being. For CBNRM to stand up to its label, the approach needs to incorporate local well-being measures.

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## Seasonal change of dung beetles in Hungarian pastures, wood-pastures and forests – knowledge for the conservation of decomposers

(Poster)

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Dung beetles (Scarabaeidae: Scarabaeinae, Aphodiinae and Geotrupidae) have an important role in several ecologically and economically valuable ecosystem functions and services through dung decomposition and by improving soil characteristics. Their number has a decreasing tendency throughout in Europe and thus, the ecosystem functions and services they provide are damaged. Main reason of decline is the change of farming practices, namely the decrease of grazing livestock and seminatural pastures. Until the second half of the 20th century wood-pastures were traditional pasture areas and grazing in forests also had great importance. However, forest grazing has now almost completely disappeared, several wood-pastures are under restoration and grazed again, primarily as conservation management. The aim of the study was to describe the structure and functional composition of the dung beetle assemblages, its seasonal changes in wood-pastures, compared to forests and pastures. Our study was carried out in three landscapes in the Északi-Középhegység (North Hungarian Mountains) and the Dunántúli-Középhegység (Transdanubian Mountains) regions. Three sampling points per area were designated in each habitat. The sampling of dung beetle assemblages was carried out in spring (May), summer (July) and autumn (October) of 2016, using pitfall traps baited with the dung of cattle, horse and sheep, the three most important livestock species in region. Pitfall traps were emptied after one week. Collected beetles were identified at species level and were categorized into functional groups. Average dry weight of each species were measured as well. In all, more than 70,000 specimens of nearly 60 species were collected and classified into four functional groups: small rollers, big tunnelers, small tunnelers and dwellers. The seasonal pattern was similar in all the three areas: the highest species richness was in spring what is gradually declined to autumn. Densities and dung preferences were significantly different in the areas. The composition and biomass of functional groups also differed between habitat types and seasons. In general, pastures were dominated by small tunneler species in spring and summer, while the forests by the big tunnelers in summer. In autumn the abundance of dwellers increased in all habitat types. The dung beetle assemblages of wood-pastures show a transition between the assemblages of forests and pastures. In these partly wooded areas the species of forests and open grasslands may occur together. Therefore, we recommend special conservation efforts to maintain and restore wood-pastures and to graze with different livestock, to secure the functioning of diverse dung beetle assemblages.



## How reindeer grazing affects oroarctic fen vegetation?

(Poster)

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### HOW REINDEER GRAZING AFFECTS OROARCTIC FEN VEGETATION?

Keywords: bryophytes, herbivory, mires, plant communities, *Salix lapponum*

Vegetation responses to reindeer grazing are variable and largely determined by vegetation type; however, major part of the research has focused on the impacts of reindeer grazing on dry heaths and meadows. Willow-dominated, peat-forming fens are important summer habitats for reindeer, but the effects of reindeer grazing on mires are not well known.

Our aim was to increase the knowledge concerning the long-term effects of reindeer grazing on fen vegetation. The study was carried out in a treeless oroarctic study area across the border of Finland and Norway (68°49', 23°49'). One characteristic feature of studied fens is the abundance of *Salix lapponum*, a willow species subject to summer grazing by reindeer. Other dominant species include *Eriophorum angustifolium*, *Carex rotundata* and among mosses *Sphagnum teres* and *Warnstorfia sarmentosa*. We explored the effects of long-term (c. 55 years) difference in grazing between Finland (summer grazing) and Norway (winter grazing), and of 13-year exclusion of reindeer in Finland. Vegetation plot data sets were collected and heights of *S. lapponum* measured in 2002, 2006 and 2015. The fruiting of *S. lapponum* in response to grazing pressure was studied in 2015.

We found differences in abundance, plant size and fruiting of *S. lapponum* between grazing treatments. In non-grazed conditions, willows in Norway and in the exclosures were significantly more abundant, grew taller, and female plants had heavier and more frequent fruit bodies, than in the summer grazed plots. Our results showed no significant differences in species diversity between treatments or years, but DCA-ordinations of pin-point cover data revealed clear distinction between the Norwegian and Finnish fens. This mainly reflected differences in vascular plant community structure, while bryophyte communities had more overlap. The total cover of bryophytes was significantly higher in Norway. Ordinations did not clearly separate the summer grazed plots and the exclosures, and thus grazing may have legacy on mire plant communities still over a decade after reindeer exclusion.

In long-term, reindeer summer grazing affected especially *S. lapponum* stands and vascular plant community structure in oroarctic fens. Bryophyte communities appeared more resilient to the effects of grazing. Northern mires are large carbon storages, and reindeer grazing may interact with climate change and affect greenhouse gas balances in mires via plant community changes. The role of mammal herbivory in carbon cycle of arctic mires is, however, still uncertain.

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## Occurrence of starry ray *Amblyraja radiata* in marine protected areas of the German Exclusive Economic Zone in the North Sea

(Poster)

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On a global scale, about one quarter of all chondrichthyan fishes, i.e. sharks, rays and chimaeras, are supposed to be threatened. This is mainly caused by fishing mortality to which these species are particularly vulnerable because of their k-selected life-history strategy including e.g. large body size, slow growth and late maturity. This is especially true for the intensively fished North Sea. Although nowadays the fishing effort has been reduced in this region, a high number of chondrichthyan species is still depleted and listed as threatened in regional and/or national red lists.

The German MSFD Programme of Measures opens up prospects for including further species in the existing system of marine protected areas in the North Sea. As a precondition, species in question need to be identified as threatened and must occur in the marine protected areas. Unfortunately, records of chondrichthyans are generally infrequent as these species are still rare and the regular scientific surveys are primarily designed for catching highly commercial bony fishes.

In order to identify a potential overlap between the distribution range of chondrichthyan fishes and the German marine protected areas, species distribution modelling is performed for the starry ray *Amblyraja radiata*. This species is used as a start since it is currently the most abundant skate species in the North Sea and thus a higher number of records is available. The results shall reveal whether this method is suitable to predict the potential occurrence of data-deficient chondrichthyans in particular areas such as the German sanctuaries. If this can be confirmed, the presented approach could provide justification for adequate protection of chondrichthyan species in the German marine protected areas.

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## The effect of environmental fluctuations – Could climate change promote species' invasion success?

(Poster)

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The global climate change is presumed to increase the amount of fluctuations in the environmental conditions. This could increase the amount of species invasion into new areas if fluctuations affect the ecological and evolutionary processes that make species successful as invaders, and native communities and their environments more susceptible to invasions<sup>1</sup>. Disturbed environments are assumed to be more prone to invasions and the fluctuations in invasive species' home range could pre-adapt them to tolerate similar conditions elsewhere. Under fluctuating conditions, natural selection could potentially favor traits like generalism, which is profitable in adaptation to wide range of conditions<sup>2</sup>. These attributes could lead to better competitive ability of the invader against the native species, especially if the native species are mal-adapted to tolerate fluctuating conditions. Moreover, the distant relatedness between the invasive species and its native competitors is hypothesized to reduce their competition for the same resources and so increase the success of the invader<sup>3</sup>. We tested these theories of how fast environmental fluctuations and relatedness of species could affect the invasion success, with our aim to find effects that would be generalizable over the species. In this study, the invasion success meant the ability of the invader population to competitively displace the population of its competitor species. Bacterial species that had evolved in stable or fluctuating temperature were competed against the dominant bacterial invader *Serratia marcescens*, which had also evolved in stable or fluctuating temperature and the invasions were initiated in environments with similarly stable or fluctuating temperature. In addition, the competitor species were differently related to the invader. The results indicated strong species-specific effects on invasion success, which could be due to the more intense competition detected between closely related species. For most of the species, the rapid temperature fluctuations during invasion made invasions more successful. Unexpectedly, the evolution in the fluctuating environment did not significantly enhance the success of *S. marcescens*. Instead, our study showed that under fast fluctuations, natural selection could select for generalist genotypes, which invade better also in suboptimal environments. We found the superiority of *S. marcescens* also when its competitor species had mal-adapted to tolerate thermal fluctuations, but this result was strongly affected by one species. Overall, our results indicate that in the future, the traits of the invader, the attributes of its native competitors and the environmental conditions during invasion need to be considered together when predicting the success of the invasive species under fluctuating conditions.

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## Accurate spatial ecology of endangered Saimaa ringed seals as a base for fishing closure determination

(Poster)

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Saimaa ringed seal (*Phoca hispida saimensis*) is an endangered subspecies living landlocked in Lake Saimaa, southeastern Finland. One of the major threats of this small population (ca 370 seals) is by-catch due to mainly recreational gill net fishing. For mitigating by-catch mortality varied fishing closures and restrictions have been established in the lake over time. The fishing restrictions cover year round ban of the most dangerous fishing methods and springtime (15.4.-30.6.) gill net ban to protect especially the pups. In this study, we describe the usage of accurate spatial ecology data of the Saimaa ringed seals as a base for conservation measures. Telemetry tracking data of both; juveniles and adults (N= 41) together with the lair and haul out locations were used to determine the key distribution area for conservation measures. Radius of average home range (5.2 km) is buffered over known lair and haul out sites, to create overall occurrence area of the seals. The distribution area usage of the seals indicate that the seals occur almost all of lake surface area. This method approach was already utilized by government Decree (259/2016), and now closures are covering spatially ca. 60% of the lake surface area (4 400 km<sup>2</sup>). However, bycatch mortality still exists, which indicate that closures are inadequate and whole distribution area would need more fishing closures. Furthermore, the temporal gill net ban is underestimated as nowadays the by-catch mortality takes place outside the temporal ban.

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## COMMERCIALIZATION OF ALTERNATIVE LIVESTOCK FEEDS COULD SAVE FISH STOCKS IN LAKE VICTORIA.

(Poster)

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Fish is an important ingredient of livestock feeds. Therefore the increasing livestock production in East Africa implies increased exploitation of fishes. This is due to the use of some fish species like Silver fish (*Rastrineobola argentea*) as source of protein in animal diets. This is likely to result into over exploitation of some fish species which has implications for the survival of many other organisms within the food chain/web in the lake.

Literature reveals organisms that have a relatively high crude protein content. Insects such as cockroaches (65% crude protein) can be domesticated and used as animal feeds. This has the potential of boosting livestock production such as poultry, fish, and piggery farming. Non-conventional feeds such as cockroaches, houseflies, earthworms, carabid beetles, among others can be domesticated and used in livestock production. This can be achieved through rearing of these alternative sources of proteins and then processing them into a form edible to the livestock. This could partially or completely substitute fishmeal depending on the production. The small acreage of land required to raise these potential sources of protein for livestock production could also reduce on the impact of agricultural practices on watersheds. The biggest problem limiting the use of non-conventional feeds is limited information on breeding insects and community attitudes towards use of these insects as alternative feeds. There is therefore need to optimize conditions for large scale insect breeding and sensitize livestock famers on the integration of non-conventional feeds in the feeding regimes of livestock.

Key words: Livestock, Watersheds, Overexploitation, non-conventional feeds.



## The importance current and historical landscape structure and biodiversity on the provision of ecosystem services in cultural landscapes with high conservation values

(Poster)

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Calcareous semi-natural alvar grasslands in Estonia have lost up to 80% of their area since the 1930s due to changes in human activities and land use. Recently, under the European Union LIFE+ Nature project "Life to alvars", this situation has improved as 1500ha of these semi-natural grasslands have been recovered. These changes over time in landscape structure have strong effects on biodiversity and ecosystem processes, resulting also on profound impacts on the provision of ecosystem services (ES) and human well-being. However, for many ecosystem characteristics, changes in the landscape do not have immediate effects but are manifested after a considerable time-lag. Not considering these differences in the ES responses to changes over time can cause an over or underestimation of the ES supply. We investigated the effects of changing landscape structure on the supply of ES in cultural landscapes with high conservation values. We propose that the presence of time-lags for the supply of ES depends on its link to biodiversity due to intrinsic ecological dynamics.

We studied 41 calcareous grasslands in west Estonia which are part of the "life to alvars" project but have not been yet restored. For each grassland, we calculated the landscape structure (area and connectivity) using historical (1930) and current (2010) land use and vegetation maps. We also assessed three ES with different links to biodiversity. The link to biodiversity was given by the different combination of indicators used to calculate the service. Pollination, with a strong link to biodiversity, was calculated as the average of abundance and richness of wild pollinators (butterflies and bumble bees) previously standardized. Carbon sequestration, with a weak link to biodiversity, was calculated as the standardized amount of soil organic carbon. Soil fertility was assessed using the average of two standardized sets of indicators. One set with a strong link to biodiversity (abundance and richness of soil biodiversity) and another set with a weak link to biodiversity (soil depth, P, K, and soil organic matter content). First, we analysed if the landscape structure had significantly changed over time using generalized linear models. Then, we analysed using boosted tree regressions the relative importance of the historical and the current landscape in the provision of ecosystem services.

Our results show that the landscape has suffered a significant area and connectivity loss since 1930. Regarding the importance of historical and present landscape on the provision of ES, the results show that ES with a weak link to biodiversity could show time-lagged responses as the historical landscape was more important than the current landscape, contrary to what happened to those strongly linked to biodiversity ES. Hence, incorporating the ES link to biodiversity and historical and present landscape when assessing ES provision could prevent potential misestimations of ES.



## Do Finns see forest from trees? An assessment of continuous-cover forestry from recreational and aesthetic perspectives

(Poster)

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North European forests have, for most part, been subject to intensive forestry since the early 1950s, with clear-cut harvesting being the dominant regeneration method. Consequently, old-growth forests and their associated species have declined, but clear cuts also tend to disturb recreational users and tourists. To mitigate these negative effects, continuous-cover forestry has been proposed to combine economic, ecological and social interests. This regime refers to techniques that retain at least half of the trees in a stand per each harvesting entry, thus maintaining canopy cover throughout the logging rotation. However, the relative merits of different logging methods from aesthetic or recreational points of view are poorly understood. We therefore applied a two-step approach to evaluate people's views about a continuum of logging methods, from clear cutting to various techniques of retention forestry and unharvested mature forests. Firstly, in autumn 2017 we requested a total of 115 persons of different stakeholder groups to evaluate forest views based on photographs (taken in summer and winter months to control for seasonal impact) and, subsequently, to evaluate the same views in the field (to assess the similarity of evaluations based on photos and field visits). These groups were forestry professionals, members of hunter/gatherer, conservation and recreation societies, and non-Finn university exchange students with varying background. Secondly, in late winter 2018 we mailed the same photo-evaluation questionnaire for a random selection of 1,500 Finns, 15-75 years of age, and ran the questionnaire in the internet also. We will present an analysis of this approach, with focus on how people's background (profession, hobbies, other interests) relate to continuous-cover forestry. Our results bear significance for areas in or nearby recreational forests or tourist attractions, but they also provide yet another view for managing ordinary managed forests.

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## Environmentally sensitive behaviours and capercaillie (*Tetrao urogallus*) conservation in the Cairngorms National Park

(Poster)

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Since the 1970s local capercaillie (*Tetrao urogallus*) populations have been in severe decline in Scotland from over 20,000 individuals to just over 1200, 80% of which are confined to the Spey Valley in the Cairngorms National Park. This decline is thought to be due to a number of factors such as climate change, habitat loss and fragmentation. However, these issues are further compounded by increasing disturbance from human activity. In recent years, tourism and outdoor recreation have risen dramatically in the Cairngorms National Park leading to potentially increased disturbance events. For this reason it is important to understand the social dynamics that surround capercaillie conservation within the Cairngorms National Park. The aims of this paper are to identify current patterns of behaviour, understanding, and values amongst visitors to the Cairngorms National Park with relation to capercaillie conservation, and looking to how to best influence these behaviours to increase capercaillie productivity. To understand these issues an interdisciplinary approach was used where 200 social surveys, based on the theory of planned behaviour, were completed in Abernethy by visitors and recreationists. Visitor profiles gained from these surveys will be integrated into capercaillie niche models to try and identify which types of park user have more of an impact on capercaillie populations, and highlight areas where conservation efforts may need to be focussed. Results from this project will not only inform future research on fragile species within tourism environments but will feed directly into the Cairngorms National Park Authorities capercaillie conservation framework.

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## Matching compensation sites with potential ecological compensation (EC) actions

(Poster)

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Ecological compensation (EC) is the practice of transforming an area to recover ecological functions and characteristics that have been impaired due to the exploitation of natural resources (e.g. mining, logging) and changes in land-use (e.g. urbanization, transformation of the land into farmland). EC is usually done at large scales and seldom times at smaller scales that could involve citizen actions.

Our newly launched project "Science embracing art to launch small scale ecological compensation actions" aims to reach out to citizens in Finland to raise their awareness of nature conservation, make them familiar with the EC concept and increase their willingness to get involved in EC actions. The EC concept will be explored from the perspective of a wide range of citizens, including different focus groups that will be invited to participate in a set of workshops. The project will have a pseudonym name in Finnish to evoke the EC concept, so that it is easily understood and memorable by citizens.

As part of this project, we will develop an EC platform where citizens can suggest sites for EC activities. We will assess key characteristics (e.g. soil type, ecosystem type, state of degradation) in the suggested sites for EC actions. Afterwards, we will classify the sites according to shared characteristics. We will then suggest a set of potential EC actions ranging from simple/short-term to complex/long-term actions for the different sites. Thus, we aim to produce an efficient platform where sites are matched with potential EC actions. The effectiveness of the EC actions conducted on compensated sites will be assessed over time by using ecological indicators such as species richness and community structure. The above mentioned conservation ecology elements of the project, will be encompassed with the study of legal framework, social science and artistic elements.

Depending on the degree of equivalency with the original ecosystem, EC actions can be classified as either in-kind or out-of-kind (Cuperus et al. 1999; Villarroya et al. 2014). Our project will make use of both types, and will also make use of private gardens as one of the focal points where EC actions can be implemented to compensate for the environmental impact of regular citizens. The project aims to raise awareness of EC and motivate citizens to volunteer for EC actions in various sites.

A flow chart of the key characteristics to be used in building the EC platform will be presented in the congress. In addition, our poster will also show the key social and ecological aspects to be studied in the garden study.

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## Diversity matters: effect of density compensation in pollination service during rainfall shift

(Poster)

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Abstract of this presentation is not public



## Developing a rapid assessment tool to promote voluntary private land conservation in productive landscapes

(Poster)

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Conservation assessments and biodiversity monitoring are key for adaptive management and are part of any conservation policy. However, designing and implementing comprehensive and affordable assessment programs remains a challenge, particularly in contexts with limited resources for conservation. Rapid assessments (RA) tools have been developed worldwide to address this challenge and support decision making. However, these tools generally require accurate ecological information and a significant allocation of resources to cover technical and implementation expenses. In addition, many of the RA tools are only focused on biodiversity, whereas in productive landscapes, agronomic information and landowners perspectives are also key for the success of the tools. In Uruguay, the National System of Protected Areas (SNAP) covers only ~1% of the land, while more than 90% of the land is privately owned and under different production regimes. Therefore, there is a need to develop and implement voluntary private land conservation strategies to complement protected areas. In order to assess the effectiveness and compliance of these strategies at the management unit level (i.e. private property), the SNAP and the national NGO Vida Silvestre Uruguay worked collaboratively to develop a RA tool, appropriate for the social-ecological and institutional contexts. First, we conducted a global systematic literature review to assess the evidence on RA tools, addressing the peer reviewed and the grey literature. We also conducted workshops with decision makers and NGO staff to understand the main needs and opportunities for the RA tool to be implemented. We then conducted expert elicitations with biodiversity and agronomic production specialists to identify a suite of appropriate ecosystem conservation indicators and their ranges, following the Open Standards for the Practice of Conservation approach. Considering that the implementation of conservation actions on private land depends mostly on landowners' willingness to collaborate, we also consulted cattle ranching landowners to include their perspectives and to identify opportunities for win-win scenarios. The ranges were then built identifying acceptable values both for biodiversity conservation and for cattle ranching, with the aim to promote sustainable use of native ecosystems and to increase landowners' involvement. Finally, we conducted field surveys using the RA in a priority area for conservation in Uruguay to adjust and test the indicators and their ranges in a traditional cattle ranching region. As a result, our RA integrates public biodiversity databases, field data and landowners' perspectives to support decision making. It can be applied by a broad set of stakeholders, with limited resources, in a short period of time. This tool will be tested in different regions of the country and can potentially inform the development of RA to assess and promote conservation in productive landscapes in other countries.



## Understanding how the scientific community influences grasslands' management decisions – a social network approach

(Poster)

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Farming landscapes of Europe are vital arenas for social-ecological sustainability because their significant coverage and potential to integrate food production with biodiversity conservation. While the term 'governance' is popular but imprecise, network governance is well defined, and allows the analysis of informal and formal arrangements where independent people or organization work together towards a common goal (Scarlett and McKinney 2016). Even though real progress has been made in conceptualizing and analyzing network governance in landscape conservation, the use of social network analysis remains at an exploratory stage. This is mostly because methodological and epistemological differences between social science and ecology tools, which make the interdisciplinary approaches a challenging task (Popescu et al. 2014). The number of studies focused on management of grasslands in Romania is limited, and the grasslands management is still deficient despite the late legal motions, which most often do not consider the contribution of science to the process. Therefore, one important issue affecting grasslands management is the gap between practice and research, and no current approach captures the level of cooperation among the researchers in the field. As a result, it is necessary to demonstrate that interactions between researchers, policy makers and stakeholders can have a crucial impact on the management quality. This is why, this paper aims at using Social Network Analysis (SNA), a well-developed scientific domain that envisages network theory to analyze relationships between authors and current situation of the overall scientific network (available online on Scopus) compared with the Romanian network. The results illustrate co-authorship networks, invisible authors, academic stars, research groups dealing with grasslands, research topics in clusters, collaboration between domains, most central researchers, bridge researchers, and also interinstitutional cooperation. Thus, understanding the roles of researchers in the field, and also the connections established within a grassland management network may provide information for designing a better management (Plieninger et al. 2015) and will help Romanian scientists to reframe the debate surrounding the conservation of biodiversity in human-dominated landscapes. Our SNA findings will lead to improved collaboration and knowledge exchange between practitioners, scientists, policy makers and stakeholders and therefore will help overcome the main issues caused by Common Agricultural Policies. Because of the biodiversity impacts of contradictory EU policies, it is fundamental for Romanian scientists and authorities to re-evaluate the traditional approaches based exclusively on protection and conservation, and rethink the landscape policy, leading it towards planning and managing by considering the past experiences, research, traditions, and public attitudes.

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## Snow Leopard Population Genetics and Diet Analysis in the Baltistan Region of Northern Pakistan

(Poster)

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The snow leopard (*Panthera uncia*), is perfectly evolved to endure the frigid temperatures and rugged, inhospitable mountain terrain found throughout its Central Asian home range (1). This, along with its phantom-like behavior, make snow leopards especially difficult to study. Nonetheless, because of the vulnerable situation of this feline, it is imperative to research and gather as much information related to snow leopards as possible.

Fortunately, the emergence of population genetics through noninvasive scat sampling has made collecting data on elusive animals easier, making it the preferred method for doing research focused on difficult to observe fauna. This approach can provide information about species, sex, and individual identification, population density, species distribution, home range, land use, and diet (2).

Population genetics is the primary focus of this study due to the fact that data it provides such as the total number of remaining snow leopards, where populations are located, and where these populations are declining is information necessary for conservation action (1). Scats will be collected from the field and delivered to two separate institutions, both of which will run the same samples and cross-reference each other's results. Samples will be run through several polymerase chain reactions (PCRs), each providing valuable data regarding snow leopard sex distribution, population density, and genetic diversity (2).

Dietary analyses will aid in clarifying prey availability and abundance. Previous studies have found ungulates, both wild and domestic, to make up the bulk of snow leopard's diets (3). Their ungulate diet is supplemented with birds and small mammals, especially in the colder months when snow leopard demands outweigh the wild ungulate populations. Knowledge gained from analyses may ease tensions between snow leopards and humans by deflecting undeserved blame put on leopards by farmers for depredation (3).

Aside from retaliatory killings, other major threats to snow leopards include poaching, illegal trafficking of their parts, habitat loss due to livestock grazing and human expansion, and decline in natural prey due to legal and illegal hunting (3). Moreover, Pakistan has been ranked 7th most effected country in the Long-Term Climate Risk Index according to the German think tank – Germanwatch. Rising temperatures have led to an expansion of the upper forest limit, diminishing the home range of *Panthera uncia* and creating an environment for which they are not adapted.

The results of this study are expected to elucidate the health of the entire ecosystem. Genetic testing highlights snow leopard population statistics, while dietary analyses give insight into the prey species and even plant matter of the area. Data gathered through this research will provide answers to lingering unknowns and will be used to encourage positive change to protect the reducing environment of Gilgit-Baltistan, Pakistan.


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# The role of habitat trees in woodpecker conservation: a case study from the Black Forest (Germany)

(Poster)

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UNIVERSITY OF JYVÄSKYLÄ



## Pre-human impact baselines of South African mammal biogeography

(Poster)

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Relevant baselines on the historical distribution of species are needed to support appropriate conservation targets for depleted species. In South Africa, over-hunting and loss of habitat largely altered the composition and distribution of the large mammal fauna, especially since the start of the colonial period. Using modern ecological data therefore has the risk of considerably underestimating the full scale of anthropogenic impacts on biodiversity. By extending the timeline usually considered in ecology, long-term archives can provide novel insights into changing species distributions through time and represent a unique opportunity to better inform regional environmental management. Here, we use a large dataset of past distribution records for medium- to large-sized terrestrial mammals in South Africa, assembled from sources of the early historical period (late 1400s to the 1920s) to reconstruct the historical extent of occurrence and extinction dynamics for >30 large mammal species. We evidence local extinctions and changes in community composition since the early historical period. The biogeography of population loss is consistent with a response to the demographic expansion of European colonists spreading from the south-western part of South Africa. These results contribute to novel baselines for conservation and provide a strengthened evidence-base for understanding long-term faunal responses to human pressures. These findings also allow the "shifted baselines" around modern mammal distributions to be identified, providing an avenue for new analyses of large mammal biogeographic patterns for this region.





## Distribution changes, species richness and the role of protected areas in Europe and Northern Africa. The case study of waterbirds

(Poster)

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Evidence is accumulating that avian species, and particularly waterbirds, are responding to anthropogenic pressure and climate change by, inter alia, changing their distributions, both in the breeding and non-breeding season. This ongoing process raise a question about the effectiveness of the current network of protected areas delivering climate change adaptation for waterbird species at larger scale than individual countries. To improve the knowledge concerning this topic, we analysed 26 years of data on wintering waterbirds (International Waterbird Census) across 44 countries in Europe and Africa. Specifically, our goals were (1) to test if the winter abundances of 166 species have changed during the past three decades across the two most important flyways in Europe and northern Africa, (2) to study whether such long-term trends in wintering numbers differed between protected and unprotected areas (SPAs, RAMSAR) and between IBAs and non-IBAs, (3) to assess potential changes in species richness (i.e. number of species) over the study period in the northeastern, central and southwestern part of the flyways, and (4) to compare whether changes in richness is linked to the amount of protected land in each region. The results of the analyses will be discussed.

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## Environmental drivers of canopy gap geometry: a meta-analysis of gap disturbance regimes across forest biomes

(Poster)

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Forest degradation and related biodiversity loss require urgent improvement of forest management practices. Ecological forestry, including emulation of natural disturbances and retention management is considered a promising candidate for a management strategy aiming for reducing logging impact on biodiversity processes underpinning ecosystem services. However, properties of natural disturbances and their consequences on forest ecosystems show immense variations across different forest biomes. Therefore, understanding region-specific properties of natural disturbances (e.g. canopy gap formations) is fundamental to implement the appropriate emulation practices. Moreover, recent climate change is already altering disturbance regimes in relation to region-specific climatic factors. Canopy gap structures are primarily determined by the response of forest structure to disturbance intensity, and thus may be associated with climatic and geographic factors. To analyze this association, we collected data of forest canopy gaps from 180 publications across various vegetation types, and compiled dataset of gap size distributions. Here, we will report first findings on geographical patterns of gap size distributions, and their correlations with climatic variables (mean temperature, annual precipitation, and maximum velocity of wind) and stand structural attributes. Based on region-specificity of gap disturbances, we will discuss possible management practices that can emulate natural disturbances and contribute to the maintenance of potential forest structures.

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## Threatened plants in Kaptai National Park in Rangamati, Bangladesh

(Poster)

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A survey was conducted during the periods of 2015-2017 with an objective to study present status of some threatened species in Kaptai National Park, a protected area of Rangamati district, Bangladesh. A total of 38 plants were listed under various threat categories recorded from different areas of Kaptai National Park based on Red Data Book of Vascular Plants of Bangladesh (Vol- I& II) and Encyclopedia of Flora and Fauna of Bangladesh. A combination of transect with centered quadrats methods were used for sampling. Out of 38 targets plants 25 plant species were recorded from the study area occupying six major plant communities. The communities are Garjan bagan (dominant *sp. Dipterocarpus*), Jarul bagan (dominant *sp. Lagerstroemia*), Jam bagan (dominant *sp. Syzygium*), Segun bagan (dominant *sp. Tectona*), Mehogony bagan (dominant *sp. Swietenia*) and Mixed plant community. Mixed plant community is the harbor of highest number of threatened plant species (16 species), followed by Jam bagan (15 species) and Jarul bagan (13 species), whereas 11 species recorded each from Garjan bagan and Mehogony bagan. The lowest number of species was reported from Segun bagan (9 species). It was also found that *Scaphium scaphigerum* and *Symplocos macrophylla* have only single individual having very small population distribution which mentioned immediate conservation attention. Special care should take to maintain habitat of these small scale population for further studies on population demography and ecological requirements of these threatened species.

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## A five-step approach to evaluate effects of infrastructure on biodiversity at Malmbanan, Sweden

(Poster)

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The Swedish Transport Administration (Trafikverket) is planning a double railway-track along *Malmbanan*, between Kiruna and Narvik, due to increasing demands for iron ore from mines in northern Sweden. The project will lead to cumulative environmental effects in protected Nature 2000 areas with high values for nature conservation, the sami people, tourism & recreation and cultural heritage. Calluna AB, a nature conservation consultant, operating in Sweden, is in charge of the Environmental Impact Assessment (EIA) for the planned railway. The aim of the EIA is to evaluate effects on listed species and habitats that are present in Nature 2000 and to suggest compensation requirements for habitat loss. Calluna has developed a five-step work process to evaluate effects on biodiversity: 1) uniform collection of biological data e.g. via SIS-certified nature value evaluation, NVI. 2) unbiased handling and grouping of collected data. 3) analyses of grouped data to evaluate effects on biodiversity, based on reviewed research-techniques. 4) evaluations of results based on comparison with reviewed results within the fields of biodiversity, landscape ecology, wildlife-management etc. and 5) reviews of results and conclusions from unbiased specialists. Using this five-step approach, the project has resulted in a gross-list with large number of "possible" species and habitats deriving from field data, historical records (e.g. from literature), reports in Artportalen (a web-based tool for public reports of species data) and findings reported from local NGO's. The gross-list was then sifted into a net-list, consisting species and habitats that are more likely present within the area today. Subsequently, analyses of functional habitats (e.g. possible breeding habitats and home range areas) will be performed for migrating species such as birds and free range wildlife on a landscape level. Metapopulation species (e.g. amphibians and insects) in patched habitats (e.g. taiga, alpine birch forest etc.) will be analysed with cost-distance-analysis to describe distance and inertia between isolated habitats of interest and the habitat network functionality. Analyses of wildlife will be conducted by open source circuit scape-analysis for better understanding of flows and directions of existing wildlife (e.g. from moose, otter, lynx). A habitat deficiency-analysis will be performed to describe the extent of missing habitats for maintaining a favourable conservation status for listed species and habitats present in Natura 2000-areas. Effects on birds from noise will be studied with a method developed by the Swedish Transport Administration. Finally, to describe cumulative effects on coinciding, multidisciplinary fields (e.g. conservation biology, rights of indigenous people, tourism & recreation and cultural heritage) a new method for evaluating ecosystem services in infrastructure projects will be used.

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## Habitat Suitability Modelling of Endangered Kashmir Grey Langur (*Semnopithecus ajax*) in North Kashmir, India

(Poster)

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Habitat Suitability Modelling of Endangered Kashmir Grey Langur (*Semnopithecus ajax*) in North Kashmir, India

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Abstract:

The Kashmir Grey Langur (*Semnopithecus ajax*), distributed along some parts of Pakistan, Nepal and India, is endangered [1] mainly due to habitat loss. Its distribution limits are still uncertain and need to be resolved in order to determine its true conservation status. Here, we studied the distribution and the status of this threatened species in North Kashmir, India (Area ~ 10000 km<sup>2</sup>). From April to July 2016, we surveyed several protected and non-protected forests to collect primary as well as secondary information pertaining to distribution and threats of Kashmir Grey Langur. Program 'Maxent' was used for modelling and mapping the current distributional range of the langur in North Kashmir. Rainfall, elevation, slope, aspect, human foot print and other climatic variables were used as environmental layers for running 'Maxent'. Best model was selected on the basis of highest AUC value. Results indicated that Kashmir Grey Langur is distributed in all the protected areas of North Kashmir including some non protected areas with encounter rates ranging from 0.21 to 5.67 individuals/km. Langur probability distribution map was produced using presence point data and environmental variable raster data in the 'Maxent' program. The predictive map indicated probability values ranging from 0.0 – 0.87, indicating different levels of habitat suitability and hence different langur presence probabilities. Based on these considerations, we propose the extension of present distributional range of langur to Kashmir Valley.

Key Words: Maxent, Langur distribution, Habitat suitability, Predictive modeling.

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## Assessing the impact of post-fire forest management using beetles and ants as bioindicators

(Poster)

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Fire is one of the most frequent disturbances in forests ecosystems. Burnt forests in southern Europe are usually harvested with heavy machinery leaving very little woody biomass on-site. This second disturbance can alter the forests physical structure, ecological key processes, and the species dynamics and interactions. However, postfire logging practices using light machinery and leaving coarse woody debris on-site, would be a more sustainable alternative. This work analyzes the impact of forest fire and salvage logging in a Mediterranean pine-oak forest burnt in July 2016. Four plots of around 1 ha were logged in April 2017 (sustainable logging; SL) with light machinery, leaving the canopies on-site as piles of branches and preserving standing living trees. Three plots of similar size were unlogged (non-intervention, NI). The impact of the two treatments (NI and SL) on beetle and ant communities, has been studied in spring-summer 2017, soon after the logging. Ants and beetles have important ecological roles and are considered good bioindicators of forest disturbances. To capture flying beetles, 14 flight traps were placed at 3–4 meters from the ground in NI and SI treatments (7 per treatment) for 6 weeks. We then analyzed their abundance, species richness, diversity and feeding guild (DE defoliator, D detritivore, S sap feeding, G granivore, F fungal feeding, P predator, PD predator-detritivore, V vegetation feeding and X xylophagous). We captured 4533 individuals belonging to 123 beetle species from 23 families. There were no significant differences in species richness between the two treatments, although abundance and diversity were significantly higher in SL. A FAMD (Factor Analysis of Mixed Data) separates a group of non-saproxyllic (G, DE, D, P and V) from a group of saproxyllic (F, X, PD) species, more abundant at SL. On the other hand, 125 pitfall traps were set up in 5 microhabitats (25 traps/microhabitat): open ground and below sprouted shrubs in the NI treatment; and ground, below sprouted shrubs and under branch piles at SL. We captured 687 individuals belonging to 13 species of ants. There were no significant differences in species richness between treatments (NI vs. SL) and between microhabitats. However, ant abundance was highest below shrubs and under branch piles and diversity was highest in the open ground of SL. The higher temperature of this microhabitat likely favours the activity of different species. These provisional results will be completed with new plots managed by conventional salvage logging, with longer sampling until 2020 and with the parallel monitoring of vegetation, spiders, birds and mammals. Together, we hope to provide diversity indicators to be used in decisions regarding the management of burnt forests.



UNIVERSITY OF JYVÄSKYLÄ



## Using GIS tools to identify conservation hot spots in large boreal lakes

(Poster)

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Balancing the growing demands of human population and sustainable use of natural resources is a great challenge for humankind and the target of several international environmental conventions. Water Framework Directive (WFD) of the European Union aims at perceiving ecosystem services provided by aquatic ecosystems, while EU Habitats Directive (HD) along with the Natura 2000 network is to ensure the long-term survival of valuable habitats in aquatic as well as terrestrial environments. Both WFD and HD treat boreal lakes as large entities. In large lake systems, the assessment of lake bodies' ecological and conservation status is determined over tens or even hundreds of square kilometres and the interpretation is often based on a few scattered field observations. Variation in ecological communities within lake bodies has received less attention, though detailed information on the spatial structuring of the communities and conservation values would improve the reliability of the ecological and conservation assessment of the habitats and promote more effective land use practices. Here, we present the first results of GIS-modelling based on intensive surveys of diversity of lake habitats in Freshwater LIFE IP project. The target lake, Southern Konnevesi, is an oligotrophic clear-water lake of HD habitat type "Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)" defined by characteristic submerged vegetation. We use maximum entropy modelling with environmental variables describing geomorphological variation on different scales to show how water depth, slope of the littoral zone, wind exposure and sediment type explain the distribution of littoral vegetation zones, i.e. different life-forms of aquatic vegetation (helophytes, nymphaeids, isoetids and elodeids). The variability of littoral vegetation zones corresponds to habitat diversity. We use the presence of isoetids restricted to the genera *Isoetes*, *Littorella* and *Lobelia* as an indicator of high conservation value for a site. Further, local anthropogenic stressors will be included in the model to evaluate the risk of human land use practices on the submerged vegetation with high conservation value. As the most influential environmental variable defining the distribution of aquatic vegetation is water depth, a good bathymetry model is needed in order to produce reliable predictions about the distribution of underwater biodiversity in new locations. Availability of detailed GIS data describing lakebeds will pose challenges for the transferability of underwater habitat distribution models. However, increasing interest of citizens in using remote sensing equipment such as high-quality sonars by fishers will likely enhance the availability of such data in the future.

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## There is more than meets the eye: Evidences of a multi-sensory and restorative experience of nature in a French urban park.

(Poster)

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As we move along in this century, western societies appear more and more separated from nature, notably in urban contexts. However, regular contacts with urban nature have been shown to have positive effects on human health, well-being, cognitive and psychological restoration. In this context, studies demonstrate that urban parks give urban dwellers the opportunities to have contacts and live experiences of nature (Soga & Gaston, 2016). This experience of nature is complex and multisensory (Clayton et al., 2017). Sensory experience of nature has been considered mostly through monosensory studies, especially vision and audition. In contrast, despite its importance in the construction of human self and identity, the sense of smell remains poorly included in the understanding of individual psychological relations to nature. By applying a two steps quantitative study in one park in the heart of Paris, we aimed to (i) determine whether visitors could describe their experience of nature focusing on one or several senses, (ii) identify the potential importance of olfaction in this multisensory experience and (iii) identify the main dimensions used by visitors to describe this experience.

A site survey was then conducted from May to August in 2016 and 2017, studying how visitors describe their sensory experience (first multi-sensory, then focusing on smells).

Based on the answers from 765 French adult respondents, we showed that 65% of them used one or more of their senses to describe their experience, with the olfaction being the most used sense in the multisensory part of the study. This result goes against the common belief that people usually are hardly able to provide descriptions of sensory experiences. Among the main dimensions used to describe their experience (biodiversity, non-living natural elements, memories and well-being), we found that 37% of the respondents referred to well-being and positive states in their description, even if they were not asked about it, and that these respondents were also the most connected to nature. We discuss these results referring to the restoration theories and call for more multisensory studies, highlighting the importance the sensory dimension of the experience of nature should take in urban planning and management plans to provide parks with optimal sensory experiences and potential restorative places to city dwellers.

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## Success and challenges of voluntary forest conservation in Finland

(Poster)

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The requirement for the development of voluntary conservation arose during the Natura 2000 process as private landowners were dissatisfied with traditional forest protection measures. In southern Finland most forests are privately owned and commercially used, thus the protected area (PA) network has remained scattered and disconnected.

The most important investment to voluntary conservation in Finland is the Forest Biodiversity Program for Southern Finland 2008-2025 (METSO). The program aims to increase biodiversity in commercial forests and improve the PA network. METSO is coordinated by the Ministry of the Environment and the Ministry of Agriculture and Forestry and implemented by local authorities. The objective for METSO is to have 96 000 hectares established as permanent reserves by 2025. In addition, the objective is to safeguard biodiversity on 82 000 hectares area of forest habitats in commercially managed forests with fixed-term contracts and nature management projects. The present proportion of statutorily protected forest land is 3,6 % in Southern Finland. After reaching objectives of METSO in 2025 the proportion will be around 4 - 4,4 % in this area.

In METSO land owners can voluntarily offer their forests to permanent or fixed-term conservation and to receive full compensation for that. Voluntary approach has increased acceptability of conservation especially among land owners and has been warmly welcomed by NGOs, forest companies, authorities, politicians and the general public. The focus is on private land but also municipal and state-owned lands are involved. The site selection criteria define which habitats are accepted in conservation. These include mainly boreal forests with natural characteristics.

The program includes research and development projects that outline the ecological and socio-economic impacts of the program and support the implementation. Ecological inventories show that the sites that have been protected in METSO generally have high ecological values (Siitonen et al. 2012).

A major challenge for METSO is how to maintain the financing over reign of several governments. Human resources and the funding for implementation of METSO have decreased over the years. Current international biodiversity targets should be taken into account through re-evaluation of the goals of the program. Small size of protected sites and poor connectivity of the PA network are main ecological weaknesses. With adequate resources, cooperation and transparent planning, voluntary conservation could provide tools to reach more ambitious targets to maintain and enhance forest biodiversity.

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## Development of artificial spawning nests for pikeperch (*Sander lucioperca* L.) in a highly modified shallow lake (Lake Balaton, Hungary)

(Poster)

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The recent fish populations of Lake Balaton considered to be not-self-sustaining, although only recreational angling is allowed in the lake. Stocks of the most important angling fishes (such as common carp, pikeperch), are maintained by artificially hatched and reared specimens by Balaton Fisheries Nonprofit Ltd. The main reason of the decreased reproductive success of native fish species is the lack of natural spawning grounds and substrates. Water regulation works conducted till the middle of the 20th century caused the loss of these important habitats. During these works the water level decreased and most of the nursery areas have been detached from the original lake.

The aim of our project is to develop and establish artificial spawning substrates for pikeperch. Previous studies reported, that the success of artificial nests depends mostly on their architectural complexity, and the material has only a secondary role. Tests were conducted for eight types (altogether 72 nests in three sites) of artificial nests over two spawning seasons. More than 70% of the deployed nests were used by pikeperch for spawning. No significant differences were found between the eight trial nest types regarding their occupation. This result confirmed the very low availability of natural spawning substrates and supports that fish may use artificial substrates as spawning grounds.

This project was supported by the “GINOP 2.3.2 -15-2016-00004: Establishing the sustainable angling-aimed management of Lake Balaton.”; and the “EFOP-3.6.3-VEKOP-16-2017-00008” projects. Árpád Ferincz and Ádám Staszny was supported by the Bolyai János Postdoctoral Fellowship of the Hungarian Academy of Sciences.

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## The effect of habitat fragmentation on climate-driven community changes

(Poster)

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There is ample evidence that the ongoing climate change has large impacts on the distribution of species and on the composition of biological communities. Specifically, we know that communities respond to climate change by a gradual replacement of cold-adapted species by warm-adapted species that shift their range towards the poles and colonise the sites that became suitable for them. However, this process of species turnover is dependent on the ability of climate-tracking species to actually disperse in the landscape. Habitat fragmentation is a major impediment to dispersal. It usually results from habitat destruction that divides habitats into smaller and more isolated patches, therefore reducing population viability and connectivity between the remnant patches. As such, habitat fragmentation can potentially prevent species to colonise habitats that have otherwise become suitable as a result of climate change. As a consequence, increasing ecological connectivity has often been proposed as a strategy to reduce the negative impacts of climate change on biological diversity. However, in practice, there is almost no empirical evaluation of the effect of habitat connectivity on community response to climate change.

Here, we used long-term monitoring datasets of European butterfly communities to assess the effect of habitat fragmentation on community change driven by climate. We extracted the percentage area and an index of the spatial aggregation of semi-natural habitat around monitoring sites at increasing spatial scales. In addition, we calculated in each of these sites the temporal change in community temperature index (CTI), a measure of the relative proportion of cold- and warm-adapted species, and assessed the joint effect of habitat amount and aggregation on CTI trend. Moreover, using estimates of colonisation and extinction trends of individual species, we assessed the effect of various traits on their sensitivity to fragmentation in a changing climate.

Altogether, these analyses revealed the impact of landscape factors on the restructuring of communities in response to climate change. We especially demonstrated that the trend in CTI was positively correlated with the amount, and negatively correlated with the aggregation, of semi-natural habitat, mainly at large spatial scales. This result suggests that the turnover of species driven by climate change was facilitated by the presence of a large enough number of stepping-stone habitats that allow species to gradually shift their distribution. Such findings have important implications both for understanding the drivers of species distributions and community compositions and in a perspective of landscape management.

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## NATURAL DISTURBANCE REGIME AND HABITAT DIVERSITY IN PRISTINE FORESTS LANDSCAPES (EASTERN PART OF BARENTZ REGION)

(Poster)

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The boreal forests provides a number of crucial ecosystem services. Unmanaged boreal forests displays high variability in structure and dynamics, which is important for biodiversity and ecosystem functioning. Preserving structural heterogeneity of forest cover, observed in natural ecosystems, can be accomplished by forest management following spatial and temporal patterns of natural disturbances. In contrast, traditional forestry aims at creating structurally homogenous mono-cohort stands with low biodiversity. Forest structure, successional pathways, and the disturbance regimes all change along topographic and climate gradients. It follows that nature-adapted forestry practices should reflect the differences in disturbance regimes and follow region-specific set of rules. Successful development of sustainable forest management policies is contingent upon accumulating empirical and region-specific data on natural dynamics of forests where natural dynamics still dominates. Majority of studies in this field has been done in North America, while similar studies on Russian boreal forests are limited. We argue that policies currently adopted in Canada and aimed at preservation of biodiversity in the landscapes just partially affected by forestry operations may be relevant in the Russian context. Efficient development of new forestry practices is seriously hampered by insufficient and poorly quantified information on the relationships between disturbance regimes and biodiversity, and quantitative information of the historical rates of variability in disturbance regimes themselves. Parametrizing disturbance regimes commonly involves disentangling effects of several disturbance factors, such as forest fires, insect outbreaks, and wind and extreme climate conditions. It follows that inventory of natural forest cover prior to the onset of forestry operations is of critical importance since it helps to obtain preliminary assessment of the scale of natural disturbance events and its distribution across the landscape in question. To this end, adequate inventory should help identify valuable habitats which may have experienced disturbance regimes which differed from regimes experienced by the majority of the studied landscape. To obtain this information for eastern part of Barents region, we studied habitat diversity and disturbance regimes of the pristine forests landscapes[1].The forested watershed are richly inhabited by endangered plant, fungi and vertebrate species, many of which are red listed. The forests exhibit high diversity of natural ecosystems and can be viewed as a representative example of the European middle and northern taiga with preserved gradient of different successional stages and habitat types.

1.Zagidullina A.Assesment of large scale disturbances regimes in intact forest landscapes/Natural and historical factors of development of actual ecosystems of Ural region,2017,Yaksha

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## Can a species confined to primeval-like forests reach fragments of habitat in a managed landscape?

(Poster)

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The Swedish government has taken initiatives to intensify the conservational work at landscape scale. That is, to analyse different needs for biodiversity, and together with different actors, for example the forestry sector, find ways for long time conservation of the biodiversity.

Old growth, moist spruce forests constitute an important habitat for a substantial part of the species belonging to the taiga. One of them is the saproxylic beetle *Pytho kolwensis*, in Sweden considered as endangered. The larvae feed on cambium on newly fallen spruces for about five years. After 10-15 years the log can no longer provide food for the larvae and the adult beetles have to lay eggs in other spruce logs. The logs are typically large trunks of old spruces (> 200 yr.), a structure no longer produced in the managed forest landscape. This type of old forest is today only found as fragments and the species is known from only about 20 localities in Sweden.

Although the habitat today is rare, it is comparably easily restored. Given enough time a spruce stand of average productivity will eventually become suitable for *P. kolwensis*, as long as no large-scale disturbance takes place. The question is; will the adult beetles find these fragments of suitable forest stands in a landscape dominated by young managed stands, i.e. is the dispersal ability of the species sufficient?

In order to reach an answer to the question, 54 spruce logs were felled in 2010 at different distances, at most about one kilometre, from a forest stand with a strong population of *P. kolwensis*. Preferably large old spruces were chosen, but in some cases, no such were found. Hence felled trees were 72-326 yr. old with a breast height diameter of 23-55 cm. Some of the cut trees were in stands in close vicinity to the source stand. Other were situated in stands surrounded by open areas without trees, habitat that possibly is avoided by flying adult beetles.

The study is performed in the central part of Sweden and is run by the County administration of Västernorrlands län. The inventory of felled trees will continue until all logs have passed the suitable stage as habitat for *kolwensis*-larvae. On ECCB 2018 the first results are presented, showing that so far some of the nearest situated logs have been colonized. The presentation also embraces what type of logs that have been used by the species.

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## Myanmar's semi-captive working elephant population is not sustainable without capture from the wild

(Poster)

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Wildlife populations in captivity are increasingly common, but captive populations often have a higher extinction risk and may require supplementation through wild-capture. Despite this, wild-capture may actually hinder long-term conservation goals by reducing remaining wild populations, and its direct and long-term indirect consequences for captive population viability are rarely addressed using longitudinal data. Here, we explore the implications of changes in wild-capture on population viability over 54 years using a multi-generational studbook of working Asian elephants from Myanmar. We show that population viability declined between 1960 and 2014 with declines in wild-capture. Wild-caught females had reduced birth rates and high mortality risk, but despite such disadvantages their capture is required to sustain the captive population. Importantly, survival in juveniles had a large influence on population viability, suggesting that targeting juvenile mortality may have a disproportionate effect on population growth. Myanmar's working population may constitute a third of the large captive population of Asian elephants (~16,000 individuals), and sustainable management of this population is crucial for the preservation of this species. Our results highlight the need to assess the demographic consequences of wild-capture as species are increasingly managed and conserved in altered or novel environments, to ensure the sustainability of both wild and captive populations.

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## Ecotourism in an archaeological site from the Danube Delta Biosphere Reserve

(Poster)

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Many cultural heritage sites are located within biodiversity hotspots and, through restricted anthropogenic intervention, allow biodiversity to thrive. These sites attract an increasing number of tourists, thus visitors-wildlife interactions and conflicts can arise. Little is known about how visitors perceive the wildlife occurring within their visiting areas, with differences in perception between species being expected. We evaluated through a questionnaire survey visitors' perception regarding the reptiles and amphibians inhabiting Histria archaeological site, located within the Danube Delta Biosphere Reserve. Past archaeological activities inside the site have positively influenced the ecology of tortoises through landscape changes (i.e., archaeological diggings), offering better hibernation sites for the winter and shelter during colder periods. We found that most visitors were not disturbed by the encounters with tortoises, terrapins, frogs and toads, while for snakes 20% were 'very' or 'extremely disturbed'. Disturbance elicited by snakes differed according to visitors' gender and nationality, women and Romanians being more disturbed. Similarly, emotional response was mostly enthusiasm, except for snakes when visitors expressed repulsion (65% of the Romanians, 30% of the foreigners), while 12% of Romanians expressed repulsion towards frogs and toads as well. Therefore education should be targeted differently according to sex, age and education level, by highlighting the need for preserving cultural and natural heritages in an integrative and educational approach. Our case study emphasized the necessity for in situ education and increasing public awareness in regards with wildlife inhabiting cultural heritage sites.

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## The elephant in the room; evaluating parasite infection with applications for management in an endangered host.

(Poster)

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In natural populations parasites are aggregated, with the majority of parasites found in few, specific hosts, whereas the majority of hosts harbour low or no parasite burdens. Previous research has outlined certain demographic groups, for example juveniles and males, as being carriers of higher parasite burdens compared to their conspecific counterparts. However many such studies are based on cross-sectional observations, or focus on findings from laboratory, captive or short-lived systems. While valuable, this skew in the literature leaves a gap in our understanding, namely that of how host-parasite dynamics operate in exotic or endangered host species, or host populations which exist in natural conditions. Consequently, there is comparatively little information concerning how infection dynamics operate in endangered or declining hosts, to aid management and welfare practices. The Asian elephant (*Elephas maximus*) is an endangered, declining species, which now exists in a fragmented populations in an area spanning approximately 5% of their former total range (IUCN 2018). Myanmar houses the largest captive population of Asian elephants in the world, with over half of this number comprising of semi-captive timber elephants, who are utilised in logging camps throughout the country. Parasites, such as gastro-intestinal nematodes, have been a recognised health threat to the working elephants of Myanmar for over a century (Evans 1910). However, few studies have assessed infection dynamics in this endangered host system. By utilizing both a multigenerational database and current measures of infection for ~300 elephant hosts, we determined host-specific variation in re-infection dynamics in response to anthelmintic treatment. First, we tested the effectiveness of treatment in decreasing nematode burden within 35 days of administration. Second, we investigated longitudinal changes in nematode burdens for different elephant demographics, following de-worming by anthelmintics, to establish variation in re-infection rates. Finally, we determine associations of treatment on host condition, using body weight as a proxy. Our results provide insights to nematode burden re-establishment for specific host demographics, in a little studied host system. As such, our findings have broader applications to the management and welfare of not only other Asian elephant populations, but also other captive, managed and endangered host taxa.

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## Mimicking small scale disturbance regimes to enhance biodiversity in middle-aged Scots Pine forests – a forest restoration experiment

(Poster)

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In 2005 the Federal Government of Germany has started to transfer valuable areas for nature conservation purposes to the German Federal Environmental Foundation (DBU) and others as National Heritage Sites (NHS). These areas are characterized by being large, relatively undisturbed landscapes with a mixture of forests and open habitats. They are known to host a high share of endangered biotopes and species. The DBU National Heritage aims at sustaining the biological diversity on the sites with the long-term goal, to leave all of the forested area to natural development. Although most of the sites are embedded in relatively natural forest, coastal and water landscapes, a large share of forests still consists of mono-layered scots pine plantations. In order to accelerate forest development towards a more structured and species-rich habitat, it might be advisable to implement forest restoration measures.

The DBU NHS "Rüthnicker Heide" close to Berlin, was chosen to conduct a large scale experiment simulating small-scale disturbance events in approximately 70-year old scots pine stands to investigate short- and long-term effects on structural, functional and species diversity. The experiment encompasses a design of four sample alternatives in four replications, each on a five hectare sample plot. The alternatives are meant to depict an increased structural complexity from 1. small scale to middle scale gaps with timber removal to 2. active deadwood accumulation where timber remains as "fallen deadwood" (downed by harvester) and "standing deadwood" (trees ringbarked by harvester) and 3. active deadwood accumulation with additional planting of deciduous tree saplings. Plots with no active intervention have been left untouched as an example for "passive restoration" (4.). All of the plots were fenced on half of their size to account for deer browsing. Inventories of structural, functional and species diversity were carried out before and after the forest restoration measures.

The study aims to reveal if the increase in structural diversity, i.e. generation of dead wood, gaps and planting of saplings, results in an increased species diversity or a shift in community composition of beetles, fungi and herbaceous plants, as well as an increased density of microhabitats. Preliminary results show no significant effects on plant and fungal diversity, however, a trend towards a higher mean number of plant species can be seen. The most promising short term effects are to be expected for beetles, but results are not available, yet. The restoration measures were able to increase the number of microhabitats (mainly root plates and bark fissures) in alternative 2 and 3 by 730 and 500%, respectively, whereas in passive restoration the increase was about 25%. Natural regeneration showed a significant increase for alternatives 1 to 3 as response towards canopy opening. The outcomes can serve as a blueprint for the treatment of similar forests in protected areas.

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## Promoting co-existence of Saimaa ringed seal and commercial fisheries by developing a seal-safe fyke net

(Poster)

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Saimaa ringed seal (*Pusa hispida saimensis*) is a critically endangered species, which lives only in the Saimaa lake area. Both commercial and recreational fisheries are common in the Saimaa lake area, and gillnets are one of the most common gears used in fisheries. On the other hand, drowning (or suffocating) into fishing gear is one of the most common causes of death for Saimaa ringed seal. Especially dangerous are gillnets for young, unexperienced seals. Closed season for gillnet fishing and technical gear restrictions are in use in large part of the Saimaa lake area to reduce fishing gear mortality of the Saimaa ringed seal, and to some extent restrictions have been effective. For commercial fishermen, fishing restrictions lead to decrease in fishing opportunities and income.

As a part of EU-funded Saimaannoppa-Life project, a new type of fyke net was developed and tested together with commercial fishermen. Main features of the gear are a steel bar structure in the fyke net throat which prevents seal from entering the closed end chamber of the fyke net. A further improvement was a partly cover on the fore-chambers of the gear. The modification made it possible to use fyke net in e.g. commercial percid fishery, which is traditionally carried out with set bottom gillnets. Main target species of the fishery are perch and pike-perch, both relatively high-value species. Especially during the open water fishing season, modified trap nets offer an alternative to commercial gill-net fishery. Results of the development work lead to changes in fishing restrictions, allowing the use of the modified fyke net in Lake Saimaa fisheries.

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## Microclimatic buffering of plant responses to macroclimate warming in temperate forests

(Poster)

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Global temperatures are rising. Temperature data derived from weather stations are used in order to assess and predict the impact of temperature changes on species, whereas the microclimate is often ignored. However, such local climates that are decoupled from regional open-habitat climatic conditions can locally buffer the impacts of climate change. With significant temperature buffering, species indeed need to migrate slower than anticipated, and therefore plants could have more time to adapt to the changing climate. Of all ecosystems, forests provide most proof of their buffering capacity due to the shading of trees.

Therefore, we aim to quantify, understand and predict microclimatic buffering of plant responses to macroclimate warming in temperate forests.

We make use of temperature gradients across four, complementary spatial scales. Miniature data loggers are collecting hourly air and soil temperature at 225 plots across Europe. In addition, data on vegetation, forest structure (i.e. terrestrial LiDAR) and management, light availability, macroclimatic temperature variability, and relative air humidity, litter and soil characteristics are being compiled for each of the 225 plots in spring 2018. The aim of this poster is to present the project set-up, the whole experimental platform and innovative methods applied to further our understanding on microclimatic buffering.

We will improve our mechanistic insights on microclimate buffering and included forest management as backbone of the experimental set-up to be able to soundly inform policy makers and land managers.

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## **A Preamble to seahorses in Mindanao, Philippines: describing variation and phenotypic differentiation of *Hippocampus* spp.**

**(Poster)**

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Abstract of this presentation is not public



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## Ecological and economic consequences of aggregating conservation sites and multiuse forests

(Poster)

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Intensive forest management has fragmented forest landscapes and decreased biodiversity and crucial ecosystem services. Current conservation and management efforts have not been sufficient and more efficient landscape level planning is needed to maintain biodiversity and ecosystem services in forest landscapes. One efficient way to improve the species survival and the maintenance of multiple benefits in forest landscapes may be applying an approach where a part (e.g. third or half) of the total area is managed as multiuse landscapes within which e.g. a third of the area is be protected [third-of-third (1), or third-of-half (2)]. Aggregated networks of protected habitats are expected to safeguard population's viability better than small and isolated habitats. Moreover, multiuse forests may support the protected sites and maintain multiple ecosystem services better than forests managed only for timber production. We explore the ecological and economic consequences of this approach by applying forest simulations of a wide variety of alternative management practices over 100 years in Finnish forest landscapes covering in total 46 000 hectares. To find the best areas for protection and multiuse landscapes, we run prioritizations of forest stands based on habitat availability of different indicator species by applying planning software Zonation. We create different scenarios in which forests are managed based on different combinations of objectives which are spatially aggregated or not. The objectives are: production (timber values), multiuse (delivery of multiple ecosystem services) and conservation (no management, total protection). Different shares and combinations of the above objectives allow us to explore the ecological and economic consequences of managing the part of forests based on conservation and multiuse objectives, as well as the effect of aggregating them. We hypothesize that 1) there are ecological benefits and economical costs in managing part of the forests based on conservation and multiuse objectives, and 2) aggregating conservation sites and multiuse forests spatially increases the ecological benefits and decreases the economic costs of them. Our results will provide knowledge about the applicability of the third-of-half approach for planners and managers.

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## Forest expansion on serpentine grassland communities: the impact of atmospheric N and land use

(Poster)

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In the Mid-Atlantic, USA we see a conservation crisis where multifaceted drivers and mesophication are accompanying afforestation on native rare serpentinite grasslands endangering local biodiversity. There are a number of directional natural and anthropogenic drivers, such as succession, acid rain, atmospheric composition, climate change, land use change, and pollutant deposition. The study objective was to explore the timing of expansion of *Pinus virginiana* and *Pinus rigida* was influenced by anthropogenic drivers. Comparisons of reconstructed tree establishment was related to climate (growing degree days and mean annual precipitation), pollution deposition (N and S) and site characteristics. Specifically, we hypothesize that traditional serpentine syndrome has been ameliorated by anthropogenic change that act as drivers of loss in species diversity, widespread mesophication, and compositional changes of plant communities.

We established 32 plots (10m x 15m) using stratified random sampling. Cores from 161 trees were sampled and cross-dated and interpreted in conjunction with aerial photographs to derive periods of woody establishment into grasslands. The effects of topographic (slope, inclination, annual direct incident radiation and heatload), soil variables (elemental analysis, pH, soil organic carbon, total nitrogen, depth, texture,  $\delta^{15}\text{N}$ , and  $\delta^{13}\text{C}$  values) and pollutant deposition data (total N and S) on species were examined using ordination and regression. Trends in establishment were compared to historic decadal means of the Palmer Drought Severity Index and mean maximum temperature ( $T_{\text{max}}$ ) and minimum temperatures ( $T_{\text{min}}$ ). Multiple linear regression was used to establish relationships between potential drivers of woody afforestation.

Diversity (H) is strongly correlated with soil depth, bulk density and negatively related to heavy metal content and heat load. The tree age structure show discontinuous patterns with peaks of regeneration pulses and periods of either low or absent recruitment. The period prior to 1900 is composed of 54% xeric oaks and when all oaks are grouped they comprise 79% of trees from that era, though *Q. montana* is absent from this group. The period between 1900 and before 1940 records a change in the age-frequency distribution of species with a marked increase in conifers and concomitant decrease of xeric oaks comprising 39% and 19% of all species respectively. Between 1950 and 1990 the percent of xeric oaks decreased to 3%, conifers to 13% while *Acer spp* increased to 19%. The number of shade tolerant species rose from 12.5% in the decades from 1850-1900 to 59% during the interval from 1950-1990. Percentage decadal tree establishment showed strong relationships with climate variables such as PDSI and pollutant deposition. Our preliminary results highlight the importance of anthropogenic driven change affecting species composition in serpentine systems undergoing rapid afforestation.



## **Non-invasive genetic monitoring of wolverines (*Gulo gulo*) in Finland: a microsatellite analysis of hairs**

**(Poster)**

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Abstract of this presentation is not public



## **“Blue Communities”: supporting sustainable and resilient marine management for coastal communities in SE Asia**

**(Poster)**

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Millions of people rely on marine and coastal ecosystems for food, employment and their general well-being. In recent years, the marine environment has suffered under pressure from the multiple, and often conflicting, needs of the people that use it. In SE Asia, marine activities are important contributors towards household incomes and community livelihoods, and consequently marine spatial planning involving coordinated decision-making has been highlighted as a key requirement for a sustainable future.

A 4-year UK-funded interdisciplinary research programme, "GCRF Blue Communities" is supporting the development, implementation and on-going management of initiatives that promote the sustainable use of marine resources. UK academics and non-governmental organizations (NGOs) are working with international partners and local stakeholders in this innovative, integrative approach, which is the first to be undertaken on this scale in SE Asia. Whilst we await the preliminary data from this programme, we share the integrated methodologies being used, present outputs of linked projects and discuss the challenges to conducting research and implementing plans that collaborators have faced in the region.

The focal areas are 'UNESCO Man and the Biosphere Reserves' or marine parks in Indonesia, the Philippines, Vietnam, and Malaysia. These 'science for sustainability' sites have an established, collaborative infrastructure in which initiatives can be developed and tested alongside local stakeholders, with an aim to trialling further afield with surrounding communities.

We present lessons learned from an integrated management plan of the first marine UNESCO Man and Biosphere reserve in the UK and discuss how these may be translated to the SE Asia context. We share outputs of an example integrative community health initiative by a partner NGO working in a marine reserve and explore options for the SE Asia situation. We present the methodologies used for our information gathering exercises, which include Evidence Syntheses, Ecosystem Services Assessments, Stakeholder Analyses and development of Theories of Change/Logic models particular to the region. These on-the-ground information gathering exercises provide an empirical basis for the management initiatives.

We discuss the need for, and the challenges faced with effective stakeholder engagement, capacity building and community involvement. Culturally-sensitive co-creation will underpin the up-take and implementation of the management plans both within and beyond the scope of this programme.

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## Finnish protected area network in a changing climate

(Poster)

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Climate change is projected to cause accelerating impacts on species populations, ecosystems and the services they provide. These impacts are often likely to be negative to biodiversity. Thus traditional static nature conservation should be complemented with climate-wise conservation planning perspectives, so that the dynamic changes in species distributions and assemblages will be properly taken into account (Ref. 1). In particular, the ability of Protected Area (PA) network to support viable species populations and representative habitat types and ecosystems under global environmental changes requires urgent examination. In such assessments, it is imperative to consider also the impact of land use in the intervening landscape, as it may critically affect species movements to newly suitable areas and PAs.

PA network in Finland includes designated areas that are nationally or regionally important for the conservation of species and habitats. However, insufficient attention has been paid for investigating its performance under changing climate, and assessing which species and habitats will be most at risk and whether the PA network is able to alleviate the negative effects of climate change on populations (Ref. 2). The SUMI ('Suojelualueverkosto muuttuvassa ilmastossa') project (2017–2019) will provide the first in-depth assessment of the effectiveness and adaptive capacity of Finnish PA network in protecting biodiversity and supporting key ecosystem services under the growing pressures of climate change and land use. The project focuses on four work packages: the effects of climate change on species (WP1), habitat types and ecosystems (WP2), the role of biogeophysical characteristics of PAs in mitigating the impacts of climate change (WP3) and the role of PAs in carbon sequestration and storage (WP4).

In WP1, the vulnerability of species to climate and land use change will be examined based on three commonly used criteria, i.e. species exposure, adaptive capacity and sensitivity to climate change, with a particular focus on traits increasing the risk of local extinctions (e.g. limited dispersal ability, habitat specialization). In WP2, the vulnerability of habitat types to climate change is reviewed and consequent implications for conservation considered. Key habitats are boreal forests, peatlands and alpine biotopes. In examining the biogeophysical features of PAs the focus is on the potential of local climatic variability and refugia to support populations. Moreover, spatial differences in the fine-scale velocity of the climate change will be compared in different parts of the PA network to determine the most vulnerable PAs and areas. Finally, in WP4, the first national estimates of the size of carbon sink in Finnish forested PAs will be produced.

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## Ecosystem-based Adaptation: A review of the constraints

(Poster)

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Ecosystem-based Adaptation (EbA) is an approach that is now widely used in climate change adaptation and development interventions especially in the least developed and developing countries. It focuses on strengthening the resilience of ecosystems, including ecosystem integrity and health, while also supporting communities and their livelihoods under a changing climate. In other words, EbA is said to have the ability to both utilize and support nature and ecosystem services, while also assisting communities in how they adapt to current and projected climate change impacts.

While EbA has certainly made progress as an adaptation approach, we still lack an understanding about how it can be effectively implemented, and the specific constraints and limits that it faces. We know that implementation of EbA approaches ideally requires a level of understanding about ecosystem structure, productivity and dynamics, and how these are affected by climate change and other direct anthropogenic stressors; information that is rarely available in developing countries. There are also other limits that relate to governance and institutions, social and cultural factors, biophysical limits, financial and economic, that all impact the extent that ecosystem-based approaches can be implemented as part of a more nature-friendly planning and policy regimes.

This poster presents research that synthesizes the main constraints and limits identified in the emerging body of EbA specific literature. We analysed in detail the following constraints: economic and financial, governance and institutional, social and cultural, knowledge constraints and gaps, and physical and biological constraints and limits. The identified constraints demonstrate the variety of limitations that ecosystem-based adaptation approaches can face, but also provide further grounds for research how such challenges can be overcome. The realization that human well-being is intrinsically connected to ecosystems and biodiversity can help approaches, such as EbA, to gain more hold and provide more positive development pathways that together can result in broader planetary well-being.

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## Is there a consensus in German forest conservation? Targeting forest conservation with compensatory payments

(Poster)

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Implementing forest conservation measures may lead to lower revenues, opportunity costs and additional expenses for forest owners. Half of the German forest area is privately owned, where it is even more challenging to implement forest conservation. Besides fair monetary compensation for income reduction, forest conservation targets and measures should be evidence-based and supported by forest owners and conservation agencies, likewise. However, problems are rooting in trade-offs between aims, limited consistency in target setting, vague concepts and discrepancies in compensatory payment legislations and implementation (1).

In order to derive a framework of targets and measures for compensatory payments in privately owned forests, we conducted a comprehensive analysis of nature conservation concepts of different stakeholders. By deducing an evidence-based and consensual system of conservation targets and measures, we claim a high degree of transferability and generality for the methods and results of our study. We conducted quantitative and qualitative textual status quo analysis in 79 biodiversity and forest conservation concepts. The concepts represented different stakeholders on various spatial scales, relevant to German forest conservation. To review the scientific rationale of targeting compensatory payments in Germany, we developed hierarchically ordered classification systems for forest conservation targets and measures. Furthermore, we wanted to reveal whether discrepancies in targets obstruct the conservation of forest biodiversity. In order to enhance the implementation of forest conservation measures in privately owned forest, we deduced a framework of relevant structures and biotopes for forest conservation.

Our analysis showed that in general, there is a broad consensus concerning forest conservation across stakeholders in Germany, with few differences in primary conservation focus. The main emphasis is laid on the preservation of species, ecosystems and natural forest elements. However, a broad range of targets was found, covering social, biotic and abiotic natural resources. Furthermore, the concepts mainly focus on active restoration and preservation measures to secure old and habitat trees and to protect species habitats in forests. Suitable measures to improve forest conservation in private forests are e.g. restoring degraded forest biotope types, continuing traditional forest management practices (wood pastures or coppicing) and conserving natural forest elements (habitat trees and deadwood).

In conclusion, targeting forest conservation in privately owned forests with compensatory payments can only be reached by choosing long-lasting contractual agreements with fair monetary compensation and improved cooperation among all participating parties.

(1) European Court of Auditors (2017): Special Report Nr. 1/2017: More efforts needed to implement the Natura 2000 network to its full potential. Luxembourg.





## Ecosystem services of the Pechurki quarry

(Poster)

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One of the actual problem is definition of targets for ecological restoration. Recovery at the quarry a lot of specialists see differently, someone sees it in increasing biodiversity, other, species from red list on the quarry, biomass of a stand, plant communities which existed before mining, soil resistance to anthropogenic influence and restore them after the mining operations, recovering links between plants and animals. We believe that one of the most universal criteria for the assessment success of ecological restoration could be ecosystem services. This investigation has been conducted on the Pechurki limestone quarry during the spring and summer season of 2016. The "Pechurki" quarry is situated in Slantsy town in Leningrad region, production of limestone was stopped in 2014. Biological reclamation had been initiated since 1970, in the course of the work pine was planted on the dumps. So at the quarry there are reclaimed plots with different times of overgrowing. However, the vast majority of the quarry area has been undergone spontaneous revegetation process. Species composition and projective cover of vegetation was estimated for different plant communities within each ecotype of quarry and soil characteristics were also evaluated. We also estimated the value of the ecosystem services provided by the plant communities in the quarry.

Calculation of ecosystem services of already-existing plant communities was carried out according to the formula proposed by A. G. Rosenberg (2016):

$E = S (T_d * N_d + N_t * T_t)$ , where:

$E_i$  - ecosystem services;

$S$  - area of plant communities;

$N_d$  - number of tree and shrub species;

$N_t$  - number of species of herbaceous plants at the quarry,

$T_d$  and  $T_t$  - valuation (this assessment used taxes to calculate the extent of harm to 1 hectare of herbaceous plants ( $T_m$ ) - 450,000 rubles, 1 hectare of trees and shrubs ( $AP$ ) - 750 000 rub.).

The total value of ecosystem services provided by the plant communities of the quarry was estimated at 108 480 mln. Rub. or 1,486,027,397 euros.

The existing ecosystem of the Pechurki quarry has a great environmental value, because a large number of rare plant and animal species have been found here. A large number of habitats for different species and biodiversity refers to "Supporting services". A lot of berries and medicinal plants, as well as edible mushrooms are provisionary services of the quarry. The "Pechurki" quarry is a unique object for ecological and biological education, therefore it provides cultural services.

Abandoned quarry - it is not a useless land, quarry is the source of a number of ecosystem services.

Rozenberg A. G. Prognoznye scenarii izmenenij jekosistemnyh uslug dlja dostizhenija ustojchivogo razvitiija Samarskoj oblasti. – Tol'jati. 2016. 22 p



## Feeding Ecology of Asiatic black bear (*Ursus thibetanus*) in Himalaya

(Poster)

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Mr. Anil Regmi

Many threatened and endangered animals face nutritional challenges that must be considered when designing strategies for their conservation and recovery, both for wild and captive populations. Here, the diet and proximate nutritional content of the leaves of plants consumed by Asiatic black bears were estimated in Api Nampa Conservation Area, Nepal during both summer and winter seasons. Nutritional geometry also was used to explore the macronutrient balance of leaves of plants species consumed by Asiatic black bear. Results of the study suggested that at least ten different types of plants species were found in winter Asiatic black bear scats, which were similar and highly correlated with summer diet. Arundinaria spp. was the main species found in Asiatic black bear scats from both seasons. The nutritional contents of the leaves of plants consumed by Asiatic black bear varied by species and season, with the highest protein content found in Halhale, fat in Rehum, and carbohydrate in Arundinaria spp., leaves in both seasons. Leaves of the most consumed species (Arundinaria spp.) showed decreased protein and ash content from summer to winter. The macronutrient balance of all leaves combined was close in nutrient balance to the most frequently consumed Arundinaria spp. in both summer and winter. The summer leaves were higher in protein and lipid than the winter leaves, while the winter leaves were higher in carbohydrate. Asiatic black bear rely mainly on Arundinaria spp. as a food source in both seasons so Asiatic black bear habitats including Arundinaria spp. should be protected properly to in order to conserve Asiatic black bear in their natural habitat.

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## Predicting the future for endangered birds

(Poster)

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### Predicting the future for endangered birds

Climate and habitat explain to a large extent the distribution and abundance of species but nowadays climate change and increasing pressure on land use are causing notable declines in various species populations, and even extinctions [1]. From the cost-efficient conservation management point-of-view it is important to know which (currently common) species are in risk to become endangered in the future. To prevent species from becoming endangered we should also understand which factors are causing population declines.

Here we use presence-absence data on 265 bird species to model their future breeding distribution areas. We use species which were observed in the common bird monitoring scheme censuses in Finland, Sweden and Norway during 1975-2015. In the analysis we use the groundbreaking concept of Hierarchical Modelling of Species Communities to build an ecological model that explains species occurrence [2]. The model is unique in that it takes into account not only climate and habitat but also species traits such as migratory behavior, taxonomic relatedness and the co-occurrence of other species. By adding various scenarios of climate change (increasing temperature) into the model, we will be able to make predictions of future species occurrence.

The results will help to understand how climate change will affect various species, and how we should prepare for those changes. In addition we will explain how the results can be applied in the national red listing as researchers are currently compiling an updated Red List of Finnish bird species. For the first time the Finnish evaluation includes use of criterion E, which requires an extensive quantitative analysis to estimate the extinction probability of a taxon based on known life history, habitat requirements, threats and any specified management options [3].

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## Advanced Earth observation techniques in forest biodiversity and carbon sequestration mapping

(Poster)

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Integrating multisource Earth observation (EO) data and methods allows studying forest biodiversity and carbon sequestration related questions at various spatial and temporal scales. We aim to develop and produce novel remotely sensed variables describing biodiversity and ecosystem properties using a multi-sensor approach. We utilize 1) optical satellite images (e.g. Sentinel, Landsat), 2) airborne laser scanning data, and 3) unmanned aircraft systems (UAS). Optical remote sensing covers large geographical areas at 10-30 m spatial resolution and temporal span of several decades. Laser scanning is a superb method to capture the 3D structure of forested ecosystems with sub-meter accuracy, and has been used in growing numbers to study wildlife habitats and biodiversity. Novel UAS methods contribute for bridging the gap between field and airborne measurements and providing ultra-high spatial and temporal resolution imagery for detailed assessment of different ecosystems properties. Because of the potential for rapid deployment, spatially explicit data from UASs can be acquired irrespective of many of the costs, scheduling, logistic and weather limitations to satellite or piloted aircraft missions.

We will develop further on the concept of spectral traits (ST) in boreal environments<sup>1</sup>. Biotic traits, especially functional traits, are becoming increasingly important concept in ecology, conservation biology and sustainable resource management. They can be biochemical, physiological, morphological, structural, phenological or functional characteristics of plants, populations or communities. Spectral traits are traits that can be directly or indirectly recorded using remote sensing. Deriving spectral traits from various remote sensing data can provide detailed valuable information for biodiversity research. Calculating the spatial composition and configuration of spectral traits plays a crucial role in distinguishing different forest biotopes, communities and species, and linking biodiversity variables with ecosystem functioning and biogeochemical processes. In addition to optical remote sensing, the planned use of lidar data allows studying traits related to forest and vegetation structure in 3D. As a case study, multi-source remote sensing data will be collected from old-growth forest sites located in Central and Eastern Finland, where various field data (e.g. the occurrence of deadwood and polyporous fungi) are available. By combining these information, we aim at finding efficient remote sensing methods for mapping the indicators of forest biodiversity.

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## Influence of vegetation and land use on functional soil conditions and soil erosion in the western coastal plain of El Salvador

(Poster)

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Soil conditions have critical effects in the function of ecosystems, and consequently, in human society. Vegetation affects soil through important feedbacks, and both vegetation and soil can be altered by human activities. In El Salvador, and in many countries worldwide, agricultural land use and management are major activities affecting vegetation, water resources and soil conditions. Hence, in order to better understand how soil quality and water availability can be improved through changes in vegetation, land use and in agricultural practices, this research aims to answer what is the influence of vegetation and land use on functional soil conditions: infiltration capacity, stability, degree of erosion, organic matter availability and moisture content; by comparing the main land uses in the western coastal plain of El Salvador: forest, resting lands, pastures, corn croplands, plantain croplands and sugar cane croplands.

The Landscape Functional Analysis (LFA) indicator methodology was used to assess soil conditions. Vegetation structure variables and soil condition indicators were collected in five sampling transects per land use, accounting for 30 samples in total, each containing six subsampling points along the transect. Three LFA indexes were also generated and compared: Nutrient Cycling/Organic Matter, Stability and Infiltration Capacity. Information to characterize the main management practices was collected directly from the field and from interviews with the local farmers.

Significant differences were found between land uses for all functional soil conditions assessed. Differences were generally higher between managed (croplands and pastures) and unmanaged (forest and resting lands) lands. For soil organic matter and the Nutrient Cycling Index the most influential variables were litter cover and management practices and the lowest values were found in sugar cane croplands; for soil stability, the former two variables and permanent vegetation cover were important, the three croplands presented lower values. In the same three land uses erosion was observed, influenced by management practices and soil cover. Sugar cane had the lowest infiltration value due to a combination of variables. Pastures also presented low infiltration values and the lowest moisture at the root level, mostly as a result of soil compaction and reduced above ground vegetation cover.

Both vegetation and management were proved to have a substantial effect on soil condition differences between the selected land uses. In order to improve soil conditions, both vegetation and management should be improved. Regarding vegetation, perennial vegetation, canopy cover and litter are particularly important. Regarding management, intensive tillage, land burning, herbicides, inadequate irrigation and intense cattle presence were identified as negatively affecting soil conditions.

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## Verifying the safe level of visitors' pressure in aquatic protected areas: surrogate signal species, dummy individuals and bioindication

(Poster)

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Aquatic areas within nature reserves can suffer from certain anthropogenic pressures of its visitors. The littoral zone within small rivers and lentic freshwater systems is particularly threatened by water sports, such as swimming and canoeing. The core zone of the Central European National Park is an example of a popular location for visitors and tourists to canoe (Křenová and Kindlmann 2015). Evaluating the direct impact of disturbances on endangered species is often very difficult due to the low number of individuals or the long-lasting impacts; therefore, three methods on how to evaluate anthropogenic disturbance rates are presented. The degree of damage on submerged macrophytes, caused by human trampling, canoe movements or paddling, is measured by capturing truncated plant fragments within the stream via nets while recording the number of visitors and measuring the water level. Concrete replicas of shells were utilized to assess the risk of removing mollusc specimens. The reactions of visitors were then recorded in terms of observing, manipulating or destroying the species. In-situ bioindication was performed in the river based on caging and exposure experiments of juvenile Freshwater Pearl Mussels. After exposure, both juvenile growth rate and survival rate were evaluated within localities where disturbances, erosion or pollution had occurred in connection to camps, hotels or settlements (Černá et al. 2018). These described methods have enabled a safe limit for the control of visitors. The national park administration office allows a regulated entrance into the park's core zone and eliminate visitor impacts on macrophytes (priority habitat V4A Macrophyte vegetation of water streams, with currently present water macrophytes) and critically endangered molluscs (*Margaritifera margaritifera* L. - Simon et al. 2015). By using precise data, it was possible to carry out these regulations against the strong pressures of boat rental companies and lobbyist. The described methods could be applied in diverse contexts within marine or freshwater ecosystems.

Černá, M., O. P. Simon, M. Bílý, K. Douda, B. Dort, M. Galová & M. Volfová, 2018. Within-river variation in growth and survival of juvenile freshwater pearl mussels assessed by in situ exposure methods. *Hydrobiologia* 810(1):393-414

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Simon, O. P., I. Vaníčková, M. Bílý, K. Douda, H. Patzenhauerová, J. Hruška & A. Peltánová, 2015. The status of freshwater pearl mussel in the Czech Republic: Several successfully rejuvenated populations but the absence of natural reproduction. *Limnologia - Ecology and Management of Inland Waters* 50:11-20

*Fig.1 Concrete replicas of pearl mussels were utilized in national park core area to assess the risk of removing or destroying the dummy mollusc colony.*





## Identifying pathways for habitat restoration in the Atlantic Forest of Brazil with co-benefits for biodiversity and local livelihoods

(Poster)

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The Atlantic Forest of Brazil (Mata Atlântica) is one of the world's 25 biodiversity conservation hotspots, home to thousands of endemic species and over half of Brazil's threatened animal species. Around 80% of Brazil's population live within the biome range, creating strong competition for land between nature and people. This vast rainforest, the second largest in South America, originally covered over 1.5 million km<sup>2</sup> along the Atlantic coast. Due to historical and ongoing pressures on the natural habitat, only an estimated 11-16% of its original extent remains covered by forest. Large scale deforestation, forest degradation and habitat fragmentation severely threaten the ecosystem, and research suggests safeguarding its flora and fauna requires restoring native forest to at least 30% of its original extent. However, there is little evidence to suggest that a 30% restoration target will prevent the loss of functional diversity or reduce total species extinction rates. Although the Atlantic Forest is the focus of various restoration pacts, the success of these projects in providing ecological benefits while sustaining local livelihoods is unclear. We conducted a systematic review of habitat restoration initiatives and their impact on biodiversity, ecosystem services and local livelihoods in order to define specific biodiversity targets, and answer the question: What is the ecological threshold of forest cover required to maintain functional intactness, avoid extinction debt, and maintain total species abundance? We used specific search strings in English, Spanish and Portuguese via online bibliographical search tools such as Scopus and ISI Web of Science. Our analysis aims to answer 'how much is enough?' in terms of Atlantic Forest habitat restoration to achieve the desired biodiversity goals. We seek to define areas for restoration of native vegetation in the Brazilian Mata Atlântica to maximise biodiversity protection without negative consequences for agriculture and farming, commercial activity or local landowners and define a restoration plan that considers both extent (defined by ecological threshold limits) and location of habitat restoration. Furthermore, we will investigate socio-economic variables that affect the success of the desired restoration initiatives and their outcome by 2050. We will use the GLOBIOM-Brazil partial equilibrium model (IIASA) to test the influence of socio-economic drivers and targeted policies on land-use dynamics in the region. Significant effort is still needed to reach ambitious restoration targets set for the Atlantic Forest by international and national bodies, and considering the ecological outcome of reforestation plans is key to achieving the UN Sustainable Development Goals, while ensuring benefits to biodiversity and livelihoods in this region.

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## **Aquatic ecosystems in change: capturing the impacts of fishing and environmental stressors by utilising ecological network theory**

**(Poster)**

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Understanding how wild populations respond to multiple environmental stressors, and how they recover following depletion, is fundamental to conservation biology and the sustainable use of resources. Fisheries represent a major scale system of human-induced mortality in natural populations (1). The theory of density-dependent population growth suggests that at a low abundance populations should grow at a fast rate, yet in reality many stocks fail to recover even after large reductions in fishing pressure (2).

The freshwater salmonid vendace (*Coregonus albula*), is an important target of freshwater fisheries in the Nordic countries. Here, we will utilise the Allometric Trophic Network (ATN) modelling framework (3) to explore the dynamics of a vendace population subjected to fishing in a typical Central Finnish lake. The model will investigate the life history changes induced by fisheries, and describe how those changes may feed back to the entire ecosystem through species interactions, ecosystem stability, and resilience against disturbances.

This poster will describe how life history changes may affect the ability of a fish population to sustain fishing and recover from overfishing. Resolving life history dynamics will ultimately help us gain a better understanding of how fishing could be conducted in a sustainable manner while accounting for the impact of multiple stressors at once.

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# Synthesis of Environmental Impact Assessment to support planning of ecological compensation and decision-making: an introduction to research project

(Poster)

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Habitat changes are the key drivers of global biodiversity loss. However, land-use decisions that extensively affect the abundance and distribution of species are made at local scale. Environmental Impact Assessment (EIA) is a systematic process where the effects of major projects on their utilized environment are examined, and it leads either to implementation, modification or rejection of the planned project. Even though EIA process also includes a proposal for the follow-up program, monitoring of the impacts is not specifically required after project has been implemented. Lack of this information, for example, complicates the mitigation of impacts since the realized loss of natural values is unknown.

We will mainly use data on birds and the Siberian flying squirrel since they are essential part of the EIA process and national monitoring data is available. Material of the Finnish EIA projects and related reports and surveys will be gathered to produce a synthesis of what is currently known on the national EIA process and what should be changed. Next, we focus on projects that relate to the construction of roads, wind plantations, peat production fields and zoning, and where both pre and post-surveys have been conducted and compare their outcomes also to underlying regional trends within different groups of species. In addition, since data on the post-implementation period is limited, comparable surveys with those of EIA reports will be repeated on particular sites where projects have been implemented.

Our results provide more information and means to EIA authorities to more accurately assess forthcoming projects and their environmental impacts and to improve mitigation their harmful effects in advance. It is also possible to denote species susceptible to particular environmental changes, which helps planning and directing of ecological compensation.

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## The distribution of Great Grey Shrike in Republic of Moldova

(Poster)

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The Great Grey Shrike (*Lanius excubitor*) is the largest species from the Laniidae family, with a wide distribution in the Northern Hemisphere, across Europe, Asia and North America. Because the species occupies a large area, the data about the spring and autumn migration and wintering areas of the whole population is poorly documented. The study area covers the territory of the Republic of Moldova (33 843.5 km<sup>2</sup>). Here, the Great Grey Shrike was known as a wintering visitor, being recorded during the late autumn up to early spring. The species was not considered to breed until now in the Republic of Moldova, therefore it was not listed in the Bird Atlas. Even today, the Great Grey shrike is a poorly studied species in our country and there is no up-to-date information except the actual study. The first breeding recorded was in 2012 in the north region of the country. After that, we started a monitoring program in order to check the species' status.

The aim of the current study was to assess the distribution of the Great Grey Shrike in the Republic of Moldova and to analyze the breeding and wintering population. The study was conducted from 2014 to 2017. During two breeding seasons (2014 and 2015) we carried out point counts with a minimum distance of 400 m between them and 5 minutes of observation in each location. The observation points were randomly selected across the study area using Hawth's Tool for Arc GIS v.9.3. In 2014 we registered 20 breeding pairs out of 470 observations and for 2015 we counted 31 breeding pairs out of 631 observation points. The density of the Great Grey Shrikes in Republic of Moldova estimated, for the research period, to 0.2-0.4 breeding pairs/square km. According to our study, its breeding range is increasing (occupying 75% of the country), extending to south, contrary to previous conclusions which stated that the population is concentrated in north. The GLM analysis showed that the great grey shrike breeds in areas with higher altitudes (a mean of 174 m), low level of precipitation in November and with low average temperatures (all  $P < 0.05$ ).

To estimate the wintering population, we used the line transect method. Monthly, we conducted 9 transects about 40 km long each (360 km per month), during November - February, for two seasons, 2015 – 2016 and 2016 – 2017. The method consists in driving a car at slow speed (up to 40 km/h) with very short stops, if necessary. The distribution across the country was uneven, 42 were observed in northern area, 37 in the central one and only 5 in south. The numbers of individuals in the first wintering season was 46, while in the second there were 38 individuals counted in Republic of Moldova. According to Manly's selectivity index the Great Grey Shrike selects during winter season orchards ( $W_i = 1.6$ ) and grasslands ( $W_i = 3.0$ ). The data collected during the winter season shows that birds tend to keep their breeding spots, being recorded near them during this harsh season.



## Restoration of an abandoned cultural landscape in a world heritage site – management of semi-natural hay meadows in the Vega Archipelago, Northern Norway

(Poster)

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The unique cultural landscape was one of the reason why the Vega Archipelago received World Heritage status in 2004. In this landscape generations of fishermen-farmers have combined fishing with small-scaled low intensive farming. As a result, several semi-natural habitats has evolved such as hay meadows, pasture and coastal heathlands. Due to the continuous of extensively farming combined with calcareous soil Vega Archipelago is considered a biodiversity hot spot. However today, the fishermen-farming practice is abandoned due to government policy in 1960-70s that led to centralisation and structural changes in agriculture and fishing. Islands were vacated following by a decay of the entire cultural landscape and loss of biodiversity. To conserve the semi-natural habitats with its biodiversity restoration of the abandoned cultural landscape was initiated. The main challenge are encroachment due to lack of grazing and mowing as well as soil erosion. In this project, we have studied restoration of a hay meadow exposed to erosion. In addition we have focused on generating and communicating knowledge about management methods because of the challenge that stakeholders has diminishing knowledge about traditional land use of semi-natural habitats as well as adapting traditional land use management into nowadays lifestyle and modern agriculture. Soil erosion in Vega is triggered by a combination of vegetation overgrowth and water vole (*Arvicola amphibius*) activity. Generally, abandoned hay meadows often are dominated by *Filipendula ulmaria*, leading to a reduced bottom vegetation layer and loss of a dense root system. During winter, soil is exposed to wind and precipitation. In addition, overgrown hay meadows are hiding places for water vole against predators contributing to an accelerated population growth. Hence, soil digging activity increases strengthening soil erosion. In some places soil layer is reduced to a minimum and bare rock is visible. Thus, restoring hay meadow is challenging regarding fragmented vegetation cover. Safeguard soil has major priority before focusing on restoring species richness. In this project several management methods has been introduced to halt soil erosion. The first measure is to use a seed mixture adapted to salty, northern conditions, which was combined in one trial with traditional soil improvement, by using seaweed. In addition, water vole was trapped to secure undisturbed plant species establishment. All measures were accompanied with vegetation survey in order to analyse changes in vegetation composition and finally to give management advice to land owners and agencies. The survey is ongoing and initial results indicate that trapping of water vole is the most effective management method that give immediate effect. However, establishment of a permanent vegetation cover is more time consuming, but essential for giving shelter to the aspired species-rich vegetation composition in a second step.

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## Improving the accuracy of estimations on natality and pre-weaning pup mortality of the endangered Saimaa ringed seal

(Poster)

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The Saimaa ringed seal (*Phoca hispida saimensis*) is the only endemic mammal in Finland. It inhabits fresh water Lake Saimaa, and its population size is around 370 individuals with 60-80 pups born annually. One of the most critical threats for the population is climate change. The ringed seal is dependent on sufficient ice and snow cover for a breeding habitat, and mild winters have a negative effect on pup survival. In addition, the reliability of the population estimates, which are based on annual lair censuses, suffers when there is no sufficient snow cover for subnivean lairs or when the lairs are not detectable during the census due to early melting. For improving the seal stock monitoring the underwater surveys at the seal's lair sites were annually conducted soon after ice break up during 2014-2017. Divers were looking for placentas as a proof of born pups, and pup carcasses or other remains of dead pups. Altogether 584 lair sites were investigated by divers. The underwater surveys increased the number of born pups by 29, which is 10% of the total observed natality during the study years. In addition, 13 dead pups were found during the surveys, which is 32% of all pups observed dead before weaning during the study. The underwater surveys at the seal's lair sites are effective method to improve the accuracy of the population estimations especially during mild winters. Reliable knowledge on natality and pre-weaning mortality of the Saimaa ringed seal is essential for the assessment of the conservation needs and effectiveness of conducted conservation acts.

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## Natura 2000 stakeholder involvement in Turkey's forests

(Poster)

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Participation of local stakeholders is very important in selection and creation of Natura 2000 areas. There is not a standard procedure that has been developed by the EU in this respect. This study primarily aims to establish the characteristics related to potential participation of stakeholders in Natura 2000 practices in Turkey. A project has been created that looks into the applicability of the Natura 2000 concept in the forest areas in Turkey. To this end, two different forest sub-district directorates in Karabuk and Yenice in the Western Black Sea region have been selected as sample research areas. The locals of the areas in this project have been considered as the primary actors in participation of stakeholders to ensure civil society dialogue in the project. Information meetings and a workshop have been held to ensure civil society dialogue. The participants took a survey at the workshop, where the results of the project were announced. It has been established that the revenues from forestry via forestry cooperatives in villages has significant importance. Potential Natura 2000 areas and their protection methods have been created to spatially materialise the impact of project outcomes on the locals. The village headmen were consulted for their opinions on these areas. As a result of the evaluation of the surveys that were taken at the end of the workshop, it has been understood that the disposition of the village headmen was positively changed as compared to the beginning of the project. It has been stressed that there are different characteristics of participation from various stakeholders across EU countries, with regard to ownership and management of forest areas in Turkey.

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## Local perceptions of carnivores in Sibiloi National Park, Kenya.

(Poster)

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Indigenous and Local Knowledge (ILK) is increasingly seen as an important data source for informing conservation efforts. However, its use as a guide for the sustainable management of natural resources is still heatedly debated in the context of pastoral grasslands. In this study, we examine the utility of ILK as an alternative source of biological information relevant to inform conservation efforts in Sibiloi National Park, Kenya. We carried out 106 semi-structured interviews with local pastoralists to understand their local perceptions of abundance and change of seven carnivore species, i.e. black-backed jackal, caracal, cheetah, leopard, lion, spotted hyena and striped hyena. Each interviewee was asked to give information on wildlife abundance, wildlife changes recorded since their childhood and species causing livestock attacks. Our results reveal that local perceptions of carnivores' abundance and change over time varied substantially from one species to another. Black-backed jackal, caracal, spotted hyena and striped hyena were perceived in high abundances by 75% of our interviewees, whereas less than 50% of our interviewees perceived cheetah, leopard and lion in high abundances. The lion was the species reported to be decreasing the most, whereas more than 50% of our interviewees perceived the rest of the species as stable over time. Our results also show a gendered pattern, with women being more likely to report changes in caracal and spotted hyena. However, local perceptions of carnivores' change over time did not vary significantly in function of the interviewee age. Moreover, the most widely perceived driver of change in species abundance was hunting, whereas food availability was often cited as a driver of the increase in population abundance. More than 75% of the interviewees reported that black-backed jackal and spotted hyena were the two species causing the majority of the livestock attacks. The results provide a novel view of the conservation status of carnivores, which can be helpful in mitigating human-wildlife conflict in Sibiloi National Park. The pastoralist groups of Sibiloi have a complex view of wildlife and we conclude that management decisions need to combine biological data with Indigenous and Local Knowledge.

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## Hydrology LIFE - conservation of peatlands and small water bodies in Finland

(Poster)

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Wetlands are biodiversity hotspots and provide many globally important ecosystem services, such as carbon storage and control of water circulation. However, they are badly degraded by human land-use and are, therefore, among most threatened habitats in Europe, for instance. A 20-year experience on wetland restoration in Finland will now be utilized in Hydrology LIFE project, that safeguards peatlands, small water bodies and important bird lakes in 103 Finnish Natura 2000 areas.

Majority of peatlands around the globe are severely degraded by human land-use. The major cause for degradation in Finland is forestry-drainage, including also areas within N2000 sites. The blocking of ditches and removal of trees on 5200 hectares in and around 95 N2000 sites recovers the wet and open habitats crucial for many valuable species. The measures also restore peatland's ability to store water, nutrients and carbon. New methods for simultaneously improving biodiversity conservation and water protection are developed in the project running 2017-2023.

Dredging, channelization and drainage are widely decreasing the ability of streams and ponds to sustain their natural communities and control the circulation of water. We restore 34 km of degraded streams and raise water table in 17 ponds to recover their natural hydrological functioning, and to regain target species.

The open water areas as well as mosaics of water and vegetation, that are important as bird nesting and breeding habitat, are decreasing in many lakes in Finland due to overgrowth by vegetation and nutrient loading from the surroundings. We create open water areas and increase the mosaic structure of habitats e.g. by dredging and raising the water table to improve the habitat quality on four especially important bird lakes.

The project funded 60% by European Commission LIFE funding focuses mainly in practical restoration.

However, we collect and analyse globally significant data-sets to better understand how restoration can be used to preserve biodiversity, to improve water quality and to slow down climate change. Lack of such long-term and well-replicated studies is one of the biggest challenges in reaching the huge global targets for wetland restoration, and for many other ecosystems. The information gained by examining how local people and the recreational users of protected areas feel about restoration can be used to develop restoration measures. Wide range of field inventories on several species groups will be done in the project to support restoration.

Successful conservation requires better public understanding on the wide range of wetland values. We raise public awareness by developing effective and innovative communication methods, such as a wetland simulator and material for teachers and nature centres.

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## Species identification of blow flies of the genus *Hypopygiopsis*

(Poster)

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## Ranking Natura 2000 habitats and Natura 2000 areas for nature

(Poster)

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We ranked 1 541 Finnish Natura 2000 areas and their 69 different habitat types for ecological restoration and nature management based on their potential for cost-effective ecosystem improvement. We did it by Zonation software and its principles: complementarity, connectivity, condition and cost-effectiveness.

We had biodiversity data (GIS: location and current state of 67 N2000 habitats and threatened species) and expert knowledge of improvement methods, effects and costs.

As results we got maps, curves of trade-offs and also a ranking list of Natura 2000 areas.

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## Differential response of *Batrachochytrium salamandrivorans* to salamander mucosomes reflects species susceptibility

(Poster)

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## **The importance of fire salamanders (*Salamandra salamandra terrestris*) within Belgian forest ecosystems**

**(Poster)**

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## Large-scale sampling of small mammals throughout the year

(Poster)

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Small mammals are a staple food for many predator species determining their abundance, distribution, and diversity (Butet, Paillat & Delattre 2006). The abundance of small mammals in agricultural landscapes varies between different habitat types and throughout the year. Mechanical disturbance through harvesting, ploughing and tillage removes shelters, destroys nests and burrows and decrease food availability for small mammals (Tew & Macdonald 1993). Consequently, intensively cultivated agricultural fields might become inhospitable for small mammals, which might only persist in habitat patches with undisturbed areas such as hedges, ditches, road verges, set-aside and wildflower areas (Arlettaz et al. 2010). However, the spatial patterns of occurrence of small mammals, especially over larger areas, are poorly investigated. We studied distribution, abundance and fluctuation of small mammal populations over larger areas and in different habitat types throughout the year. The abundance of small mammals was measured with indirect methods, i.e. field signs and track plates in four regions in Switzerland. We sampled field signs like runways, holes and molehills along transects of 5 m length and set a track plate during three days close to each transect. Our results show that the abundance of small mammals not only fluctuated in annual cycles but also highly between seasons and habitat types. Over larger areas, fluctuations were not synchronous but highly variable between the sampled regions and habitat types. Small mammal populations crashed down in agricultural fields after harvesting, while populations remained more stable during the whole year in less disturbed structures such as hedges and ditches. Such large annual, seasonal and spatial variation patterns might highly determine prey availability for predators and are of major importance for many endangered farmland species feeding on small mammals such Barn Owls and Stoats. Monitoring small mammal populations through indirect methods is a good alternative compared to live-trapping because it allows covering much larger areas with similar efforts. It provides a temporal and spatial resolution which cannot be achieved by live-trapping. Such large-scale samplings of small mammals could help improving conservation measures on larger scales, especially for predator species living in farmlands.

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## Finding the best compromises for wind power locations in Finland via spatial prioritization modeling

(Poster)

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Anthropogenic climate warming is a great threat to the future wellbeing of nature and people alike. Therefore decreasing greenhouse gas emissions as quickly as possible is of utmost importance. Wind power is one of the most applied “carbon-free” alternatives for producing electricity, and its popularity is still growing. Numerous studies have shown that wind turbines can kill, disturb or displace animals, especially certain bird and bat species. Building a wind turbine also causes local habitat changes to the area immediately beneath the turbine, and the noise can affect nearby people and other animals. Studies have shown large location-dependent variation in the strength of negative effects of individual wind turbines and wind farms. The environmental factors contributing to this variation are fairly well known, as well as the most vulnerable species. Therefore, careful planning of the locations of the wind turbine construction is generally seen as the most efficient method for minimizing the negative effects of wind turbines. The potential population-level effects of wind power are caused by the combined effects of wind turbines over large areas, especially in migratory species covering hundreds to thousands of kilometers annually. Hence, the planning of the wind power should be done in as large scale, but currently planning as well as assessment and monitoring of environmental effects is mostly done at a level of individual wind farms or counties.

In my study I model the relative suitability of land areas for building wind power over the whole Finland (ca 340 000 km<sup>2</sup>). Suitability is defined as the best trade-offs between the wellbeing of nature and people, wind power building and maintenance costs, and potential for energy production (average wind speed, based on Finnish wind atlas), but without compromising the most vulnerable species and habitats. In the spatial models I combine species data (occurrences), environmental data (e.g. habitat types, forest ages, wind speed data, populated areas) and wind power building and maintenance cost data. Experts from nature conservation, wind power companies and state officials are involved in order to provide the most reliable and relevant measures. The modeling is done with Zonation, which is a software developed for spatially prioritizing areas based on their features. From the model I will produce a map showing the small-scale suitabilities for wind power across Finland. I will also present comparisons in the modeled suitabilities between different environmental factors and show which combinations of several environmental factors were found especially suitable or non-suitable. I will also compare the modeled suitabilities with the areas already designated to wind power construction in Finland. If discrepancies between these previously designated areas and the most suitable areas in this study are found, the reasons behind the observed differences are scrutinized and discussed.

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## Characteristics of boreal and hemiboreal herb-rich forests as polypore habitats

(Poster)

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Habitat deterioration caused by intensive silvicultural actions has resulted in the decline of saprotrophic species, including polypore fungi (Basidiomycota). Polypore assemblages in herb-rich forests remain little studied, regardless of the fact that these forests are considered as biodiversity hotspots in the boreal zone.

The aim of this study is to evaluate the significance of herb-rich forests as polypore habitats and assess the relationships between stand- and substrate-scale variables and polypore species richness, abundance and diversity. In addition, an alternative way to measure the diversity of coarse dead wood (CWD) is presented. Polypore fruit body and CWD inventories were conducted in 75 herb-rich forest stands from hemiboreal to middle boreal vegetation zones. Overall, the data covers 5097 dead wood units and 3046 observations of 101 species, including 19 herb-rich forest associated and 15 red-listed species. The largest size class of CWD units (diameter >40 cm) hosted up to 4.5 times more polypores than the smallest size class (10-14 cm). Results of GLMs and correlation analyses showed that the total polypore species richness, and the number of observations of red-listed and herb-rich forest associated species have differing responses to habitat and substrate quality. For instance, the diversity of CWD, northern coordinate and abundance of large-diameter (>30 cm) dead wood all significantly explained variation in total species richness, whereas the red-listed species responded only to the number of large dead wood units. In NMDS-ordination, the polypore assemblages were strikingly different between host-tree species, with the clearest division between coniferous and deciduous trees.

The results highlight the importance of dead wood diversity and large-diameter dead wood, especially aspen and birch, for polypore assemblages in boreal herb-rich forests. Comparing the results to previous studies, herb-rich forests are likely to host lower polypore species richness and smaller populations of red-listed species than old-growth spruce forests. However, because of a high proportion of deciduous trees in the dead wood profile, herb-rich forests can be presumed to sustain polypore assemblages divergent from those found in conifer-dominated boreal heath forests.

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## Plot-based observations on rare macrofungi confined to peatland habitats in West Siberia

(Poster)

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Conservation of fungi largely depends on conservation of their habitats as many species are host- and habitat-specific. The peatland habitats are characterized by excess of water and acidic pH of soil, hence the mycota of peatlands is relatively poor by species number but rich in habitat-specific species. Considering small areas of pristine peatlands which were mainly destroyed in Europe, species restricted to these habitats are now rare or endangered. A few dozens of macrofungi confined to peatlands now protected by some Red Data Lists of European countries. The analyses of Red Data Lists of different Russian regions revealed 6 species confined to peatland habitats. The biology, ecology and occurrence of some of these species were explored in details. For example, a discomycete growing on Sphagnum and peat *Ascocoryne turficola* found exclusively in fens and protected in all countries where it was registered. Another example is *Armillaria ectypa* (Marsh Honey Fungus) - a macromycete of fen habitats which is included in the IUCN Red List under the category NT due to the drainage and other destruction of its habitats. Many other species remain under-explored and the peatland habitats are rare targets of mycological surveys on the whole. Therefore, targeted surveys of fungal communities composition, quantitative structure and dynamics are important to be conducted in peatlands. Our plot-based investigation of peatland fungal communities in West Siberia, Russia was initiated in 2014 and will continue in the future. The recommended protocols for sampling macrofungi (Mueller et al. 2004) were used allowing to receive reliable reproducible results. The major target were oligotrophic Sphagnum-dominated bogs, which are widely spread and well preserved in pristine state in the region. Altogether about 70 species of macrofungi were registered in raised bogs during 4 years of observations, including some being restricted to peatlands (ecology determined based on literature data). The last group includes about 30 species and is of particular interest from the position of Conservation programs: the occurrence of these species was analyzed based on plot-counts during 4 years, the phenology of fruiting and weather-related dynamics have been registered and the ecology and population structure of some species were studied in details (1). Eight species restricted to bogs estimated to be relatively rare (based on counts of fruiting bodies) and of particular interest for conservation programs: *A. turficola*, *Geoglossum sphagnophilum*, *Entoloma fuscomarginatum*, *Hygrocybe cinerella*, *Mycena concolor*, *Omphaliaster borealis*, *Psilocybe turficola* and *Sphagnomphalia brevibasidiata*. Three species were included in the Red Data list of Khanty-Mansi Autonomous Okrug-Yugra based on these studies.

1. Filippova N V, Bulyonkova T M 2013 Notes on the ecology of *Ascocoryne turficola* (Ascomycota: Helotiales) in West Siberia *Environmental Dynamics and global Climate Change* 4 (2)





## LEDs, rivers and insect attraction: distance thresholds for attracting adult aquatic insects from their river habitat to artificial lights.

(Poster)

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The availability of cheap LED lamp technology may result in a shift in the spatial extent and quality of night time outdoor lighting. The impact of LED lamps on sensitive habitats such as streams and riparian areas is largely unknown, despite lighting often being installed close to lakes and rivers. Increasing light pollution therefore poses an additional risk for taxa such as Ephemeroptera and Trichoptera which are already threatened by water pollution and habitat degradation. Terrestrial adults of many aquatic insect species are known to be attracted by artificial lighting, yet little information is available to support applied conservation practice. To address this gap, we undertook a controlled field experiment by placing LED lamps and modified flight intercept traps at different distances from a light-naïve river. We had the following questions

- Is there a lighting effect on the abundance of Ephemeroptera and Trichoptera?
- What is the magnitude of the lighting effect?
- Is proximity of the lamp to the river important?
- Is there a river proximity threshold for impacts?

We could show that the light treatment has a significant positive effect and distance a significant negative effect on abundance of both taxa. We could show that abundance around LED lamps reduces in a non-linear manner, with distinct river-proximity thresholds. Our results could be used to directly inform lighting management along freshwater bodies to reduce ecological impacts.


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## Impact of Climatic Change on Mosquito Distribution in Federal Capital Territory, Abuja, North-Central Nigeria

(Poster)

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Climate changes have been widely associated with the development mosquito population and therefore help spread diseases, the need to continually check the diversity of the mosquitoes in Nigeria cannot be overemphasized. Indoor resting mosquitoes were collected in the University of Abuja Campus using Pyrethrum spray insecticide, climatic data were determined using daily weather report software on Nokia Ash 230 phone. Of the three hundred and ninety-eight (398) mosquito species encountered, they include; *Anopheles gambiae* 137 (34.42 %), *Anopheles arabiensis* 98 (24.62 %), *Anopheles funestus* 67 (16.83 %), *Anopheles rufipes* 60 (15.09 %), *Culex* sp 34 (8.54 %) and *Aedes aegypti* 2(0.50 %). Monthly abundance showed that May and June recorded the highest with 216 mosquitoes, while March recorded the least with mosquitoes collected with 6. The highest number of mosquitoes was found in male hostel with 160, the female hostel had 110, and faculties had 74 while lecture halls had the least with 54. There was no significant difference between the species of mosquitoes found in each month, but May and June showed significant difference with number of mosquitoes collected at  $p < 0.05$  level. The abundance in May and June may be due to the favourable climatic conditions.

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## Genomics of an “extinct” fly

(Poster)

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Abstract of this presentation is not public



UNIVERSITY OF JYVÄSKYLÄ



## The Swedish Species Information Centre – biodiversity and species

(Poster)

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Species and habitats are important. In order to understand the world we live in, we need to recognise what species there are, how many they are, and how well they are doing. This is practically what the Swedish Species Information Centre does. We accumulate, analyse and disseminate information concerning the species and habitats occurring in Sweden by:

- assessing and evaluating the conservation status of the Swedish species,
- keeping track of the names of species, habitat types and other terms and concepts pertaining to biodiversity and conservation,
- accumulating and disseminating information about findings of individual species,
- supporting the implementation of EU regulations,
- and by conducting and supporting research in the fields of biodiversity and conservation.

We work with commissions from the Swedish Government and other authorities within the field of Swedish biodiversity, frequently in cooperation with various NGOs. We also conduct research in the fields of ecology and conservation.

In order to map the diversity in Sweden, The Swedish Taxonomy Initiative works with listing all existing multicellular species in Sweden - a high set goal which we work towards by providing the digital infrastructure, but also through research projects to investigate less well known groups.

In the Swedish Species Observation System, data from citizen observations - currently with some 60,000,000 entries - is stored, but we also store data from different research projects through the database Lifewatch. We pass on information about biodiversity and conservation to authorities, researchers, development and industry as well as the general public. A more thorough assessment of the conservation status of Swedish species is done every fifth year as we produce the red-list of endangered species.

To summarize, we work for a rich and well known nature.

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## Multifunctional flower strips - does such a thing exist?

(Poster)

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Agricultural production is one of the key drivers of biodiversity loss in the world, and as a consequence of this some ecosystem services that are important for crop production are threatened. There is a plethora of different agri-environmental/conservation measures taken to counter the biodiversity losses in agricultural landscapes, some better supported by evidence than others. One of these measures is flower strips adjacent to crop fields. Flower strips have mainly been proposed to support pollinators and pollination of crops (Jönsson et al., 2015) but may also support natural enemies and natural biological control of pests (Tschumi et al., 2015). However, the role of flower strips for biodiversity per se remains controversial. It has been suggested that they mainly support the relatively common species providing ecosystem services, and not rarer species in need of conservation measures (Wood et al., 2016). Further, most studied flower strips target only one organism group or ecosystem service. We suggest that the seed mix in the flower strip is an important determiner for which species it attracts. In this study, annual flower strips with a flower mixture tailored to attract both pollinators and natural enemies were sown on 12 different farms in a high intensively farmed area in southern Sweden. Effects of the flower strips for different organism groups were measured at different spatial scales after flowering of oilseed rape, when agricultural landscapes are usually lacking nectar and pollen resources. We measured the presence and abundance of pollinators (wild bees and hover flies) and natural enemies in the flower strips. We also sampled natural enemies and aphids in the adjacent wheat field, at several different distances from the field edge. Colonies of bumble bees (*Bombus terrestris*) were placed at different distances from the flower strips and their fitness assessed. With these different methods, we aim to get a comprehensive picture of how an annual flower strip, tailored to attract both pollinators and natural enemies, affect both common and rare species in the different organism groups at a landscape scale. Preliminary results show that the fitness of the bumble bee colonies declined sharply with their distance to the flower strips, solely, but also in interaction with the size of the flower strips and the proportion of agricultural land. Further analyses will show how wild bees and hoverflies as well as natural enemies and pest control were affected by the presence of and distance to a flower strip. The results from this study will expand our knowledge about flower strips as a conservation measure. It will teach us more about the potential of flower strips tailored to benefit not only one organism group but several. We will also learn more about the potential of annual flower strips to benefit rare species.

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UNIVERSITY OF JYVÄSKYLÄ



## PATTERNS OF BILBERRY DISPERSAL IN A HIGHLY HUMANIZED PROTECTED AREA: A PRELIMINARY STUDY

(Poster)

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Frugivory and the associated removal of seeds is an important ecosystem function, which - in temperate region - is carried out mainly by mammals and birds. The bilberry (*Vaccinium myrtillus*) is a low-growing shrub very important economically across the world and also a very important food resource for a wide range of animal species, such as the brown bear or the western capercaillie. Bilberry populations usually expand their size by clonal propagation but, under very specific conditions, seedling recruitment can also happen and is very important for gene flow among populations and establishment of new populations. We investigated the community of dispersers of the bilberry species in Tatra National Park, southern Poland, a biosphere reserve that attracts up to three million tourists per year and holds more than 270 kilometers of public hiking and ski trails. From mid-July to mid-October 2017 we collected all bird droppings and mammal scats containing bilberry remains on six different transects (1.5 kilometer length and 3 meter width each) in both restricted and public sites along a 750 meter altitudinal gradient in four rounds. We found 10 times more bird droppings than mammal scats. The dispersal rate at the beginning of the berry season was lower and an altitudinal shift of dispersers towards higher elevations was recorded at the end of the berry season. We also found a trend indicating that bilberry dispersers use more often the restricted areas than the public ones. We present preliminary results on the composition of the community of birds and mammals that disperse bilberry seeds, based on DNA barcoding of the faecal samples. We discuss the implications of protected areas for the maintenance of animal-mediated seed dispersal, as a key ecological process contributing to plant regeneration.

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## Biodiversity effects of constructed and restored wetlands – an ecological and socioeconomical approach

(Poster)

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Wetlands are highly productive ecosystems with characteristics of both terrestrial and aquatic ecosystems. They have special biota adapted to inundation by water. Between 1970 and 2008, natural wetlands declined on average by about 30% globally and 50% in Europe. The severe loss of natural wetlands, as well as their degradation by agriculture, forestry and other human activity, has caused declines in natural wetland habitat types and specialized species, for example waterfowl populations in Finland. During the last decade, wetlands have been protected, restored and even constructed to save the diversity of wetland biota. Many studies show that constructed and restored wetlands can provide suitable habitats for waterfowl, waders and other wetland-dependent taxa. However, the biological characteristics of such wetlands often differ from natural ones and the habitat variables of constructed or restored wetlands affect the use of wetlands by waterbirds. My PhD project focuses on the biodiversity of constructed and restored wetlands on agricultural areas. The aims of the project are: 1) to investigate the effects of the characteristics, i.e. size, mean water depth, shoreline length and age of wetlands on vegetation, waterbirds and dragonflies, 2) to study the effects of regional land use and wetland connectivity on waterfowl diversity, densities and wetland suitability as breeding habitat, and 3) to study the motives of landowners to apply for EU-subsidies for wetland construction and the cost-effectiveness of such subsidies. I will present the results of the effects of several habitat characteristics of constructed wetland on waterbirds at 32 constructed agricultural wetlands in boreal zone, Finland. We use orthoimages generated from aerial photographs taken with an unmanned aerial vehicle (quadcopter) to estimate open water area and shoreline length of the sites, belt-line transect quadrat method for defining vegetation structure and standard Finnish waterbird census method for species, pair and brood counts. The results can be applied in cost-efficient construction and restoration of wetlands with high biodiversity values.

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## **A BIODIVERSITY PROGRAM FOR GOLF COURSES - A national study program to improve the knowledge about biodiversity, its conservation, fostering its establishment on French golf courses**

**(Poster)**

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In France, the total surface occupied by golf courses is of 30 000 ha. On most of golf courses, playing areas represent about 1/2 of the total surface. The remaining areas are usually natural ones such as meadows, ponds, hedges, etc. Golf courses can thus host a wide range of unrecognized and therefore underestimated biodiversity. Since 2016, the French Golf Federation (ffgolf) and the National Museum of Natural History (MNHN) have entered a partnership. One of the objectives of such a collaboration is to design a methodological support to develop a database and a tool to assess and monitor biodiversity at golf course scale: The Biodiversity Program on French golf courses was born.

The objectives of this program are to assess the ecological issues on golf courses at a national scale, to improve the knowledge, the management and the conservation of biodiversity on golf courses.

- 1) Develop and share knowledge relating to nature and increase awareness about the natural heritage in order to foster its value.
- 2) Promote the conservation of biodiversity on golfing areas, improving its integration and developing hosting areas.
- 3) Raise awareness for ecological issues.
- 4) Build constructive partnerships at a local scale with biodiversity stakeholders.

Through 3 progressive levels, the Program, a voluntary approach, helps golf courses to take into account biodiversity. The Program coordinates the implementation of naturalist studies, with the support of local naturalist bodies. All naturalist standardized data are integrated into the French natural heritage data platform (INPN: <https://inpn.mnhn.fr>). Ecological issues are identified and put in perspective with golf courses' management teams who are encouraged to improve their practices applying the recommendations. The Program has already been tested with success on 4 different golf courses. 2017 has been the 'pilot' year of the Biodiversity Program for Golf courses. 2018 is the official kick-off year of the Program and we present the first results. We are already considering to develop a similar Program for French Overseas Territories with a deployment to foreign countries and many other sports federations.





## The residual effect of fertilizer in soil: Can crop rotation practices combat soil fertility loss and increase crop yield?

(Poster)

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The depletion of soil nutrients is a global problem with a tendency to increase under climate change leading to degraded soils and decreasing crop yields. Various initiatives aim at the restoration of soils and the ecosystem services they provide. Studies investigating the effects of fertilizer application on soils have found positive long-term effects on soil nutrient content and crop yield even in the season after the fertilizer application. The utilization of this so called fertilizer residual effect has been suggested as a possible solution to prevent decreasing soil fertility. This study investigates the residual effects of NPK fertilizer on the fertility of agricultural soil in the Sudanian Savannah of the Republic of Benin in West Africa. Smallholder farmers in the study area commonly practice crop rotations and apply NPK fertilizer for the cultivation of cotton. Many of those farmers have claimed to benefit from fertilizer application in terms of higher crop yields in subsequent seasons even without the application of further fertilizer. In this study soil samples were taken and analyzed for soil nutrient content and smallholder farmers of associated agricultural fields were interviewed to understand farmer's motivations to adopt the agricultural practice of crop rotation. The collected data was combined with spatial information derived from satellite imagery and compared to farmer interview responses. The results provide information on crop rotation cycles, soil N, P and K content and farmer's motivation for 120 agricultural fields in Dassari, Benin. Data shows no significant correlation between year of fertilizer application, soil nutrient content or crop cycle used for rotation. This study therefore contradicts the hypothesis of the positive effect of residual fertilizer on crop yield and questions the application of chemical fertilizer for sustainable ecosystem restoration. Results of this study can be used by projects in development cooperation to train smallholder farmers in more sustainable agricultural practices to restore soil fertility and increase crop yield in order to strengthen food security and fight land degradation in the West African Sudanian Savanna belt and get closer to achieving SDG2 and SDG15.

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## Wing morphometric analysis of flesh fly specimens from Thailand

(Poster)

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Abstract of this presentation is not public



## Project LIFE Saimaa Seal - Safeguarding the Saimaa ringed seal

(Poster)

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The Saimaa ringed seal (*Pusa hispida saimensis*) is one of the most endangered and rarest seals in the world. The current population size is ca. 370 individuals, and the Saimaa seal is the only endemic mammal in Finland. The national conservation strategy and action plan for the Saimaa ringed seal was adopted in 2011 to improve the conservation status of the species. Even though the previous conservation efforts have been successful the seal still is endangered. The current seal population might overcome detrimental effects of a singular threat, but the combined effects of different threats may still be fatal to the population. The ongoing project LIFE Saimaa seal (duration 2013-2018) was targeted to reducing the key threats and problems identified in the conservation strategy. The objectives of the project were to reduce risks especially related to fishing, human induced disturbance, and climate change, thus helping to improve the conservation status of the species. The goals of the project were to produce updated knowledge on e.g. home range of seals and the potential threats, to reduce by-catch mortality, to adapt to the climate change by adapting a method of man-made snowdrifts to improve the breeding habitat during mild winters, and to reduce human-induced disturbances on seal. The project contributed to the development of the updated Conservation policy together with relevant parties for safeguarding more favourable environment for the seal in the future, and the results of the project have been used in the updating of the conservation strategy in 2017 and related fishing regulations in 2016. The Saimaa Seal LIFE project approached the protection of Saimaa ringed seals from a variety of different angles and searched solutions through the joint efforts of several partners. Overall awareness about the seal and its conservation is a key for effective conservation work. The project produced a wide range of information for the planning of the protection measures as well as communication and environmental education to various target groups. Metsähallitus Parks & Wildlife Finland coordinates the project that is implemented together with eight national project partners. The project budget is 5.26 million euros, of which the share of EU funding is ca. 3.95 million euros.

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## Blue target classification and Heureka

(Poster)

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Forest and its waters are closely connected and dependent on each other. This means that management activities in the forest affect water quality. To be able to take as effective consideration as possible it is important to have guidelines that can guide actions to areas and activities with the highest effect at the lowest cost. Blue target classification is a classification system for water environments developed by WWF in cooperation with Swedish forest companies. The system has been evaluated and is considered having good potential for improving water quality consideration within forestry. But for the classification system to be able to be utilised on large scale, and to be as effective as possible there is a need for easy to use methods that can connect a stream classification with adjacent forest's planning. Heureka is the leading forest planning system in Sweden, and we have developed a tool within Heureka that can do just that.

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## A social network approach for assessing sustainability of traditionally managed grasslands in a policy-driven management context

(Poster)

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A substantial coverage of native vegetation with high diversity of structural elements, protected species and functional groups can be an important source of resilience for the farming landscapes. Nevertheless, the new Common Agricultural Policies (CAP) measures contradict the EU Biodiversity Strategy to 2020 objective of halting the loss of grasslands, by making agricultural intensification or afforestation an attractive option for farmers (Pe'er et al. 2014). This situation can be interpreted as a "rigidity trap" case, where the landowners recognize the unsuitability of CAP measures but are encouraged to continue by EU subsidies. Furthermore, acquisition of agricultural lands by large landowners (land concentration) allows a small number of owners to control large swaths of land. Such threats simplify the management of grasslands, change the connections among farmers and ultimately disrupt the traditional land use (Hartel and Plieninger 2014). Governance structures involved in agricultural landscape management are highly fragmented mostly because policy and operational responsibilities are divided between an array of organizations and persons which makes the analysis of governance structures difficult with conventional tools. However, network governance allows the analysis of informal and formal arrangements where independent people or organisations work together for a common goal, such as management of grasslands (Alexander et al. 2016). To analyze the changes in grasslands governance induced by EU CAP policies, we use social network analysis to contrast two areas over time (before and after influence of CAP) in two regions from Romania - Iron Gates Natural Park and Dobrogea. We selected two Romanian regions (Iron Gates Natural Park (IGNP) - SW Romania and Dobrogea - SE Romania), representative for grassland management in mountain and lowland settings, respectively. The IGNP pasture management was traditionally performed in a decentralized, community-level system and this type of management continues to this day. In contrast, Dobrogea was characterized by a centralized, state-run management regime during the communist time, and by large landowners after transition period ended. We first identified actors of grasslands' governance (i.e., organisations, local people) and analyse management networks using social network metrics (e.g., network-level metrics), we then, identified actors or groups of actors with leadership roles, mainly those promoting sustainability of traditionally managed grasslands in a EU policy-driven management context (e.g., pioneer, sponsor, steward, facilitator of a network), and finally, reported the difference between management regimes in two areas. The results allowed us to explore barriers and opportunities for successful governance by considering influences of typical practices regarding landscape governance and performance, and to understand how formal policy networks influence informal social networks.

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## The effect of human-modified landscape structure on forest grouse broods in two landscape types

(Poster)

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The population sizes and the breeding success of Finnish tetraonids have been decreasing for decades. In this study, the presence of a grouse hen with a brood in a landscape was used to indicate habitat-related breeding success. We combined the locations of 938 black grouse (*Tetrao tetrix*), 388 capercaillie (*T. urogallus*), and 917 hazel grouse (*Tetrastes bonasia*) broods after the breeding season in mid-August with landscape data by employing Geographic Information Systems (GIS) and grouse data derived from the Finnish wildlife triangle censuses conducted during 1997–2004. Two large study areas with different landscape structures; northern forest-mire area and southern cultivated area, were selected for the investigation. The presence of grouse broods was positively related to the amount of old coniferous mixed forest. Grouse broods may prefer this forest habitat because of a rich understorey cover and a rich bilberry field layer offering a diversity of insects as food. Broods had a strong positive response to the amount of forest habitat. The effect of forest fragmentation on the broods' distribution did not increase even with decreasing forest habitat. We suggest that there are several ecological causes for the observed spatial correlations. Predation on nests and broods by generalist predators is presumably high in human modified open and semi-open landscapes. Against our expectations, the effect of landscape composition on grouse broods was more marked in the northern than in the southern study area, most likely because predator populations are more food-regulated in the north. This finding supports the alternative-prey hypothesis. Further, large drained and reforested peatland mire areas had a negative impact on grouse broods in the north. In the drainage areas, decreased availability of vegetation cover and insect food, increased predation risk, and drowning of chicks in ditches may increase brood mortality.





## The potential biodiversity effects of voluntary peatland conservation in Finland

(Poster)

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Extending conservation area networks is one of the most important measures in the struggle against biodiversity loss. Many areas with high conservation effect locate in privately owned land so establishing new protected areas on private land is often seen necessary. In many countries, protection of private land has traditionally been top-down controlled and landowners have had little or no power to affect conservation decisions. A good example is European Union's Natura 2000 programme that led to conservation conflicts locally. To avoid conflicts and to increase acceptability of new protected areas located in privately owned land, many voluntary and incentive-based conservation measures have been already widely applied. Many scientific papers report of successful protection through voluntary measures and celebrate their ability to make conservation socially more acceptable. However, voluntary measures do not affect only the social aspects of conservation, but also the biodiversity representation, by limiting the different options for protection. We studied the second phase of Finnish Peatland Conservation Programme that was originally planned to be implemented as a statutory programme enabling land expropriations, but was later changed as a programme of voluntary protection. We constructed three structurally different spatial prioritization analyses for three different scenarios: 1. Total acceptance; the analysis removes all the opposed peatlands from the solution despite their biodiversity representation. 2. Partial acceptance; the analysis considers landowners' resistance as a continuous variable seeking a balance between resistance and biodiversity's irreplaceability, while trying to maximize biodiversity representation with connectivity considerations. 3. Forced protection; the analysis maximises biodiversity representation and connectivity without considering landowners' resistance to protection. Preliminary results show that demanding landowners' total acceptance in peatland protection means a solution with significantly lower biodiversity representation for legal protection than the two other solutions. Instead, considering landowners' acceptance partially leads to the solution that enables protection of practically as much biodiversity as forced protection. Our study shows that when high quality substitutive areas do not exist, categorical consideration of landowners' resistance to protection leads to inefficient use of conservation resources. To avoid this, the ecologically most valuable areas should be allowed to be protected in spite of landowners' opinion. Our results also indicate that a great deal of landowners' resistance can be considered without a major decline in biodiversity representation in the solution, if conservation planners integrate landowners' opinions as part of a planning process from the very beginning.

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## Functional diversity of the Middle-Danubian fish fauna, the role of non-native species

(Poster)

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It is well known that physical appearance and behavior of each species reflects to its habitat preference, feeding habits, etc. Therefore, one can describe the ecological role of species in a community by characterizing their life-history and functional traits. By applying this framework across all species present in the community, we can characterize its functional diversity. The Middle-Danubian hydrosystem is characterised by valuable and diverse fish fauna, at the same time this area is highly exposed to the invasions because of the „natural" range expansion of Ponto-Caspic species and due to the illegal fish stockings. And although several notes deal with the effect of non-native species on the native biota, the role of these species in the invaded communities is still not discovered in detail.

The life history traits of the Middle-Danubian fish fauna has already been revealed, but there is no information published about the functional traits of the species living in this area. Thus our primary aim is to explore functional diversity of the fish fauna of this area with special regard to the native and invasive fauna components. For this reason a database containing 15 functional traits describing the food acquisition and locomotion features (e.g. oral gape position, fins surface ratio, etc.) of the analyzed species was compiled. This database recently contains the functional trait data of 73 species can be found in the Middle-Danubian hydrosystem. By multivariate analyses of this dataset, the species' places in the functional trait space was defined, moreover the distribution of non-native species was revealed also. Our results show that the overall distribution of analyzed 23 non-native species in the functional trait space show almost complete overlap with the native ones. Moreover several native-non-native species pairs with highly similar functional traits were revealed (e.g. *Rhodeus sericeus* and *Pseudorasbora parva*). These results can help to form reliable conservation plans. The database can provide the basis of further investigations dealing with functional diversity. This work was supported by the "OTKA PD 115801" project.

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## An overview of Lejeuneaceae (Marchantiophyta) in India with a comprehensive note on the status of the family in the state Assam

(Poster)

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Lejeuneaceae is one of the dominant and advanced families of the group Marchantiophyta (liverwort) of bryophytes which prefers to grow in humid forests of tropical-subtropical regions. India, owing to its tropical climate, vast range of topography and high percentage of forest cover, harbours a significant percentage of the Lejeuneaceae members represented by 25 genera and 233 species (including infraspecific taxa) (Sing & al., 2016). Lejeuneaceae is the largest liverwort family of India and the taxa account for about 26% of the total Marchantiophyta flora of the country. Within the family, genus *Cololejeunea* is the largest with 56 species followed by genus *Lejeunea* with 50 species. Some other prolific genera are *Cheilolejeunea* (21 spp.), *Drepanolejeunea* (18 spp.), *Lopholejeunea* (15 spp.) and *Leptolejeunea* (12 spp.). Six genera are represented by single species each viz. *Frullanoides*, *Lepidolejeunea*, *Myriocoleopsis*, *Otelejeunea*, *Ptychanthus* and *Tuzibeanthus*. Out of the total taxa of Lejeuneaceae reported from India, 44 species are found as endemic to the country. Among these, genera *Lejeunea* and *Cololejeunea* contribute a large percentage with 14 and nine endemic species respectively. Assam, a forest dominated state in North-eastern India lying in the rain shadow of Himalayan ranges and situated amidst the Indo-Burma Biodiversity Hotspot, cradles a good number of taxa from the family with 61 species under 13 genera. Here too, *Cololejeunea* has been found to be the dominant genus with 24 taxa. Some other dominant genera are *Lejeunea* (8 spp.), *Leptolejeunea* (6 spp.) and *Cheilolejeunea* (6 spp.). Genera represented by single species in the state are *Caudalejeunea*, *Colura* and *Ptychanthus*. Seven taxa from the family, which are endemic to India, have been found to occur within the state. Three taxa, viz. *Cololejeunea denticulata*, *C. inflata* and *Drepanolejeunea spicata* have been reported to occur only in the state Assam within the Indian territory. Although members of the family use a wide range of substrates for their growth, but, mostly they favour barks (corticolous) and/or leaves (epiphyllous) of other higher plants and thus, constitute dominant composition of epiphytic liverworts. In the state Assam, heavy rainfall, high percentage of humidity and dense, moist forests have provided a suitable microclimate for growth of the epiphytes. It has been found from the present study that about 75% of taxa from Lejeuneaceae in the state are epiphytic. Some common host plants of the epiphytic Lejeuneaceae are various ferns, *Bambusa* sp., *Ficus* sp., *Shorea robusta*, *Morus* sp., *Zingiber* sp., etc. It has been observed that corticolous taxa grow mostly on plants having rough stem bark for ease of anchorage of the rhizoids.

Keywords: Lejeuneaceae, India, Assam

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UNIVERSITY OF JYVÄSKYLÄ



## Sustainable Land Use for Smallholder Farming Communities in Papua New Guinea

(Poster)

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Combining agricultural production with biodiversity conservation is one of the main challenges of the 21st century. This issue is especially urgent in Papua New Guinea (PNG): 85% of PNG's population depends on shifting agriculture, and the rapid population growth is causing a need for increased food production. At the same time PNG's tropical forest hosts 5-10% of the world's biodiversity. Subsistence agriculture is already a major driver of deforestation in PNG. Smallholder farming communities in PNG play an essential role in ensuring food security and biodiversity conservation, because 85% of the land is under customary land tenure. Currently there is a major knowledge gap with regards to how land in PNG can best be managed to produce the food required, while at the same time safeguarding the environment, in the context of population growth and climate change.

The aim of my research project is to contribute to the scientific understanding of agricultural production and biodiversity conservation in PNG, and use the information to engage in land use planning exercises with smallholder farming communities in which it is examined how agriculture and biodiversity conservation can best be combined in the context of social- and ecological change.

To achieve this aim I have conducted fieldwork in different smallholder farming communities based along an elevational gradient in PNG. I performed an ecological survey which examined how herbivory and disease influence current crop yield in smallholder systems in PNG, and what farming practices influence these ecological processes. Results indicate that surrounding a crop field with trees and increasing crop diversity may reduce herbivore- and pathogen damage. In addition, I conducted a social survey which looked at natural resource use and willingness to change current farming practices. Results show that farmers are willing to change their practices.

This February I will again perform ecological and social surveys in PNG. This time I will investigate whether using soil enhancement techniques could be a feasible option to enhance agricultural production.

Future fieldwork will focus on understanding the effect of forest fragmentation in PNG on ecological functioning of the primary forest. I will also explore options that would enable local communities to balance the need for both enhanced food production and biodiversity conservation on their land in a sustainable manner, in the context of a dynamic social-ecological system.

On the ECCB I would like to present the results of my ecological and social surveys that I conducted so far. This means that my presentation will focus on how agricultural production by smallholder farming communities in PNG could be enhanced in a sustainable way.

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## Investigating the value of gardens for providing floral resources to pollinating insects

(Poster)

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### Introduction:

Animal pollination is essential for the production of 75% of the world's crops, with insects playing the largest role in this service. Bees are viewed as the most significant group of pollinators, particularly the honey bee and some species of bumble bee, whose foraging habits have been studied well. As important as these two groups are for crop pollination, there is growing attention towards the role that lesser known species such as solitary bees and hoverflies contribute to this key ecosystem service.

There has been a considerable decline of pollinators in recent years, owing to pressures such as habitat fragmentation, climate change, pests and disease. As floral resources are a limiting factor of pollinator abundance, gardens could play a key role in alleviating pollinator declines by providing a wealth of native and non-native resources and increasing floristic diversity. There are extensive lists available which name 'pollinator-friendly' plants that can be planted in gardens to aid biodiversity, however these lists can be subjective as they are usually inconsistent and a limited number are based on clear scientific evidence.

### Aims:

This study aims to identify the plants that wild pollinators use and determine how these can be provided in gardens and urban amenity areas. These data will be compared to a complementary project looking at the foraging habits of managed honey bees in order to ascertain the way in which different pollinators utilise the resources available to them in the landscape. The results of this project can be delivered to gardeners, land owners and policy makers to aid in pollinator conservation management.

### Methods:

DNA metabarcoding can be used to identify pollen carried by pollinators. Pollen will be sampled monthly from a range of wild pollinators from sites within and surrounding the National Botanic Garden of Wales. DNA will be extracted and the rbcL and ITS2 markers amplified to be sequenced on the Illumina MiSeq platform. These sequences will be compared to the Barcode UK reference library in order to identify the plants the pollen originated from. The area surrounding the study sites will be surveyed during the same period as pollinators are sampled, to create a record of what floral resources are available at each time period, and how much of the floral availability is actually utilised by the pollinators.

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## Comparative spatial behaviour and longevity in cicadas in unburnt vs. burnt forest areas with different management

(Poster)

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Recently burnt habitats are a challenge for the persistence of animal populations. Insects that survive the fire, for example belowground, may sometimes show behavioural plasticity and manage to find adequate resources. But the disturbed habitat is usually not favourable to their survival and reproduction, because of increased predation and limiting resources. Whether insects survive, die or emigrate from burnt areas depends on species-specific traits. Cicadas live belowground as nymphs for several years, appearing aboveground as adults for just a few days. They often emerge in severely burnt forests that may have been logged afterwards, where the habitat structure and composition is totally different from the green forest where the eggs were laid. In order to quantify the movements and survival of cicadas in different disturbance contexts, we radio-tagged and followed, in July 2017, 63 males of *Lyristes plebejus*, a common European cicada species. We used a wildfire of 1235 ha that took place two years before the study, and its vicinity, to set up six study zones (of around 37 ha each) of Mediterranean-climate Aleppo pine forest, with two zones per disturbance treatment (unburnt forest, burnt-unlogged forest and burnt-logged forest, with 19, 21 and 23 radio-tracked cicadas, respectively). A detailed photo-cartography of the zones with the help of a drone was used to locate points of interest such as unburnt forest patches, standing dead trees across the landscape or general suitable habitat. Preliminary results show considerable dispersal distance, with a maximum of 890 m of accumulated movement for one individual. In burnt zones, the majority of long movements (>200 m) ended up in vegetation patches with unburnt canopy. Although we found little dispersal differences between burnt-unlogged and burnt-logged zones, there were smaller Minimum Convex Polygons (MCP) of cicada locations in unburnt than in burnt-unlogged and burnt-logged zones (average of 1.1, 5.8 and 3.0 ha, respectively). Moreover there was higher mean individual longevity in unburnt (4.8 days) than in burnt zones (4.0 days in burnt-unlogged and 3.0 days in burnt-logged). In conclusion, burnt areas appear as a less suitable habitat for *Lyristes plebejus* because of lower canopy cover. Accordingly, individuals may be more exposed to predation and have lower resource availability. In burnt areas, individuals with good fitness can look for better habitat such as unburnt vegetation patches or external unburnt forest. These results emphasize the importance of unburnt patches, that should be excluded from salvage logging, for insects.





## Threats in protected area: Distribution and status of Western Chimpanzee (*Pan troglodytes verus*) population in Sapo National Park, Liberia

(Poster)

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The West African chimpanzee *Pan troglodytes verus*, is highly threatened and the global population has dramatically declined by more than 80% over the last three generations. Sapo National Park (SNP) holds one of the largest remaining populations of the species in West Africa. This study assesses the conservation status, distribution and threats impacting the Western Chimps population in SNP in the last three years (2014-2016). Surveys were carried out along a system of 90 line transects (2km each) established across the 180,365 ha park. We used QGIS to map the distribution of the species across the park. Presence of West African Chimps was detected by identifying nests, vocalization, dungs, tracks, nuts cracking sites, and deployment of camera traps. Seventy-four out of 90 transects surveyed in 2014 show high abundance of the species in the south-western and eastern parts of the park compared to the north. Conversely, results from 62 out of 90 transects surveyed in 2015 show a decline in the abundance of the species in the eastern part of the park compared to the west. In 2016, results from 58 out of 90 transects surveyed show a dramatic decline in the species abundance in eastern compared to the west. There was also high encounter rate of anthropogenic activities in the north-eastern parts of the park compared to the south-western parts. Liberia contains the second highest population of the Chimpanzees and has been identifying as having the most suitable environmental conditions for chimps in West Africa. Therefore, understanding the threats that they face in SNP is important to inform the design and implementation of an effective Regional Action Plan for the protection, preservation, and restoration of Western chimpanzee population.

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## Mutualistic interactions along a fragmentation gradient

(Poster)

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Forest cover loss and fragmentation due to land use changes are one of the principal causes of global biodiversity loss. Indirectly, forest fragmentation can reduce biodiversity and ecosystem functioning by disrupting species interaction networks. Interaction networks, such as seed dispersal networks, are fundamental in maintaining ecosystem services. In tropical forests, frugivorous animals are the most important seed dispersers and thus the main agents of forest regeneration. In general, large tree species produce large seeds that are dispersed by large frugivores. Therefore, in absence of large frugivores, the average size in the tree community is hypothesized to eventually decrease which would lead to lowered carbon storage capacity. The objective of this study was to examine how fragmentation-related factors affect interactions between seed dispersers and trees in highly fragmented Brazilian Atlantic Forest biome. We utilized spatially and taxonomically comprehensive data on 407 frugivorous animal and 1426 zoochoric tree species' occurrences. We fitted spatially explicit joint species distribution models to the occurrence data to combine information on environmental covariates, life-history traits, and phylogenetic correlations. To examine the co-occurrence patterns of frugivores and trees, we first used the fitted models to generate predicted communities spanning over the entire biome. We then calculated the co-occurrence probability of each frugivore-tree pair and examined how the total number of interactions, as well as the proportion of interactions provided by keystone frugivores varied with fragmentation-related covariates (core-to-edge ratio, area of functionally connected forest and distance to nearest road). We found that the proportion of interactions provided by the keystone frugivores experienced an overall decline with increasing level of fragmentation. Furthermore, we observed a decline in the number of frugivore interactions per tree species with increasing level of fragmentation. However, the effect was solely contributed to the functionally connected forest area, not to the edge effect-related covariates. Even though the effects of fragmentation were not as strong as the climatic effects in shaping the seed dispersal interactions, they were consistent and showed that fragmentation changes the networks both quantitatively (via total number of interactions) and qualitatively (via proportion of interactions provided by keystone species). Based on the results, we conclude that identifying and conserving the keystone frugivores could be an efficient way to maintain the stability of the tropical forests.



## Spatial conservation prioritization of Finnish forests for more sustainable land use planning

(Poster)

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Accelerating use of natural resources causing harmful impacts on biodiversity, together with limited resources for conservation, highlight the importance of developing cost-effective, ecologically sustainable land use planning approaches. In Finland, a recent conservation project “METSO - Forest Biodiversity Programme for Southern Finland” tackles the challenge of integrating conservation with sustainable forestry to halt the decline in forest species and habitats. A core element in METSO is the spatial conservation prioritization of forests to supplement the current protected area network, based on concepts of complementarity, and voluntariness. These analyses pave way towards new practices where ecological decision making has a vital role in forest management decision making.

We used the prioritization program, Zonation, to recognize new potential high conservation value forest areas. The overall aim was to conduct nationwide prioritization analyses based on biodiversity-related forest data and land use data recorded at forest stand level. We primarily employed forest structure and quality data (vegetation class, tree species, volume and diameter) which provide ecologically useful surrogates for conservation values in boreal forest. MOTTI-program was used for modelling decaying wood potential indexes and forest data were fed to measure this potential for the whole Finland, using 16 m x 16 m grid. This allowed forecasting the high conservation value areas that contain a lot of decaying wood - a key component for boreal forest biodiversity. In addition, connectivity was taken into account in prioritizations at 3 different levels: (1) connectivity and quality of ecologically similar forest patches, and connectivity measured based on quality and distance to (2) woodland key habitats and (3) permanent conservation areas. The selected forest structure and quality features, linked with connectivity analysis, represent important factors for the long term persistence of red list forest species.

In sum, 6 different analysis setups were employed so that each new version included everything that had been added before. Version 1 included only the decaying wood potential and the last version all features: decaying wood potential, penalty for recorded harmful actions for forest biodiversity, observations of red list forest species and 3 different connectivity measures. As a practical outcome, results will be used in 2015 – 2025 to support local, areal and national level sustainable land use planning and nature conservation by informing ministries, different stake holders in forestry and landowners.

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## Foraging, swimming performance and morphology of semi-wild and hatchery-reared landlocked salmon juveniles

(Poster)

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The Saimaa landlocked salmon (*Salmo salar* m. sebago) in Finland is a critically endangered ecomorph due to the historical damming of rivers. The morph has been dependent on stockings of hatchery-reared juveniles for more than 40 years. Recently, various efforts have been taken to restore some of the earlier reproduction areas to return the natural life cycle. However, as the population has been reared in hatcheries over many generations and as the released fish generally suffer high post-release mortality, it is crucial to know whether domestication has affected the population's fitness-related traits and to assess how the developmental environment affects salmon's phenotype. In the present experiment, we studied the role of the early developmental environment in trait formation by comparing juveniles (0+ years) from three different backgrounds: 1) semi-wild fish from the River Ala-Koitaajoki (stocked as alevins), 2) fish grown in standard hatchery rearing conditions and 3) fish grown in enriched hatchery rearing conditions. All the study fish originated from the same generation and had the same genetic background. We tested their capability of feeding on natural prey, critical swimming speed and studied their morphology. Our preliminary analyses indicate notable background-dependent variation in all the studied traits. Semi-wild fish consumed more natural prey items, had higher critical swimming speed and differed in their fin morphology, when compared to hatchery reared fish. The developmental environment seems to produce differences in key traits, but how this is linked to survival in the wild remains to be studied in the near future.

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## Bilberry (*Vaccinium myrtillus*) pickers on forest landscape: implications for sustaining a non-timber value

(Poster)

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Non-timber-forest-products can offer provisioning services as well as cultural values for a wide range of people. In developed countries gathering of the NTFP has decreased, mostly because of socio-economic changes, but depletion or damaging of key resources can also play a role. Bilberry stands out because of its high anthocyanin content and sensitivity to forest management. We focus on a tradition of bilberry picking in Estonia, where wild berries are gathered by locals both for recreational and commercial purposes and for home use.

The most bilberry-rich forests grow on Podzols as well as on paludified and peat soils; silviculture modifies this distribution through clear-cutting and artificial drainage. Based on 53 interviews with regular berry-pickers, we modelled their picking site preferences, established knowledge sources, movement habits, and reactions to forestry. We used availability sampling among recreational and commercial pickers. The absolute values of the results should not be extrapolated, but we think that the trends reflect the real situation in Estonia.

A strong majority of respondents agreed to show us their berry picking sites on the condition of confidentiality. The gatherers used clearly delineated picking areas, which constituted a subset of bilberry-rich habitats. The highest preference for dry forests suggested that in addition to the amount of resource, the movement complexity and landscape aesthetics are important factors. Knowing good bilberry places in divergent habitats also stabilises the gathering possibilities regardless of weather-driven yearly variations. Similar conclusions have been deduced from Scandinavian studies.

We are not aware of any studies about the behaviour of berry pickers in relation to forest management. In our study, site loss through clear-cutting was experienced as major disturbance (60% of respondents had been forced to find new sites), while bilberry spread in regenerating forests or after drainage was hardly noticed. The last, together with low preference for drained peatland forest, was surprising, as in general drainage increases the bilberry cover in those forests. Berry-pickers preferred public forests, but had no preference for protected areas. However, in protected areas, site abandonment due to forest management was a very rare case. This appeals for acknowledging the values of protected areas more widely, which could also direct the gatherers to more stable sites.

Our study and the pickers' observations distinguished participatory spatial planning of continuous-cover forestry and gap-felling systems in state forests as a priority approach for sustaining traditional bilberry-gathering. Using a representative sample of gatherers to compile a model for spatial planning, could be effective and low-cost approach beside stakeholder involvement, as the knowledge about good bilberry places emerged to be perceived as relatively private information, which value decreases if shared.

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## A new Red Book supplement prepared by the Spanish Plant Conservation Society

(Poster)

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The ‘Guidelines for the monitoring and evaluation of the conservation status of threatened and of special protection species in Spain’ were jointly approved in 2012 by the national and regional governments. This document prescribes the monitoring of 289 vascular plants protected in Spain, either because are included in the Annexes of the Habitats Directive (HD), or because they belong to the Spanish Catalog of Endangered Species. A large part of these plants are local endemics or inhabit a single Spanish area, so regional environmental services are in charge of their study. However, 74 taxa are distributed across several regions (Autonomous Communities), so the responsibility for their monitoring lies with the Spanish ministry.

The Spanish Society of Plant Conservation Biology (SEBICOP) groups together 250 researchers, managers and institutions (botanic gardens), and forms a network of specialists in conservation biology disseminated throughout the country. This scientific society was constituted in 2002 and has carried out the elaboration of the Red Data Book and its addenda, as well as the two Red Lists published so far. During the 2016-17 period, SEBICOP was in charge of the project for the evaluation and monitoring of such 74 species of disjunct distribution, for instance aquatic plants present in several river basins. For this purpose, 24 work teams (universities, research institutes, local botanists) were coordinated to the assessment of the conservation status of these taxa, many included in the HD Annexes and deeply studied for the first time -in case of plants of less concern or conservation urgency-.

The work carried out has produced many surprises regarding previous available information, with some species more threatened than was published in the last Red List (2008), but a larger number in which their risk categories were downgraded. In total, IUCN categories were endorsed as follow: 5 CR, 18 EN, 16 VU, 18 NT, 16 LC, and 1 NE.

Results of the project include a refined methodology for future monitoring phases, prepare a new addendum to the Spanish Red Book to be published in 2018, and serve as the basis for the next Spanish report on state of conservation for several species in the following sexennial report of the HD. Fixed plots have been installed and georeferenced to resampling the status of studied populations every 3-6 years.

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## Priority areas for conserving obligate scavengers and preventing bottom-up ecosystem disruptions

(Poster)

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Biodiversity conservation lacks sufficient funding and the evidence-base on what works and where efforts should be focused. Vultures are the sole obligate vertebrate scavengers and play a key role in maintaining the ecosystem in balance, e.g. by rapidly removing decomposing organic matter, aiding in sanitation and prevention in the spread of diseases. Vultures are the most threatened avian functional group, owing to poisoning, collision with wind turbines and transmission lines, electrocution, anthropogenic disturbance and habitat degradation, among other threats. Recent international commitments to halt the decline of African and Eurasian vultures have been formalized (CMS-Multi-species Action Plan to conserve Africa-Eurasian vultures), whereby the threats, and the actions to revert them, have been identified. Given the vast range covered by vultures, there is a need to identify priority areas for vulture conservation where efforts should be concentrated. We run a spatial prioritization analysis aimed to identify priority areas for conserving the 15 vulture species occurring across Africa-Eurasia. We performed species distribution modeling to refine vulture occurrence within their IUCN range. Next we obtained spatial threat layers. A layer for unintentional poisoning, whereby farmers attempt to control carnivores using poisons which also kill vultures, was obtained by mapping the human-carnivore conflict, i.e. by interacting carnivore and livestock co-occurrence. Similarly, we mapped intentional poisoning, whereby poachers in Africa use poisons to kill vultures, by first identifying the ungulate and carnivore species target of poisoning, then mapping this threat using the selected species ranges across Africa. We used a spatial layer of wind energy potential as proxy for collision with wind turbines, and the global human influence index map as a proxy for multiple anthropogenic threats, such as electrocution, human disturbance, collision with transmission lines. The intensity of these threats was regionally assessed by local experts as part of the CMS. We use this expert information to regionally weight the threats according to their intensity. Similarly, we weighted each vulture species according to its IUCN threat, so that highly endangered species receive higher weight in the prioritization. We then prioritized areas representing core distributions of the vultures and where the intensity of their threats is highest. The aggregate weight of the threats was set to equal that of the vultures to obtain a balanced prioritization between vultures and their threats. The resulting priority map indicates that large swaths of Southern and Eastern Africa, as well as southern Europe, the Arabian Peninsula and the Indian subcontinent emerge as high priorities. These are the areas where conservation efforts should be concentrated, and where individual or multiple threats to vultures should be tackled with high urgency.



## A literature review of legal hunting practices

(Poster)

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Humans have always hunted for food, recreation, sport or cultural reasons. However, legal hunting practices are increasingly being challenged on sustainability and animal welfare grounds, even if hunting can contribute to reach biodiversity objectives (Di Minin et al. 2016). Previous reviews have especially focused on illegal hunting (Benítez-López et al. 2016). In order to collect information on the sustainability of hunting we reviewed the peer-reviewed English language literature on legal hunting. We used 26 hunting related terms to search for all the literature on legal hunting on Web of Science. We focused on terrestrial ecosystems and species, therefore excluding fishing and whaling. The original search resulted in 2 985 papers. These were screened, based on title and abstract, for papers not addressing legal hunting. After this the remaining 1 608 papers were read through to insure systematic inclusion in the database. We further excluded papers that did not specifically study the impact of hunting on species populations, management, conservation, economics, socio-cultural values, animal welfare, or other sustainability related issues. The final review consisted of 1200 articles published between 1953 and January 2018. Our preliminary results highlight the spatial and temporal patterns of legal hunting in English scientific research and present which species the studies have mainly focused on, as well as the socio-ecological, management, governance and animal welfare implications of legal hunting. Overall, we found that there were fewer papers that covered the overall sustainability, ecological, and socio-economic impacts of legal hunting. Some species were studied extensively in North America, also the location with most studies. Other locations highlighted by the number of studies are some parts of Europe and southern Africa. Our review highlights gaps in research that should be filled by future research and provide evidence in supporting conservation decision making.

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## Urban and rural pollinators and pollination – When is the city green enough?

(Poster)

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The declines of insect pollinators have largely been attributed to human induced land use changes such as farming intensification and concomitant landscape changes have been identified as major drivers<sup>1</sup>. Declines in pollinators are negative for biodiversity *per se* and pose a risk to pollination of native plants and crops. Urban areas have been suggested as potential refuges for insect pollinators compared to farmland<sup>2</sup>. The suitability of cities for pollinators likely depend on the extent and quality of urban green spaces<sup>3</sup>. Consequently, these factors could also benefit urban pollination, but this has not yet been thoroughly investigated. Cities are increasingly used for local crop production, stressing the need for pollination. Cities also provide space for increasing numbers of humans and grow both by expansion and infill development, and both directions of growth may be negative for pollinators. To advice on how to build cities to benefit biodiversity while accommodating people, it is therefore essential to consider effects of both human population density and vegetation cover on biodiversity.

We investigated insect pollinators and pollination of native plants and garden crops in two urban areas: Malmö, Sweden, and Brisbane, Australia. We selected 40-45 domestic gardens per city along gradients of surrounding vegetation cover and population density. In Malmö, an additional 14 gardens in rural areas surrounding the city were included as a comparison. We surveyed pollinators and placed experimental plants (3 native species and 2 crops in Malmö, 3 crops in Brisbane) in gardens. We measured insect visitation rates to plants, fruit weight and seed set.

Preliminary results from a subset of the experimental plants species show contrasting effects among plants, and for bees and hoverflies. For an early flowering bellflower we found higher visitation rates of hoverflies at rural sites, while visitation rates by bees were higher at urban sites. For the early flowering strawberry we found no effect of land use on fruit weight. Seed set of the late flowering knapweed was higher in urban than in rural sites in Malmö, but we detected no difference in insect visitation rates. Results on the vegetation and population gradients show a near-significant trend for surrounding vegetation cover to positively affect hoverfly visitation rates to bellflower, while we found no such effect on seed set, insect visitation to knapweed, or strawberry weight. In Brisbane, we found a non-significant trend for vegetation cover to positively affect abundance of non-managed pollinators combined (hover flies and solitary bees). Potentially, contrasting effects of bees and hover flies, as was shown for Malmö, partly mask effects.

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## Predicting the impact of climate change: genomic measures of local adaptation in the Near Eastern Fire Salamander (*Salamandra atra*)

(Poster)

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The Near Eastern fire salamander (*Salamandra atra*) is an endangered species in Israel and the Israeli populations occupy the southernmost, and most xeric habitats of the *Salamandra* genus worldwide. Due to its geographic distribution, restricted to a typical Mediterranean region, *S. atra* is potentially vulnerable to strong environmental changes, such as an increase in temperature or a decrease in the water level. One main problem is that rates of climate change often exceed the rate at which many species can shift their range to find new suitable conditions, and therefore species survival will depend on phenotypic plasticity or adaptive capacity. Although species persistence and local adaptation are directly related to genetic diversity, most of the studies about climate change usually ignore genetic effects on species persistence. In our study we use a Climate Change Vulnerability Assessment to identify the most vulnerable populations of *S. atra* in Israel, to prioritize conservation efforts and resources. We use population specific information on exposure, sensitivity and adaptability from 18 populations of *S. atra*, incorporating estimates of adaptive potential and local adaptation. Since temperature is a parameter that affects almost every aspect of development and metabolism, we choose to estimate exposure to temperature for both larvae (data collected in the field during the whole reproductive period, November-May) and adults (data obtained from Movebank). We assess the physiological sensitivity by using the thermal development optimum (growth curves), critical thermal maximum (CTmax) and acclimation capacity values, that we experimentally obtained. To estimate the potential for each population to tolerate or adapt to climate change, we estimate the demographic adaptive capacity as number of populations and local abundance. We measure the genetic adaptive capacity using allelic richness (estimated from microsatellite data) and we are testing the different populations for local adaptation. Mapping RNA sequencing reads against the available transcriptomes for *S. atra*, we look for SNPs in genes that can be important for local adaptation processes, such as genes involved in oxygen response, growth or development, energy metabolism, etc. We found about 2000 SNPs for one geographic region, and the analyses for the other regions are in progress. The identification of outlier SNPs in some populations can reveal a signal of local adaptation and shed light on the relationships of the genes involved in the adaptation process to specific environmental features. Combining exhaustive information about ecology and genetics for each population will be integral for guiding local conservation management in the most efficient way.



## Conservation issues of two critically endangered Gyps vultures in Assam, India

(Poster)

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Abstract of this presentation is not public



## Assessing the effects of information on the level of support toward charismatic and inconspicuous wildlife species in a highly threatened wetland by the urban population of Valdivia, Chile

(Poster)

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The inclusion of human communities into practical conservation of threatened species has received increasing recognition. One way to achieve this is to understand the current (actual) relation between people and wildlife in a specific territory (1,2,3). The advantage of such understanding is to predict public support towards wildlife species, and therefore develop accurate environmental management strategies (2). The willingness to pay method has been used for this purpose (3). Based on surveys, this method elicits the level of support of people by identifying the amount of money that a person would be willing to give to support conservation activities (3). In the present study it will be used not to obtain a monetary value but to compare the level of support towards different species, as an alternative to the Likert scale method. Besides, it is possible within the survey, to classify people's values towards wildlife and nature (1).

The Centro de Humedales Río Cruces (CHRC) is a pro environmental institution in Valdivia, Chile. In accordance with what is described above, it is necessary to understand the relation between the residents of Valdivia and the wildlife. Doing this will help the CHRC to develop activities for the residents of Valdivia, to conserve not only charismatic species but also inconspicuous.

The aim of the study is to understand how additional information could affect public preferences towards native wildlife species and its conservation, present in the river "Cruces" wetland, by the residents of the city of Valdivia, Chile. The specific objectives are to determine: i) the support towards charismatic and inconspicuous wildlife species, ii) the influence of knowledge (e.i. threatened category and endemism) in the support of species, iii) and determine the underlying values of the support towards wildlife species.

The study will be conducted in Valdivia, Chile, which is situated in the middle of the river "Cruces" wetland. This wetland have a high percentage of threatened and endemic species and is located in one of the 36 biodiversity hotspot.

A questionnaire will be conducted by in-person interviews (March - April 2018). It will be similar to similar previous studies (2), compose by sections. The sections will be: i) demographic characteristics, ii) naturalistic activities, iii) worldview's iv) aesthetic and negativistic attitudes, v) the support towards wildlife species, and vi) the influence of information in the support towards wildlife species.

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## Effects of grassland habitat loss on selection of nature's contributions to people

(Poster)

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Nature's contributions to people (NCP) are nature's characteristics that are vital for human well-being. During recent years, the maintenance and safeguarding of these contributions has become the key issue in nature conservation. Variety of NCP are related to biodiversity of habitats. Biodiversity, in turn, is highly dependent on landscape composition and environmental conditions of habitats. Land use change, habitat degradation and destruction are the primary causes of biodiversity loss and also degradation of NCP's.

Our study was carried out on calcareous grasslands in Estonian islands Saaremaa, Hiiumaa, Muhu and on the mainland of Western Estonia. A total of 35 study sites were sampled. On each study site, we distinguished three successional stages (subsites): a) open alvar - good-quality alvar grasslands characterised by short herb layer and moderate (up to 30-40%) shrub cover (mostly *Juniperus communis*) reflecting historical state of alvars; b) shrubland - previously open alvar grasslands that have been overgrown with dense (<60% cover) juniper shrubs (*J. communis*); and c) afforested alvar - previously open alvar grasslands that have been afforested with Scots pine (*Pinus sylvestris*) in 1970-80s. We studied the effects of changing landscape structure and environmental conditions and compared the provisioning of pollination, pest regulation, climate regulation, soil quality and cultural benefits on every subsite. To assess the potential to provide pollination we used the abundance and species richness of butterflies and bumblebees as an indicator. Additionally, we observed the species richness and abundance of entomophilous plants to measure the potential to attract pollinators. Pest regulation was assessed using species richness and activity density of ground-dwelling spiders and predatory carabids. For climate regulation we used carbon stock and carbon sequestration potential. Soil fertility was assessed using abundance and richness of soil fauna, soil components (soil nutrients K, P, Mg and soil organic matter) and soil depth. To find out the potential to provide cultural benefits we carried through a survey where respondents were expected to value photos of alvar grasslands with different shrub cover and in different successional stages to determine what kind of landscape people would prefer to visit and what do they value about these sceneries. We also asked how much they would be willing to pay to preserve such habitats.

We documented vast changes in landscape structure and in environmental conditions of grassland habitats as a result of overgrowing or afforestation. These changes had also negative impacts on the sustainable supply of observed NCP's. Ecosystem restoration efforts like LIFE+ program project "LIFE to Alvars" could potentially help to decrease the degradation of alvar grasslands and help to maintain vital ecosystem benefits these semi-natural grassland communities provide.



UNIVERSITY OF JYVÄSKYLÄ



## Multidisciplinary assessment of European aapa mire ecosystem changes

(Poster)

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Fens prevail in north-boreal to subarctic regions, while bogs are more common in hemiboreal to middle boreal zones. In concordance with this pattern, the expected north-ward movement of climatic ecotones theoretically includes the transformation of northern fens into bogs. Such a major ecotone shift is plausible because it conforms to the typical pattern of bog development, as most bogs have been fens in their early phases of development. Several recent case studies have suggested that critical phases of the fen-bog transition (i.e. ombrotrophication) may take place rapidly within few decades.

The main goal of SHIFTMIRE is to identify changes in main ecosystem structures during recent decades in aapa mires, an ecotone mire complex type with restricted climatic-zonal occurrence in the north-boreal zone. Ecosystem-scale structural changes can affect important functions like carbon sequestration in peat and have feedback in the climate system. The main hypothesis is that northern ecosystems are in an onset response to climate change and regionally to hydrological disturbances that may lead to ecosystem shifts, corresponding to the threshold state of the Red List assessment protocol of IUCN. We ask if aapa mire ecosystems are changing and can climate and hydrological modelling explain and predict their trends?

In aapa mires, the well-known succession pattern of fen-bog transition is the main theoretical basis of ecosystem change, a phenomenon observed to have taken place within past decades in recent case studies. We aim at testing the use of quantitative proxy results in the Red List of ecosystems protocol and connected risk analysis modelling. Aapa mires are an excellent system for developing and testing of ecosystems modelling, given the advanced understanding of ecological drivers and mire dynamics, a strong capital of ecological time series data and the threats posed by future climate and land use change.

We apply a multidisciplinary approach involving vegetation and peat sampling, remote sensing and modelling of changes in hydrology and vegetation of aapa mires over recent decades. Sampling will first focus on detailed case studies in Finland and subsequently cover a geographically representative sample of aapa mires of NW Europe. Novel methods of hyperspectral imaging of dated peat profiles will be developed for detecting plant material composition of peat. We proceed to climate-model based prediction of potential changes of aapa mires in the next 100 years and make assessment of their ecosystem Red List status.

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## Distribution of Decapoda in Hungary and the impacts of the invasive red swamp crayfish (*Procambarus clarkii*, Girard 1852) to the native ecosystem

(Poster)

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The aim of our studies to summarise the current status of the Decapods species in Hungary and presented the effect of the red swamp crayfish (*Procambarus clarkii*) to the species composition in a tributary stream of the River Danube. During our field surveys the crayfishes were collected by electrofishing and different types of traps in several water habitats in whole territory of Hungary.

Currently, three indigenous crayfish species occur in Hungary. The narrow-clawed crayfish (*Pontastacus leptodactylus*) and the noble crayfish (*Astacus astacus*) are common species and a traditional food source until the mid-20th century. In contrast, the stone crayfish (*Austropotamobius torrentium*) remains the rarest one, being found only at upland locations (Pilis-, Börzsöny-, Visegrádi-, Kőszegi-mountains). Number of native crayfish populations remains steadily decreasing. Therefore, all of them are classified as endangered. The main reasons of their decline are anthropogenic impacts such as water pollution, habitat modifications, and introduction of non-native species. Recently, various examples of crayfish and shrimps released or escaped from indoor aquaria and garden ponds highlighted the pet trade as one of the most important pathways for introductions of non-native decapods.

Nowadays seven non-native decapods have been reported in the wild in Hungary. The spiny-cheek crayfish (*Faxonius limosus*) being first found in 1985, the signal crayfish (*Pacifastacus leniusculus*) in 1998, the catadromous Chinese mitten crab (*Eriocheir sinensis*) in 2003, the marbled crayfish (*Procambarus virginalis*), and the red swamp crayfish in 2014. The results of our intensive research in recent years resulted in two further non-native crayfish. The individuals of the Australian redclaw crayfish (*Cherax quadricarinatus*) and the Mexican dwarf crayfish (*Cambarellus patzcuarensis*) (ref. 1) were found both in thermal waters and in the Danube River (ref. 2). Moreover, we defined their spread dynamics and the impacts on native faunal assemblages.

Following the first record of red swamp crayfish in Carpathian Basin, the first established populations were found in a tributary stream and in the Danube River in 2016. The species composition of the habitats of red swamp

crayfish were surveyed parallel with similar stream where do not occur the species. The results of our two-years survey showed that the non-native red swamp crayfish is capable to completely alter aquatic macrophytes, macroinvertebrates, fish, amphibians and aquatic reptiles. Our results are in line with previous findings on *P. clarkii* in Western Europe and elsewhere.

The research was supported by the UNKP-17-3 New National Excellence Program of the Ministry of Human Capacities.

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## Conservation needs to integrate fire management into an adaptive planning perspective to leverage wildfire suppression co-benefits for bird conservation

(Poster)

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Protected areas (PAs) play a key role in safeguarding biodiversity worldwide. However, their future role can be seriously compromised in dynamic socio-ecological systems due to their limited ability to incorporate the future impact of changing environmental conditions. In this study, we predicted the future effectiveness of the Natura 2000 (N2000) - the current network of protected areas in Europe - at maintaining and representing suitable environmental conditions for a set of 79 bird species between 2000 and 2050 in a fire-prone area strongly affected by land abandonment processes in NE Spain. We then compared PA performance against a set of alternative priority areas for conservation, which take into account fire-vegetation dynamics, selected by using a conservation planning tool (MARXAN). Fire-vegetation dynamics were modelled using a process-based model (MEDFIRE MODEL) under alternative fire management and climate change scenarios. Potential changes in the bird community composition between 2000 and 2050 were predicted under each fire management scenario by applying the SESAM ('spatially explicit species assemblage modelling') framework. This modelling framework applies successive filters to constrained predictions of richness and composition obtained by stacking species distribution models that hierarchically integrate climate change and wildfire-vegetation dynamics. The overall performance of the PA systems was predicted to be higher in terms of representativeness for 2050 (from 49 to 52% across management scenarios) than for present-day conditions (47.9%) for both the static (i.e., current N2000) and adaptive (i.e., MARXAN solutions) systems. However, the effectiveness of the PAs under 2050 conditions was only predicted to be higher than currently when applying an adaptive system. Fire management was also predicted to significantly affect their performance. The efficiency of the current PA system was predicted to decrease from 17.4 to 15% over the next decades. However, a more efficient PA system could be achieved with a conservation planning approach that explicitly considers fire-vegetation dynamics and their management. Our findings showed that the current Natura 2000 might still hold an important bird conservation value by 2050. However, the relocation of some protected areas could be also considered along the next decades to substantially increase bird conservation effectiveness. This study showed how the integration of fire-vegetation dynamics (i.e., fire disturbance, natural succession and post-fire regeneration), fire management policies and their objectives within conservation planning might provide 'win-win' solutions for bird conservation and fire prevention in fire-prone abandoned landscapes. This is especially relevant in the Mediterranean Europe, where the number of high-intensity fires is expected to increase over the next decades due to the interacting effects of rural abandonment and climate warming.



## Practical aspects in the relocation of Hermit beetle *Osmoderma barnabita* micropopulations in Latvia

(Poster)

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Hermit beetle *Osmoderma barnabita* is a species of beetle protected in Latvia and Europe. In accordance with the data of the report to the European Commission on the situation of habitat and species protection in Latvia for 2007–2012 (Article 17 report), the population size of the Hermit beetle *Osmoderma barnabita* protected both in Latvia and Europe is estimated at 350–1000 localities. Specially Protected Nature Territories (hereinafter – SPNT) with Natura 2000 site status contain 71 (41 %) of population, while 103 (59 %) of population are situated outside these sites. A considerable portion of Latvia's population inhabits parks, avenues and other plantations of residential areas, where the hollow trees are felled and removed more and more frequently. The objective of the article is to publish the experience of the research on dead trees inhabited by *Osmoderma barnabita* accumulated to date, methodological aspects of population relocation, as well as to provide recommendations for further research and micropopulation relocation work. The research of the trunks of broken or felled trees by dividing them into shorter spans, sieving the rotten wood, describing the structure of the hollows and counting the detected specimens of *Osmoderma barnabita*, was used as the main research method. Varying quantities of dead wood and numbers of *Osmoderma barnabita* (1–83 specimens) and *Liocola lugubris* (6–55 specimens) have been detected in the five examined trees. In two cases it was detected that in the time period from the felling of the tree until examination (20–40 days) the number of larvae present in the wood was reduced. The hypothesis was proposed that the internal surface area of the hollow of the tree is a significant factor that determines the number of *Osmoderma barnabita* specimens in the hollow.

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## Are rare species more common on organic than on conventional farms?

(Poster)

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Abstract of this presentation is not public



## The amphibian chytrid fungus *Batrachochytrium dendrobatidis* in Sweden

(Poster)

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The amphibian chytrid fungus *Batrachochytrium dendrobatidis* in Sweden

Emerging infectious disease is an important source of wildlife population declines and loss of biological diversity. Many of these emerging wildlife diseases are caused by fungi. The chytrid fungus *Batrachochytrium dendrobatidis* (Bd) infects amphibians and has caused severe population declines in all continents where amphibians occur. While Bd is widespread in southern and central Europe, its occurrence and distribution in northernmost Europe is unknown. Bd was first found in Sweden in 2010. To get a more complete picture of the distribution of the chytrid we conducted a larger survey during 2015 and 2016 centered round the areas of the original findings in southern Sweden and at five new sites in central Sweden. In total, we collected samples from 1144 amphibians from 40 localities. Bd was detected in 47.5 % of the 40 localities studied with an overall prevalence of 17%. In the southern sites Bd was found in all seven species studied, pool frog *Pelophylax lessonae* (63.64%) and green toad *Bufo variabilis* (61.43 %) having highest prevalence. In central Sweden (Uppsala) Bd was found in three of five localities studied, representing the northernmost records of Bd in Europe. Here three species were sampled and the common toad *Bufo bufo* was the only species infected (prevalence 9.5 %).

No individuals showing signs of chytridiomycosis were found in either of the areas. However, in inoculation trials using Bd isolated and cultured from green toads in southern Sweden, high mortality rates were found in infected *B. bufo* with the highest mortality in individuals from northern populations. The same pattern but with lower mortality rates was shown in *Rana arvalis*. The isolated strain of Bd belongs to the global pandemic lineage (GPL). An additional study showed that northern populations of *R. arvalis* have a lower variation in a major histocompatibility (MHC) class II gene –implicated to play a role in Bd resistance - than southern populations.

These results indicate that Bd is much more widespread and common in Scandinavia than previously thought. They also suggest that high-latitude - amphibians may be more sensitive to infectious disease than those from more southern populations. This can be of considerable conservation concern if Bd is becoming more common at high latitudes.

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## **Dog days are over? Human activity interacts with climatic variables to lower survival in an African carnivore**

**(Poster)**

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Abstract of this presentation is not public



## Landscape structure, habitat quality and metapopulation structure as predictors of population size of the Glanville fritillary butterfly

(Poster)

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Spatial variation in population size is affected by many factors, which makes it hard to evaluate the appropriateness of empirical models of population sizes or range dynamics. To complicate matters further in dynamic and spatially structured populations, such as metapopulations, spatial interactions via dispersal as well as local extinctions and colonizations confound the effects of environmental factors. Additionally, while a wealth of "coarse" environmental data are available for most terrestrial ecosystems it is difficult to know how adequate such data are for explaining abundance compared to situations where more detailed habitat and demographic data are also available. The acquisition of such detailed data is costly and might not be available in reasonable time, but can at the same time be crucial for useful modelling outcomes.

To quantify the performance of models incorporating different environmental and demographic data, we analyzed sixteen years of population surveys of the Glanville fritillary butterfly (*Melitaea cinxia*) in the Åland Islands archipelago in Finland. We concentrated on the relative role of landscape heterogeneity and habitat quality in population dynamics of the butterfly as contrasted to the spatial configuration of habitat — issues of some contention between landscape and metapopulation ecology. For landscape effects we used habitat land use as well as distance-based and multi-scale measures of surrounding land use and topography. Habitat quality incorporated different measures of host-plant abundance and vegetation quality in the dry meadows that host the larval stages of the butterfly. To quantify the role of different sources of variation we grouped explanatory variables into (meta)population, habitat quality and landscape structure-related variables. We then assessed their relative importance by comparing spatiotemporal random effects models incorporating permutations of these variable groupings as covariates. The models were implemented using INLA. To mimic situations where only less detailed demographic data are available, we compared the results of the modelling with abundance data to presence-absence data.

Models incorporating both measures of habitat quality and spatial configuration of the habitat performed better than combinations with landscape structure, though the model incorporating all classes of covariates still performed best. These results further confirm that for species with short generation times and life stages involving specialized habitat, some data on habitat and demography is essential. From the viewpoint of metapopulation ecology, these results show that large scale occupancy patterns and abundance are predicted well by metapopulation theory even in a highly heterogeneous insular environment. Nonetheless, the inclusion of landscape structure in spatial population models improves the predictive capability of simpler models and influences estimates of metapopulation persistence.





## An invitation to join sPlot, the global vegetation database

(Poster)

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sPlot is the first vegetation-plot database with global coverage and standardised plant nomenclature. The current version, sPlot 2.1, contains more than one million vegetation plots that have been contributed by regional, national and continental databases. The data has been harmonized with the global trait database (TRY) and is currently being used to perform studies on global vegetation patterns. Undergoing projects using sPlot span from the study of global trait-environment relationships, to the description of global patterns of taxonomical, phylogenetic and functional diversity, and how these vary across scales. These are flanked by other projects focusing on either specific communities (e.g. temperate forests, mountain ecosystems) or taxonomical groups (e.g., ferns, macrophytes), often focusing on the differences between their native and exotic ranges.

We plan to foster the further development of the sPlot initiative in two directions: filling up the remaining data gaps for specific regions of the world, and granting the use of the database to a wider network of users. Indeed, sPlot is still geographically unbalanced, with many gaps outside Europe and the United States. As such we are currently looking for new vegetation databases to join sPlot 3.0 especially with data from Latin America, South Asia, Africa, Oceania and the boreal zone. We believe that sPlot can be the basis for a new generation of studies, not only to address fundamental ecological questions related to plant diversity patterns or community assembly rules, but also as an information baseline for refining interdisciplinary conservation studies in a human-dominated, changing world. With this poster we will illustrate the geographic distribution of the data currently available, the regions that need to be covered, and the main steps for becoming part of the sPlot Consortium.

Further information: [https://www.idiv.de/en/sdiv/working\\_groups/wg\\_pool/splot.html](https://www.idiv.de/en/sdiv/working_groups/wg_pool/splot.html)



UNIVERSITY OF JYVÄSKYLÄ



## Helping society to mitigate logging impacts on biodiversity and ecosystem services of burned forests

(Poster)

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Over the last decades, an average of 213,000 ha of European forest has been affected by fire every year, with 90% of this area corresponding to Mediterranean countries. The timber of the burned forests is harvested by clearcutting over large areas. Whole trees are then chipped to be used as bioenergy, so that very little coarse woody debris remains in the ecosystem. In recent years, scientific evidence has shown the strong impact that these practices of “salvage logging” have on the soil, the ecosystem regeneration and the conservation of biodiversity. Academic debate is therefore centered in the convenience of harvesting burnt forests based on the trade-off between environmental impacts and practical reasons of logging. However, forest owners and companies largely ignore this debate, and salvage logging decisions are usually taken for other reasons, including economic and emotional aspects, immediately after fire. Instead of demonizing postfire logging, our approach has been to look for best forestry practices to protect biodiversity and services provided by the regenerating ecosystem. Based on bibliographic review and feedback with practitioners, authorities and the forest sector, in 2016 we published a “Handbook of good management practices in burnt Mediterranean forests” (pdf available at <http://anifog.wixsite.com/anifog/blank>). The handbook contains the fundamentals of management (based on the measured effects of salvage logging), a decision-making tool to help management decisions, and the recommendations for sustainable forestry (depending on the managers’ objectives and on the environmental context). The next step is to experimentally test alternative management practices. Using 3-4 plots/treatment we are currently measuring the effects of non-intervention (NI), conventional (CL) and sustainable logging (SL) on ecosystem and biodiversity indicators in a mixed pine-oak forest burnt in 2016. Selected indicators will give us information about soil fertility and erosion, woody biomass, plant regeneration, invertebrate diversity (ants, beetles and spiders), vertebrate occupancy, seed removal and the economic yield of each treatment. NI and SL plots are being monitored since 2017, whereas CL plots will be studied from 2018. The total wood biomass was 88 and 98 m<sup>3</sup>/ha in NI and SL plots, respectively. Harvested wood biomass in SL plots was 69 m<sup>3</sup>/ha, while 28 m<sup>3</sup>/ha remained as coarse woody debris (piles of branches and scattered logs) and 11 m<sup>3</sup>/ha as burnt living trees. Provisional results for biodiversity found in the burnt forest include 29 spider, 13 ant and 123 beetle species (70% of them being saproxylic). At the end of the study in 2020 we expect to provide practitioners with quantitative evaluation of three main postfire management options taking into account biodiversity and the ecosystem resilience. We will also provide authorities with ecological assessment protocols to be used before and after the management of burnt forests.

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## Activity Patterns of the Reintroduced Brown Bears (*Ursus arctos*) in the Pyrenees Estimated by Photo-trapping Camera

(Poster)

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Information on intra-specific activity patterns in non-social species, such as the brown bear (*Ursus arctos*), is important for understanding behavioral strategies of avoidance among individuals, specially between different age-sex classes during the breeding season. These studies are particularly important in small and reintroduced populations that are growing and recovering to apply effective conservation measurements. In this study, we reported the intra-specific activity patterns of the bear population in the Pyrenees (Northern Spain and Southern France), between March 2010 and December 2017, in relation with individual avoidance according to sex (males, solitary females and females with offspring), reproductive class (adults, sub-adults and cubs) and dominant males in the study area (dominant and sub-dominant), using a camera-trap survey. We found strong evidence that activity differed between two reproductive classes, sex and seasons. In general, bears were primarily nocturnal, with crepuscular peaks at 6h and 20h (sundial time); however, we present first evidence for this area suggesting that intra-specific activity differs among individuals as an adaptive behavioral strategy, namely: (1) females with cubs avoid males during the mating season, (2) females with cubs and sub-adults are more diurnal, and (3) the activity periods of solitary females and males is similar. Results revealed a high overlap between the activity pattern of males and solitary females, and also between dominant and sub-dominant bears. Indeed, the overlap between males and females with young, and between adult and sub-adult, was lower. These findings support the idea that in the Pyrenees the temporal segregation of brown bear activity is a behavioral strategy to avoid or support encounters with males, according to the reproductive class, decreasing the chances of infanticide.

1. Activity patterns
- 2.. Brown bear
3. Pyrenees



## The shift from Scots pine to Norway spruce in southern Swedish forestry: consequences for biodiversity

(Poster)

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The specific management prescriptions used in production forest stands have direct implications for the biodiversity these managed lands support. A key management prescription in intensively managed production forests is the tree species grown. In southern Sweden Scots pine (*Pinus sylvestris*) was the dominating coniferous tree species used in production forests up until the early 20th century. However, over recent decades there has been a rapid shift in land use, with Norway spruce (*Picea abies*) frequently being planted in place of this tree species. Although both tree species are conifers, their distinctive physiognomy, and the associated implications for understorey conditions has raised concerns regarding the possible implications of this land-use change for biodiversity. We therefore evaluated these concerns by surveying the understorey vascular plants and bryophyte communities of these two production forest types. To do so we surveyed 30 stands each of Scots pine and Norway spruce, in three mature age categories, and analysed associated drivers of understorey vegetation, including site characteristics, and silvicultural prescriptions. Our results reveal significantly higher coverage of vascular plants in sites dominated by Scots pine, and a distinctive community composition in these stands; whereas the cover of bryophytes is similar in both stand types.

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## How do domestic dogs influence intraguild interactions among native canids?

(Poster)

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Harvest rates and bowhunter survey data in the Midwestern U.S. suggest both red fox (*Vulpes vulpes*) and gray fox (*Urocyon cinereoargenteus*) populations have declined, and a recent assessment of mesocarnivore occupancy across southern Illinois suggested gray fox range was contracting. Indices of coyote (*Canis latrans*) abundance increased concurrently and competition resulting in intraguild killing and spatial displacement to human-associated habitats have been proposed as agents of gray fox population decline. In addition, we previously demonstrated a strong elevation in both red fox and gray fox occupancy near human-developed areas if coyotes were present. One complication previously unaccounted for in assessing dynamics between coyotes and foxes is the presence of free-ranging domestic dogs (*Canis familiaris*), commonly associated with anthropogenic habitats. Thus, as gray foxes shift to areas adjacent to anthropogenic habitat to avoid coyotes, they may instead contend with domestic dogs. We utilized an extensive camera-trap data set collected over three years at 1,181 stations across 16 counties in southern Illinois, USA, to evaluate factors influencing species occupancy and interactions between domestic dogs, coyotes, gray foxes and red foxes. Naïve dog occupancy was 0.53 and estimated dog occupancy decreased with distance from structures and municipalities but increased with distance from roads. We found no evidence for species interactions between domestic dogs and coyotes, weak support for a negative interaction between dogs and red foxes, and strong evidence of a negative interaction between dogs and gray foxes. Thus, interacting competitive pressures from coyotes in forest habitats, red foxes in anthropogenic habitats, and the presence of free-ranging dogs along anthropogenic habitat edge, could result in dramatic cumulative impacts to gray fox populations across the region and contribute to the recent decline.

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UNIVERSITY OF JYVÄSKYLÄ



## Effects of habitat fragmentation on bumblebee foraging trip duration and colony fitness

(Poster)

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Agricultural intensification with the associated habitat loss and fragmentation are among the most important drivers for the dramatic loss of wild pollinators. In this study, conducted in intensively managed vineyards in southern Switzerland, we tested the interdependent effects of habitat amount (surface of vegetated vineyards per landscape) and fragmentation (number of vegetated vineyards per landscape) on fitness-relevant traits in bumblebee *Bombus terrestris terrestris* colonies. Individual bumblebee foraging trips were measured with RFID (radio frequency identification) technology while colony fitness was assessed by quantifying nest parameters related to colony size. Vegetation cover in vineyards showed an overall positive effect on colony fitness and foraging behaviour. More specifically, colony fitness was strongly driven by an interactive effect of habitat amount and fragmentation: the degree of fragmentation had a negative effect on bumblebee colony fitness when the amount of habitat was low, while it positively affected colony fitness in landscapes with high amounts of habitat. These results highlight the interdependency of habitat amount and fragmentation on a pollinator's fitness with its concomitant consequences on management recommendations. Whenever habitat amount is low the surface of vegetated vineyards should be increased and aggregated whereas mosaic-like habitats composed of different management styles should be created when habitat amount is high.

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## Plant reproductive success in highly fragmented Valais vineyard landscapes: a quasi-experimental approach

(Poster)

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The ongoing intensification of agriculture has led to habitat loss, degradation and fragmentation with their concomitant negative effects on biodiversity. For plant populations relying on pollinators those processes are expected to have severe effects on individual fitness due to limited pollinator numbers or reduced accessibility in isolated habitat patches. Intensively managed vineyards represent an ideal study system due to their near-binary habitats (vineyards with and without ground vegetation) and their high variation in habitat configuration on a landscape-scale. Here we investigated the effects of habitat quality and the degree of habitat fragmentation on fitness-related variables in four plant species (*Lotus corniculatus*, *Trifolium pratense*, *Centaurea jacea* and *Sinapis alba*) and the relationships with pollinator abundance. Habitat quality, i.e. the amount of ground vegetation significantly affected pollinator visitation rate and reproductive success of plants. Interestingly, habitat amount and the degree of fragmentation had no detectable effects on plant reproductive success, most likely due to the high mobility of pollinator species. Overall these results indicate that the reproductive success of a plant is mainly determined by local habitat quality, i.e. the local management of a vineyard, and to a lower degree by factors acting on the landscape scale.

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## Towards a more nature-based silviculture: effects of experimental forestry treatments on forest regeneration in an oak-hornbeam stand

(Poster)

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Conservational concerns are increasingly important in timber production forest management. Besides clear-cutting and shelterwood forestry systems the more nature-based continuous cover forestry is spreading in temperate forests. To evaluate the success of tree regeneration in various forestry treatments is relevant both from conservational and forestry aspects.

We studied the mortality and growth of planted seedlings within the framework of a comprehensive field experiment (Pilis Experiment). Five treatment types were investigated: clear-cutting (diameter: 80 m), retention tree group within the clear-felled area (diameter: 20 m), preparation cutting (30% of the dominant trees and the whole secondary layer were felled), gap-cutting (diameter: 20 m) and uncut control. The study was conducted in a mature sessile oak-hornbeam forest stand in Northern Hungary, in a complete block design with six replicates. Altogether 750 seedlings, i.e. 150 individuals of five tree species (sessile oak - *Quercus petraea*, Turkey oak - *Quercus cerris*, beech - *Fagus sylvatica*, hornbeam - *Carpinus betulus* and European ash - *Fraxinus excelsior*) were planted. The effect of browsing was completely excluded by the fencing of the plots. Height, stem diameter, shoot number and leaf area of each individual were measured yearly. Here we compare the development of the seedlings in the different treatments, based on the height and shoot number increment during the first three years after the interventions.

Mortality of the seedlings was the lowest in the gaps, and the highest in the control. Height growth of beech, shoot number increment of sessile oak, and both variables of the other species were significantly affected by the treatments. Growth of beech, hornbeam and ash was the largest in the gap- and clear-cutting; their height increased the most intensively in the gap, while shoot number increment did not differ between the gap and the clear-cutting. The shoot number of oaks increased significantly more in the clear-cutting compared to the other treatments; however, their height growth was not significantly greater there. The development of seedlings in the preparation cutting and retention tree group was weak, similarly to the control sites.

Considering both the survival and development of the seedlings, for shade-tolerant species gap-cutting proved to be the best treatment, and for oaks it was similarly suitable than clear-cutting. Continuous cover forestry is much favourable from conservational aspect than rotation forestry. Our short-term result confirm that it also ensures the convenient tree regeneration, thus it can be a good alternative for the industrial forestry to achieve multiple (management and conservational) purposes.

The study was supported by the Hungarian Research Found (OTKA 111887) and by the National Research Development and Innovation Office (GINOP-2.3.2-15-2016-00019, PD123811). Website of Pilis Experiment: <http://piliskiserlet.okologia.mta.hu/en>.



## POPULATION SIZE AND HABITAT OF INDIAN GAZELLE (*Gazella bennettii*) IN NIZAMPUR AREA, DISTRICT NWSHEHRA, PAKISTAN

(Poster)

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The Indian gazelle (*Gazella bennettii*) also known as Chinkara, is a very adaptable wild animal found in the District Nowshera, Khyber Pukhtunkhwa. The present study was conducted on population size and habitat association of Indian gazelle in Manglot near Nizampur area of District Nowshera. The study was conducted from September 2015 to July 2016. The data on population density was collected by direct counting using vantage point method. Data on population was collected by scanning from four vantage points. A total of 19 Indian gazelles were observed in these four different study sites between 328 m and 504 m elevation in the study area. Of the total individuals observed, 21% were males, 37% were females, 32% were yearlings and 10% were young. Habitat analysis was done through vegetation survey using quadrat method in its habitat. Relative density, relative frequency, relative cover and importance value index were calculated for all plant species recorded in Indian gazelle habitat at four study sites. A total of 22 quadrates were taken between the elevation of 328m and 504m near four Vantage Points. A total of 33 plant species belonging to 16 families were recorded in Indian gazelle habitat. Among these species trees were 24.2%, shrubs were 30.3%, herbs were 18.2% and grasses were 27.3%. Indian gazelle in the study area is facing some problems due to impact of increasing human population and also extension of agriculture practices in its potential habitat.

Key Words: 1. Indian gazelle, 2. Population size, 3. habitat

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## Eurasian Chronicle of Nature as a basis for large-scale analysis of changing ecosystems.

(Poster)

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At present, the study of the consequences of global climate change on ecosystems has become particularly relevant. "Chronicles of Nature" is a unique monitoring program unmatched in geographical (former USSR) and temporal scale (from early 1900s and still ongoing in most locations), that accumulated mostly on paper until early 2000s with no coordinated attempt to compile it in a common format. It has become the basis for international cooperation since 2011 in the framework of ECN project led by the University of Helsinki. ECN: Eurasian Chronicle of Nature - Large Scale Analysis of Changing Ecosystems, it has more than 450 participants (researchers) representing 176 organizations from 12 countries including 114 PAs, 34 research institutes, 15 universities, and ministries and departments for environmental protection. The compilation of the data into a common database was conducted by the database coordinators. Large-scale and long-term dataset currently processed that can be used to examine community-level spatial variation in phenological dynamics and its climatic drivers. The database consist of 401,127 observation dates collected in 239 localities in Russia, Ukraine, Belarus, Latvia, Lithuania and Estonia, with the longest time series of 115 years - from 1899 to 2014. In addition to phenological data, we compile the long-term population data of mammals and birds and other types of surveys included "Chronicle of nature". From the very beginning, the project had the task of forming an international network of cooperation and provided for the creation of a database for the mass counting of mammals (including small ones), birds, invertebrates, the dynamics of abundance and diversity of vascular plants and fungi, hunting statistics, meteorological factors, forest cover and phenology. The area of research is biomes of the Eurasian taiga - from Scandinavia to the Urals and further to the coast of the Pacific Ocean. It is assumed, that the database will reflect the environmental changes that have occurred in the ecosystem of boreal forests over the last 50-100 years (including taking into account the monitoring of anthropogenic dynamics of the forest structure occurring against the backdrop of climate change). Data processing is based on developments of the Group of Mathematical Biology of the University of Helsinki. The main work of the Group focuses on the interaction between theoretical and empirical research in spatial and evolutionary biology. The group developed a wide range of mathematical, statistical and computational methods for analyzing the movement of species inhabiting diverse landscapes, with special emphasis on the survival of populations. The existing experience of joint research allows us to speak about the special importance of monitoring works within the "Chronicles of nature" of PAs, and the significance of this work grows in proportion to the duration of observations.

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## Landscape genomics of a grassland plant *Primula veris* in fragmented alvar grasslands of Estonia

(Poster)

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Loss and fragmentation of natural and semi-natural habitats is one of the major threats to genetic diversity. Lowered genetic diversity, in turn, may jeopardize the ability of fragmented populations to respond to environmental perturbations, such as climate change and pollution.

Significant advances in molecular tools during recent years have provided researchers with unprecedented insight not only into patterns of neutral genetic diversity of wild populations, but is now allowing to quantify variation at those regions of the genome, which are affected by natural selection, i.e. adaptive genetic variation. Information on genetic diversity of adaptive relevance helps to predict the vulnerability of wild species to ongoing climate change and significantly facilitates organising conservation of populations in environmentally dynamic habitats. Nevertheless, studies applying such high-throughput genomic tools are still rare in conservation biology.

We examined the genomic diversity of 42 populations of *Primula veris* (20 individuals per population), an insect-pollinated plant species characteristic of calcareous grasslands, in alvar grasslands of Western Estonia. Alvar grasslands are characterised by high plant species richness and unique species composition, but have suffered from severe decrease in area and connectivity during the last hundred years, and hence represent habitats with high conservation importance. These grasslands are thus a good study system for examining the impact of recent landscape change on biodiversity.

To assess genetic diversity of the study populations, we use nearly 5000 single nucleotide polymorphisms (SNPs) obtained through restriction site associated DNA sequencing (RADseq). In addition to current landscape characteristics, we obtained detailed historic information on alvar area and connectivity and surrounding landscape characteristics in 1930s. Furthermore, we have collected a detailed set of various environmental variables at study locations, which help to determine key drivers of local adaptation in our study system. Preliminary evidence indicates that current patterns of genomic diversity in *Primula veris* may exhibit a delayed response to landscape change. We are convinced that our project, which has been carried out in close collaboration with conservation practitioners, will help to propose effective measures for conservation of fragmented plant populations in the light of environmental changes.

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## Development and use of radiometric indexes for assessing Mediterranean wetland functions and human well being

(Poster)

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Wetland ecosystems in Mediterranean regions, especially coastal, are cradles of biological diversity, providing water and primary productivity upon which countless species of plants, animals depend for survival. They offer too recreational activities for human well-being. Recently, remote sensing and Geographic Information Systems tools have been used to assess, monitor wetlands biodiversity and to promote awareness providing technical support to decision makers for conservation and sustainable development of these ecosystems. This research is done in Halk al Minjel sebkha, known as Hergla wetland, located in the center of Tunisia, covering an area of 12 km<sup>2</sup> characterized by its landscape diversity. However, this ecosystem is threatened by different forms of degradation. To monitor changes in this ecosystem, Landsat 5 and Sentinel 2 images have been used from 2007 and 2017 and two radiometric indexes have been calculated for each year: Normalized Difference Vegetation Index (NDVI) and Normalized Differential Salinity Index (NDSI). By analyzing thematic maps, we can deduce that important spatial and temporal variations are detected for each index and a strong correlation is checked. Interpretation of the results according to climate changes and human factors shows negative effects on wetland function and human well being.

Key words: wetland, radiometric indexes, well being





## Are stray Tibetan mastiffs a potential threat to snow leopards on the Tibetan Plateau?

(Poster)

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Around 2012, due to the rise then collapse of the Tibetan mastiff (*Canis lupus familiaris*) market, many dog breeders around Sanjiangyuan Nature Reserve abandoned their mastiffs. Since mastiffs have a range of biological traits and broad morphological adaptability, they occur at densities higher than any other similar sized native carnivores. In recent years, local people have observed incidents of mastiffs in packs attacking snow leopards (*Panthera uncia*) and other wildlife. As a result, stray mastiffs, acting as an introduced species, may become a novel threat to snow leopards, which are a flagship species of the fragile highland ecosystem. Our research aims to understand the ecological role played by stray Tibetan mastiffs in the local ecosystem, and if mastiffs could act as potential predators, prey, and competitors for snow leopards.

We assessed stray mastiff population dynamics by photo recaptures and line transects around 57 sites across 3 years. We put GPS collars on 16 stray mastiffs to estimate their home range, distribution patterns, and movement model. We collected 386 snow leopards and 157 mastiffs scat samples to acquire diet and intestinal microbial community. We set 55 camera traps to analyze activity patterns and habitat selection of them. We then looked at how stray Tibetan mastiffs were interacting with snow leopards through spatial, temporal, and resource separation within Sanjiangyuan Nature Reserve.

Pregnancy rate of female mastiffs was as high as 40.4±5.0%, with the death rate of pups estimated at 64.1±7.3% in the first year, the population growth rate was 5.1±3%. The density of stray Tibetan mastiffs ranged from 0.34-10.6 Indi/km<sup>2</sup>, averaged at 1.6±0.3 Indi/km<sup>2</sup>. 95% kernel estimation of home range ranged from 0.15-28.23 km<sup>2</sup>, average 10.14±3.50 km<sup>2</sup>. High birth rate and density, large home range, combined average weight exceeds 20 kg and group hunting behavior, the stray Tibetan mastiffs may be in a dominant position in the interference competition.

The dietary overlap between Tibetan mastiffs and snow leopards was 0.43, ANOSIM (OTU level) of intestinal microbial community was 0.33. This suggests that there are similarities in dietary structure among both species. Around 52962 km<sup>2</sup> is occupied by Tibetan mastiffs, and 19756km<sup>2</sup> was in snow leopard habitat (16.9%). Combining the overlap of activity patterns was 0.53, we cannot neglect the exploitative competition between the two species.

All the evidence demonstrates stray Tibetan mastiffs could potentially become an emerging threat to snow leopards. Our research can contribute valuable knowledge on a key threat to snow leopards and develop locally relevant solutions that is scientifically based, locally accepted and participatory. We have been working with the local government and communities on the early tests of public education, sterilization and adoption of stray mastiffs. As a result, we hope to see a better future for the long-term conservation of Sanjiangyuan Region.



## The impact of freshwater mussels (order Unionoida) on river bed characteristics and sediment flux: A flume-based study.

(Poster)

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Unionoid mussels are considered keystone species due to their ability to modify and link pelagic, benthic and hyporheic environments in freshwater systems, [1,2,3] yet empirical data to determine their influence on river bed dynamics and sediment flux is lacking.

A recirculating flume-based study using fifty individuals of the unionoid species *Anodonta anatina* investigated the impact of this species on bedform development and particle flux of a polymodal substrate representative of the grain size distribution of the mussel's river habitat. River seston was added to the flume at weekly intervals, and water and substrate conditions were monitored for the eight-week duration of the study. The control experiment had mussels absent from the flume. It was found that the presence of *A. anatina* increased the organic content of the substrate through deposition of pseudofaeces, and led to significant reductions in near-bed velocity, boundary shear-stress and the amount of suspended and dissolved solids in the water column.

However, despite these impacts a greater quantity of sediment and a larger range of grainsizes entered the flume's sediment trap compared to the control experiment when mussels were absent. The impact of mussel bioturbation appears to outweigh any sediment stabilisation effects arising from the increased organic content of the substrate and the reduced near bed velocities. Additionally, sediment grainsize and longitudinal wetted profile measurements indicate that the mussels increased bed roughness and heterogeneity of the substrate.

Given that freshwater mussels can exist at very high densities within rivers, [3] increased mixing and mobilisation of bedload, improved habitat heterogeneity and the transferral of material from the water to the substrate by mussels implies they constitute a critical element in the sediment and nutrient dynamics of fluvial systems.

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## Effects of an invasive plant species, giant goldenrod (*Solidago gigantea*) on pollinator communities

(Poster)

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Invasive plant species can have an effect on native plant and related pollinator insect communities both in anthropogenically disturbed and semi-natural habitats. Due to the dominance of invasive plant species, the impoverished vegetation often results in a decline of native pollinator diversity. Furthermore, invasive species may have a negative effect on flower-visitation of the native wild plant or crop species. We studied the effect of giant goldenrod (*Solidago gigantea*), a common insect-pollinated invasive plant species in Hungary, on bee (Hymenoptera: Apoidea) and hoverfly (Diptera: Syrphidae) communities. We compared 10 invaded (relative cover of *S. gigantea* >50%) with 10 uninvaded (<5% *S. gigantea*) sites. Pollinators were sampled along two 100m long 2m wide transects per study site, twice: before and during the peak flowering of *S. gigantea*. We recorded floral resources at ten 1×1 m quadrates/transect. We analysed the data by generalized linear mixed models, where the response variables were the abundance and species richness of wild bees, hoverflies and abundance of honeybees; explanatory variables were invaded-uninvaded effect, number of flowering species, flower abundance, sampling occasion; random effect was the sampling site, hence we could compare the site-pairs. The flower abundance was larger at the uninvaded sites before and similar between the invaded and uninvaded sites during the flowering of *S. gigantea*. Abundance of pollinators increased with flower abundance in all investigated pollinator groups. Wild bees were the most abundant in the uninvaded sites, before flowering of *S. gigantea*. Honey bees were most abundant in the invaded sites during the flowering of *S. gigantea*. Hoverflies were more abundant in the uninvaded than in the invaded sites before flowering of *S. gigantea*, but showed the opposite during flowering of *S. gigantea*. Our results suggest that sites invaded by *S. gigantea* can host less pollinators due to the lack of native wildflower resources, while later in the season the flowering patches of *S. gigantea* are attractive for honeybees and hoverfly species. We suggest that further similar studies are needed on other invasive plant species to highlight trait-specific differences in the response of pollinator insects. Furthermore, studies are needed at finer temporal scale to reveal the whole seasonal effect of invasive species on plant-pollinator networks.

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## “Beyond the grassland”: habitat use of extensively grazing cattle, sheep

(Poster)

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Noémi Ujházy<sup>4</sup>, Kinga Öllerer<sup>3</sup>, Ábel Molnár<sup>5</sup>, Krisztina Molnár<sup>6</sup>, Kriszta Gellény<sup>7</sup>,  
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The role of extensive grazing in nature conservation is growing. The historical importance of this management type in Europe is widely acknowledged, but detailed, systematic description of the practices and of the related traditional knowledge is still absent. Our aim was to study which habitat types were grazed and what was their role in the extensive grazing systems during the last 80 years. We carried out 147 structured interviews in 38 landscapes throughout the Carpathian Basin, with 3–5 informants/landscape. The number of actively grazing cattle, sheep and pigs, their year-round habitat use and the proportion of herds actively tended were documented for four characteristic historical periods (before, during and after socialist cooperatives and after EU Accession). The numbers of grazing cattle and sheep had decreased substantially by 2010 (by 71% and 49%, respectively), while pig grazing almost disappeared by the 1970s. Cattle primarily grazed habitats with taller vegetation. Sheep grazed dry pastures and stubbles, while pigs were driven into marshes and forests. In general, the importance of dry and wet grasslands increased, while the significance of marshes, stubble fields, vegetation along linear elements, second growth on hay meadows, wood-pastures and forests decreased over time. Approximately half of the grazed habitats were not typical pasture grasslands, and functioned as supplementary pastures during droughts, autumn and winter. The number of habitat types grazed per month per site dropped, and herding decreased substantially, in particular in the case of cattle and pigs. It can be stated that the majority of these extensive grazing systems could be considered as agroforestry and silvopastoral systems. Contributing factors of the economic and social changes of the examined period included the collapse of the communist-era legal framework, the intensification of livestock husbandry, EU Common Agricultural Policy (CAP) regulations, and the rise of a nature conservation ethic. We conclude that agricultural policies should take into account the full spectrum of habitat types necessary for the effective operation of extensive grazing systems. Our results encourage forest grazing for nature conservation purpose, thus under strictly defined conditions.

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## Climate change and habitat management implications for a declining grassland songbird in the North American Great Plains

(Poster)

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Accelerating climate change is affecting species worldwide, and is expected to have impacts on more than half of North American bird species. Some of the most rapidly declining birds in continental North America include those in the Great Plains, which are considered particularly vulnerable to climate-induced range contractions and shifts. Although grassland bird responses to habitat management are well-documented, less is known about their population responses to climate change and its interactions with their breeding habitat. We evaluated how climate and habitat management parameters influenced the abundance of Grasshopper Sparrow (*Ammodramus savannarum*), a declining Neotropical migratory bird that breeds on private conservation lands in the Platte River Valley, Nebraska, USA. To assess the potential impacts of future climate change on this species, we used a mark-recapture framework to sample birds at a total of 15 grassland sites subjected to various management actions including patch burning, cattle grazing, and haying over a 6 year period. We collected data for a total of 1194 birds over 388 netting days and used data to test sparrow responses to climate and management variables and their interactions via a series of candidate models created as generalized linear mixed models in R. Our top model incorporated the additive effects of interactions between grazing and burning histories with spring precipitation. Lower rainfall was correlated with higher sparrow abundance, likely due to its influence on foraging and food availability. The Grasshopper Sparrow population in this study was heavily affected by climate, so we expect ongoing climate change to have a strong influence on future population trends. The high conservation value of this area for a steeply declining grassland bird species highlights the importance of private conservation lands in mitigating negative anthropogenic impacts, including climate change, on wildlife, and the importance of adaptive management in maintaining populations of vulnerable species.

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2018/06/12

11:00

Room: A1 Wilhelm



## Impact of forest management on global vegetation biomass

(Oral)

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Carbon stocks in vegetation play a key role in the climate system. In a recent study, we showed the effect of land use on these carbon stocks. We found that vegetation currently stores around 450 petagrams of carbon, which is less than half of the potential vegetation that would prevail in the hypothetical absence of land use. While deforestation and other land-cover changes are responsible for a bit more than half of the difference between current and potential biomass stocks, land management effects contribute the other half. Forest management presently lowers carbon stocks by 100-150 petagrams of carbon compared potential carbon stocks in forests, which is the same effect as deforestation for cropland or 11 to 16 times the of current global annual GHG emissions. We will discuss the relevance of properly integrating these management effects into global carbon models. Overall, our results highlight trade-offs between conserving carbon stocks on managed land and raising the contribution of biomass to raw material and energy supply for the mitigation of climate change.

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## Direct and indirect impacts of climate change and land use change over biodiversity: a case of study with the brown bear in Europe

(Oral)

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Climate and land use changes are the main drivers of biodiversity loss and species distribution range contractions. Previous studies have primarily explored the direct effects of these drivers on biodiversity while ignoring the indirect effects that come through other species. Models ignoring these mechanisms are prone to erroneous predictions of how global change impacts biodiversity, which impedes our ability to make effective management decision for biodiversity conservation. Here, we focus on the brown bear (*Ursus arctos*), a well-studied omnivore species that has trophic interactions with many different taxa. We aim understand how direct and indirect impacts of climate and land use change would affect the future distribution and vulnerability of different populations across Europe. We first conducted a literature search in Web of Science and Google Scholar to gather all available brown bear diet studies in Europe, based on faecal or stomach content. From the 32 identified studies, we selected 16 in which food items were described at the species level. In total, we compiled information on ~100 species that are generally consumed by brown bears. We constructed a spatial dataset assigning diet to different populations. We download well-defined and located occurrence data for all species found in the diet of the from brown bear from GBIF. To build reliable species distribution models for all these species, we used *biomod2* in R that provides multiple algorithms and allows generating ensemble of species predictions per species. We control for the potential spatial bias in GBIF in the selection of pseudo-absence data following recommendation by Phillips et al. 2006. Single species distribution models for all species found in the diet were finally built in function of current climate and land use data. Using different scenarios for climate and land use change, we projected the future distributions of the brown bear diet species. Finally, using these projections and scenarios, we calculated the potential current and future suitable habitats of brown bear in Europe in function of its diet, climate and land use. The range dynamic of the brown bear was best explained by considering both direct and indirect impacts. Accounting for diet (indirect effect) buffered the direct impact of climate and land use change. Our results highlight the importance of taking a food-web ecosystem approach to evaluate the impact of global changes and predict modifications in the distribution and vulnerability of species.



## Stand-scale potential of production forests for lichen diversity: a hemiboreal perspective

(Oral)

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It is still poorly documented how the role of production forests for sustaining biodiversity varies depending on the management techniques used, particularly in the case of species-rich and poorly detectable taxon groups. We studied lichens in hemiboreal forest landscapes in Estonia to understand (i) the stand-scale potential of production forests in maintaining the full assemblages present in old-growth forests and natural wildfire areas; (ii) limiting factors for lichen species and assemblages in production forests.

The Estonian production forests are known to have relatively high habitat quality despite the dominant clear-cutting practices: their medium-intensity ‘semi-natural forestry’ approach has maintained tree species diversity through predominantly natural regeneration and through retention and low-intensity thinning practices. We sampled stand-scale full lichen assemblages and measured stand structure in 125 2-ha plots representing three successional stages (old growth; mature managed forests; clearcut sites) and both clear-cut and wildfire origin. The full dataset (378 species, including non-lichenized calicioid fungi and lichenicolous fungi) comprised three-fourths of the respective species pool known to inhabit forests in Estonia.

Our main finding was that approximately half of the total species pool can inhabit production forests only if specific substratum legacies (e.g., deciduous trees, dead wood) are favored during management. In turn, half of these species tend to be nationally rare and their populations in production forests may be crucially important (currently distributed in rather similar proportion between production forests and reserves). The other half of the total species pool comprises species that regularly inhabit production forests of highly variable habitat quality (35% of all species) or are restricted to natural forests (15%).

The post-disturbance successional differences among lichens assemblages were very clear, and this was only partly dependent on tree retention practices that determined the presence of 152 epiphyte species in early successional stands. Additionally, one third of species regularly inhabiting production forests were confined to older stands where their presence depends on rotation age or the spread of uneven-aged silviculture. Managing for tree species diversity within stands was also very influential while the diversity among stands was restricted to two main assemblage types (pine forests and spruce-deciduous mixed forests).

In conclusion, production forests did not form one ‘habitat’ that could be used for analysing conservation solutions across landscapes and much more attention should be paid on the particular management regimes used or available.



## Net carbon balance of Finnish forests under climate change - Forest management induced differences between local and global model estimates

(Oral)

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Several studies predict increases of forest growth and carbon stocks under climate change. Increases can be largely attributed to increasing temperature and CO<sub>2</sub> concentration of atmosphere, and the assumption that water does not limit to growth. However, in intensively managed regions such as Finland, forests carbon stocks are perpetuated foremost by forest management, which means that little additional C from atmosphere may be stored in the biomass stock forests if management remains intensive. In this study, we simulated forest growth and carbon balances using a stand model PREBAS and a land surface model JSBACH under bias-corrected forcings of three AR5 climate scenarios run by 5 climate models. PREBAS was initialized with high resolution maps of forest inventory data covering Finland, which realistically represent the structure and biomass distribution in Finnish forests. Forest management followed (a variant of) forest management guidelines yielding realistic level of removals at the national level. JSBACH used PFT-based areal classification as a starting point of the simulations and it did not simulate harvests. Simulations of both models showed positive responses of GPP and NPP of forests to longer and warmer growing seasons little influenced by drought. Biomass carbon stocks and NEE, on the other hand, were sensitive to the management assumption. The study highlights the importance of simulating forest management also in land-surface models, because it directly affects how much C will be removed from atmosphere and how much of it will be stored in the managed ecosystems in future.

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## Ecosystem services and assessment of the soil biological activity exemplified by the mountain chernozem soils of the Central Caucasus

(Oral)

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Different subtypes of mountain chernozem soils (total area 845 km<sup>2</sup>) of Kabardino-Balkar Republic formed at a height range of over 500 m a.s.l. within the elbrusskiy variant of vertical zones distribution of the Central Caucasus. These unique highly productive pedoenvironments are actively used in agriculture, that leads to a significant change of their biological properties. The purpose of the study is the comparative evaluation of biological indicators and general level of biological activity in the upper horizons (0-20cm) of natural and arable mountain chernozem soils of the Central Caucasus. The criterion for the evaluation of the overall biological activity is an integral index of the ecologic–biological soil state (IIEBSS, %), defined on the basis of the following soil parameters of biological activity: content and reserves of humus, content and reserves of microbial biomass carbon (Cmic), basal and substrate - induced respiration rate, enzymatic activity (urease, invertase, phosphatase, dehydrogenase, catalase).

The results of the study indicate a different degree of stability of the controlled biological activity indicators to the long-term agricultural impact. In the arable horizons the urease activity is reduced by 63% - invertase by 57% - the basal respiration rate by 48% - the phosphatase by 44% - dehydrogenase by 42% - humus content and substrate - induced respiration rate by 29% - microbial biomass carbon content (Cmic) by 28% - Cmic reserves by 21% - humus reserves by 20% and catalase activity by 16%.

These changes in all the indicators result in decrease of the overall level of biological activity of mountain agrochernozems. The decrease in the IIEBSS value by 35-42% is alarming, because according to the opinion of leading experts the loss of the bioenergy potential by more than 30% points to disturbance of threshold stability of soil systems and their abilities to restore its natural resource properties.



However, it should be noted that the high natural fertility of the mountain chernozems allows them to maintain a stable state after long-term agricultural use. Arable horizons are characterized by favorable physical and chemical properties, quite high content of humus (5%) and microbial biomass carbon (more than 1050 mcg C/g). It should make every efforts to maintain and increase the productivity of these rare and fertile soils which are able to date to provide ecosystem services, functioning both in natural and agrogenic conditions. The conservation of the natural mountain chernozem soils is prerequisite for maintaining unique ecosystems in foothill steppes and meadows, which are currently on the brink of extinction.



## Effects of Fisheries on Complex Food Webs

(Oral)

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Vast scientific research has demonstrated that overfishing causes species extinctions, decreases the abundance and body size of target populations and accelerates their maturation. However, we still lack good understanding and predictive power on how these impacts propagate through the trophic network, affect other species and alter the structure and dynamics of the whole community. We help develop such understanding by computationally evaluating effects of fisheries on complex communities using concepts and tools from complex networks. I will first present our study on the effects of artisanal fisheries on the structure and dynamics of complex food webs of the intertidal and subtidal ecosystems of Central Chile. To study those effects, we compiled data on trophic interactions and commercial loads to build the food webs and then simulate their community dynamics including human exploitation using “Allometric Trophic Network” models. I will finish my talk by presenting our new theoretical research incorporating economic dynamics of fisheries into complex food web models.

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## Alien plants and recipient habitats in the Mediterranean Basin: How similar they are?

(Oral)

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Biological invasions have become one of the most critical issues related to global change. The aim of this work was to investigate alien plant species invasion levels in different habitats and alien species traits by comparing the naturalized flora in different areas of the same biogeographical region. The locations selected for study were 4 countries across the European Mediterranean basin comprising an east–west gradient, namely Spain, Italy, Greece and Cyprus. Floristic similarity among the 4 countries was found very low, with only 30 species present in all four countries out of the 782 naturalized neophytes. The four alien floras share the same patterns of growth form (mostly herbs), life cycle (mostly perennials) and life form (mostly therophytes, hemicryptophytes and phanerophytes). Artificial habitats and wetlands were the habitats with the highest numbers of naturalized species and display the greatest homogenization in all four countries. Coastal habitats display a lower degree of homogenization but a high frequency of aliens. Dry shrubs and rocky habitats display a lower degree of homogenization and a low frequency of aliens.

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## Trajectory analyses of past human land use as a tool to understand present terrestrial mammals' distribution

(Oral)

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Apart from the known environmental factors influencing species distribution at the global scale, additional anthropogenic factors need to be considered in order to understand their current extents of occurrence. Namely, threatened species should particularly be influenced by human activities, since they are known to be in decline under their influence. The role of present human activities in modeling species distribution seems clear, but there is still a facet of land use that has not yet been sufficiently explored: land-use history. In the present work we show how to summarize overall land-use trajectories based on available data ranging from c.B.C.6000 to c.A.D.2000 by using a clustering method. Then, we explore how indicators of total land use area at different time spans, rates of land-use change, or the occurrence of remarkable land-use shifts associate to the current distribution of total and threatened mammal richness by means of boosted regression trees. We find that we can separate the Earth surface into three groups, according to their trajectory of past land use: low-, recently- and steadily-used areas. Differences in total or threatened mammalian richness among clusters are not significant, however differences in the shape of the past land use- species richness relationship are relevant. This finding warn us about the risk of interpreting certain patterns as global rules, when they may actually depend on the past land-use history of an area. On the other hand, past land-use metrics are little relevant in predicting their distribution compared to latitude or total mammalian richness. Nevertheless, past land-use indicators are more informative than present land-use values, which may be pointing at the existence of a generalized extinction debt in the whole planet Earth regarding mammals. In conclusion, understanding general past land-use changes improves our ability to interpret current species distribution patterns.

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## Ecosystem carbon and biodiversity in thirteen landscapes around the world

(Oral)

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Impacts on biodiversity are considered one of the main detrimental consequences of changing climates. However, climate change mitigation is also directly influencing biodiversity if it is done by adding ecosystem carbon relative to a reference scenario. Often it has been assumed that adding ecosystem carbon relative to a reference scenario, e.g. by avoiding deforestation and forest degradation, is always beneficial for biodiversity conservation. However, this association has been shown to hold only locally, or with a specific taxonomic or functional group. Our objective was to study this relationship based on expert interviews. We interviewed 115 biodiversity experts on value for biodiversity of various land uses found in 12 landscapes in 7 countries and 5 continents around the world. The experts gave an approximate score from zero to ten on value of the land use types on conservation of the taxon in focus. We found support to the thinking that land uses containing a large amount of ecosystem carbon are associated with a high value for biodiversity conservation but with some notable exceptions. For example converting a native scrubland to an exotic tree plantation was found to have a negative impact on biodiversity. However, in general, biodiversity conservation is in most cases an important co-benefit of climate change mitigation.

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## An eco-evolutionary perspective on marine reserves

(Oral)

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Marine reserves are a valuable tool for protecting against human impacts such as harvesting and are expected to support fisheries beyond their boundaries through spillover of juveniles and mature fish. Furthermore, marine reserves could guard against fisheries-induced evolutionary changes in fish life-history traits such as growth and maturation, by protecting phenotypes that are otherwise typically targeted by fishers. However, little attention has been paid to the potential for selection directly on behavioural traits posed by fisheries and to the role that marine reserves may play in buffering or strengthening those processes. Recently, it has been hypothesised that spillover fisheries (operating along the reserve border) could exert strong selection against individuals with a higher tendency to spend time outside the reserve (e.g. individuals with larger home ranges) potentially eroding the fisheries benefits while increasing the conservation effectiveness of the reserves. I will present case studies on harvested fish species from the Norwegian coast, where we use long-term mark-recapture and telemetry data to quantify individual behaviour and fate in the wild, before and after the implementation of marine reserves. Our studies highlight how such spatial management actions could alter the selection regimes in aquatic systems.

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## The effects of logging residue extraction for energy on ecosystem services and biodiversity: a synthesis

(Oral)

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This presentation is based on a paper in press in *Journal of Environmental Management*. We review the consequences for biodiversity and ecosystem services from the industrial-scale extraction of logging residues (tops, branches and stumps from harvested trees and small-diameter trees from thinnings) in managed forests. Logging residue extraction can be used in place of fossil fuels, and thus contribute to climate change mitigation. The additional biomass and nutrients removed, and soils and other structures disturbed, have several potential environmental impacts. To evaluate potential impacts on ecosystem services and biodiversity we reviewed 279 scientific papers that compared logging residue extraction with non-extraction, the majority of which were conducted in Northern Europe and North America. The weight of available evidence indicates that logging residue extraction can have significant negative effects on biodiversity, especially for species naturally adapted to sun-exposed conditions and the large amounts of dead wood that are created by large-scaled forest disturbances. Slash extraction may also pose risks for future biomass production itself, due to the associated loss of nutrients. For water quality, reindeer herding, mammalian game species, berries, and natural heritage the results were complicated by primarily negative but some positive effects, while for recreation and pest control positive effects were more consistent. Further, there are initial negative effects on carbon storage, but these effects are transient and carbon stocks are mostly restored over decadal time perspectives. We summarize ways of decreasing some of the negative effects of logging residue extraction on specific ecosystem services, by changing the categories of residue extracted, and site or forest type targeted for extraction. However, we found that suggested pathways for minimizing adverse outcomes were often in conflict among the ecosystem services assessed. Compensatory measures for logging residue extraction may also be used (e.g. ash recycling, liming, fertilization), though these may also be associated with adverse environmental impacts.



## DNA metabarcoding of hidden biodiversity in the Mediterranean Basin

(Oral)

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One of the most remarkable features of Mediterranean-type regions worldwide is their high levels of biodiversity. However, it is striking that we still know so little about many of its taxa, particularly regarding the invertebrates. This is regrettable, because Mediterranean biodiversity is threatened by a range of factors that include land use changes, overexploitation of natural resources and global climate changes. As a consequence, biodiversity assessments and biomonitoring studies are more urgent than ever, as they provide critical baselines for planning and monitoring conservation programs.

For many species groups, key obstacles to the development of comprehensive biodiversity surveys are the shortage of specialised taxonomists, and the fact that “traditional” taxonomic work is highly time consuming. Furthermore, there is increasing evidence that many species recognised based only on morphology are indeed complexes of cryptic species, which adds difficulty to “traditional” taxonomy. Until recently, these difficulties seemed largely unsurmountable, and thus conservation research has mainly focused on a narrow set of taxonomic groups such as vertebrates or flowering plants, or otherwise on a few charismatic species of arthropods or of other less known groups. Fortunately, the situation is changing fast, due to the advent of next-generation sequencing coupled with DNA metabarcoding approaches. These powerful tools have the ability to revolutionise biodiversity research in the Mediterranean, making it possible to survey virtually any group of species, with highly replicated sampling, at a range of spatial and temporal scales.

In this presentation, we provide an overview of DNA metabarcoding for conservation research in the Mediterranean, using a case study in NE Portugal where we are evaluating the complementarity of natural and agricultural habitats for nocturnal arthropods assemblages. First, we illustrate the development of a comprehensive DNA barcode collection of target taxonomic groups, which is a critical prerequisite for developing conservation research using DNA metabarcoding. In particular, we highlight the role of “traditional” taxonomists, which need to remain deeply involved despite the development of molecular techniques. Second, we illustrate how samples can be collected and processed to allow for DNA metabarcoding studies, and stress the importance of robust and highly-replicated sampling designs. Third, we describe the lab and bioinformatics pipelines, providing a simple overview on the challenges and potential pitfalls. Fourth, we show the type of data that emerges from DNA metabarcoding studies, and how they can be used to answer conservation biology questions. Finally, we end with a quick overview on the potential and current limitations for mainstreaming DNA metabarcoding into Mediterranean conservation research.



## Metabarcoding of arthropod communities as biomonitoring tool for the conservation

(Oral)

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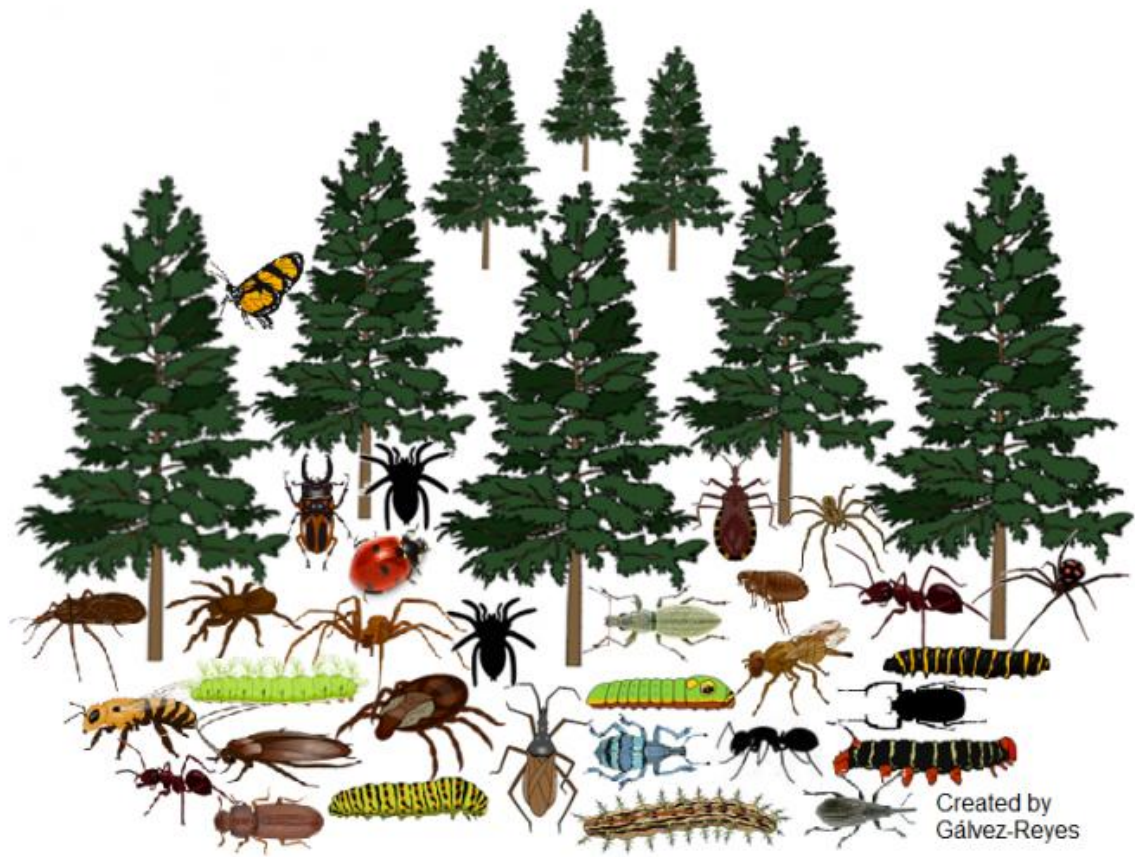
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Deforestation and fragmentation of forests contributes to dramatic loss of biodiversity and ecosystem services. As a strategy to combat this degradation, it has been proposed to recover deforested areas through forest plantations and to perform sustainable forestry as an alternative to illegal logging. For example, these strategies are part of the arguments used to change the type of natural protected area of the Nevado de Toluca Park, in Mexico. Although plantations and sustainable forestry ensure the persistence of the tree cover, these involve anthropogenic changes and disturbances, whose effects on fauna communities and biodiversity evolution are poorly known. To study these effects from an ecological perspective and to provide effective management recommendations data on species' distribution and abundance over large geographic and temporal scales is needed. Here, we perform arthropod biomonitoring of Nevado de Toluca forests lands subjected to conservation or different types of forestry, to examine changes at the biological community level. For this, we sampled around 3,000 pitfall traps during 15 days of the main rain season. These were subjected to metabarcoding (COI gene) sequencing for operational taxonomic units (OTUs) identification. We focus in the arthropods-community as bio-indicator, joining the community structure (diversity, abundance and richness) with the estimators of biological diversity (indices of diversity: abundance and species richness) to describe the behavior of arthropods-communities under different environmental and management conditions. Metabarcoding allowed to identify OTUs and describe communities with a resolution not feasible by traditional methods, due to the poor taxonomic knowledge of the area. When then analyses how components of Gamma diversity (regional pool of species = landscape), Alpha diversity (local pool) and Beta diversity (replacement/ turnover) between communities vary according to the different types of forest land conditions. We conclude arthropod metabarcoding is a reliable and informative biomonitoring tool that allowed to better understand the impact of forest management on arthropods communities.







## Empirical Links Between Demography, Life History, and Recovery in Fishes

(Oral)

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Studies on small and declining populations dominate research in conservation biology. This emphasis reflects two overarching frameworks: the small-population paradigm focuses on correlates of increased extinction probability; the declining-population paradigm directs attention to the causes and consequences of depletion. Neither, however, particularly informs research on the determinants, rate, or uncertainty of population increase. Compounding this deficiency is a long-standing assumption that Allee effects (declining per capita growth rate, 'r', with declining population size) either do not exist, or are generally not important, in aquatic systems. Several recent studies challenge the assumption that population-size thresholds, or 'tipping points', do not exist in fishes. Key conclusions emerge from this body of work. The greater the reduction in population size, the greater the likelihood that Allee effects impair recovery. Secondly, life-history traits, although poor predictors of recovery when considered singly, can reliably predict recovery potential when combined to estimate natural mortality. Coupling population-dynamical correlates of recovery with evolution – the result of natural and human-induced selection – provides additional challenges to forecasting rates and probabilities of recovery in depleted fishes.

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## Intrinsic and extrinsic correlates of range change in mammals

(Oral)

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The global conservation status of all mammals has been evaluated for the first time in 2008, and in 2010 Hoffman et al. (2010) made a retrospective assessment related to the year 1996. A recent study by Di Marco et al. (2014) assigned species to a threat category in 1970, based on information in the published literature. Despite the great efforts made in understanding the situation of mammals in the recent past, most of the existing studies lack information on changes in the spatial distribution of the species. In this study we aimed at filling this gap by collecting data on the distribution of mammals in the 1970s, when this information was available and reliable, and we then compared the past range of species to their current range. We identified the areas gained or lost by each selected mammal, and analysed the relationship between the loss or gain of part of the distributional range and a set of intrinsic traits and drivers of threat. For most of the species that experienced a range reduction, the increase in human population and pressure have been the major drivers of decline. This work will help to understand the success of past and current conservation actions on species and also the identification of sites potentially exposed to human influence in the near future.

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## Walk on the Wild Side: Using Walking Interviews and Focusing to Assess Cultural Ecosystem Services

(Oral)

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Cultural ecosystem services (CES) include recreational, spiritual, cultural and cognitive services that people receive from nature. They are inherently difficult to assess due to their largely intangible nature. We first review the main methodologies currently used for CES assessment, such as monetary evaluation (earnings or willingness to pay), GIS mapping, surveys, interviews and focus groups, and describe their respective advantages and limitations (Orenstein, Zimroni & Eisenberg 2015).

We then present the current study, in which we implement a novel methodology that combines walking interviews in natural landscapes and the technique of *Focusing*. Walking interviews have been found to produce more valuable place-related data, more natural and less inhibited interviews, and information involving all senses (Anderson 2004). Focusing was developed by Eugene Gendlin for therapeutic applications (1996). It encourages focusers to be attentive to the "felt sense" their bodies provide, including information often perceived as irrelevant "background". Focusing interviews thus provide insight into human experiences rather than into opinions or preferences.

In the pilot study, we conducted 30 walking-focusing interviews in the Negev Desert, asking subjects to focus on various aspects of their experience. Interviews were recorded, transcribed, and thematically analyzed. Main themes included a sense of detachment from everyday life, obtaining a new point of view, enhanced imagination, reminiscing, feelings of love and longing, fear, boredom, finding the landscape reminiscent of biblical times or other planets, scientific curiosity and appreciating long-term geological processes and sophisticated biological mechanisms.

Results indicate that this methodology can enable scientists to better understand the holistic experience of subjects and that the advantageous combination of walking in nature and focusing gives access to myriad types of information, including physical, emotional and cognitive experiences, often intertwined. It also has the potential to supply data that is closer to the authentic human experience of nature. This is due to the nature of this technique, which includes very little guidance on the part of the interviewer and mostly follows up on the subject's previous responses.

Finally, we suggest that this methodology was particularly suitable for the study of CES in drylands. As drylands often have less conspicuous fauna and flora, focusing enabled participants to notice and address them more clearly.

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12:30

Room: K305 Alvar



## Panel discussion: The diversity of Biodiversity Monitoring

(Oral)

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Abstract of this presentation is not public



## Detecting deterrence from patrol data

(Oral)

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The threat posed to protected areas (PAs) by the illegal killing of wildlife is countered principally by ranger patrols that aim to detect and deter potential offenders. Deterring poaching is a fundamental conservation objective [1]. However, deterrence is difficult to identify, especially when the prime source of information comes in the form of the patrols' own records, which inevitably contain biases [2]. Sophisticated statistical techniques for the analysis of patrol data have been developed which considerable promise [3], but there is also a need for simple, widely-applicable metrics which can reliably detect deterrence. Here, we present a mechanistic model of law-breaking and law enforcement in which we simulate deterrence alongside exogenous changes in the frequency of offences, under different temporal patterns of enforcement effort. We use this to compare the performance of a set of candidate metrics that can be derived from patrol data alone. We find that plots of infractions detected per unit of patrol effort against patrol effort (IPUE-E plots) are not reliable indicators of deterrence. However, plots of change in IPUE over change in effort ( $\Delta$ IPUE- $\Delta$ E) reliably diagnose deterrence, regardless of the temporal distribution of effort or any exogenous change in illegal activity levels, as long as data are collected such that detection probability does not saturate with increased effort, and when the time-lag between patrol effort and subsequent behavioural change among offenders is approximately known.  $\Delta$ IPUE- $\Delta$ E plots are no more conceptually complicated than the basic IPUE-effort plots, and require no specialist knowledge or software to produce.  $\Delta$ IPUE- $\Delta$ E offers a robust, simple, metric for monitoring patrol effectiveness where detection is proportional to effort. This work provides key insights into the nature of patrol data, as well as practical recommendations for on-the-ground data interpretation.

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2. Keane A, Jones JP, Milner-Gulland EJ (2011) Encounter data in resource management and ecology: pitfalls and possibilities. *J Appl Ecol* 48(5):1164-1173.
3. Critchlow R, Plumtre AJ, Driciru M, Rwetsiba A, Stokes EJ, Tumwesigye C, Wanyama F, Beale CM (2015) Spatiotemporal trends of illegal activities from ranger-collected data in a Ugandan national park. *Conserv Biol* 29(5):1458-1470.





## Large-scale grassland restoration in Estonia – best practice and socio-economic implications

(Oral)

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In the beginning of 20th century, 1/3 of mainland area of Estonia – 18 000 km<sup>2</sup> – was covered by semi-natural grasslands. Since then, similarly to all other regions in Europe, changes in land-use resulted in abandonment and conversion of grasslands and disappearance of cultural landscapes. In 2013, only 270 km<sup>2</sup> (1.5% of historical coverage) of semi-natural grassland areas were under suitable management (grazing or mowing), necessary for their long-term persistence. With a target set in the “Action plan for Estonian semi-natural grassland communities until 2020”, Estonia aims to increase managed grassland area to 450 km<sup>2</sup> by 2020 [1].

We will provide overview of the current status and trends of restoration of biodiverse semi-natural grassland systems in Estonia. More specifically, we will focus on large-scale restoration activities that have occurred in alvar grasslands in Western Estonia. From 2014 to 2020, ca 600 land-owners and 41 local farmers and farming companies in 25 regions all over western part of Estonia are participating in the LIFE+ program project “LIFE to Alvars” (LIFE13NAT/EE/000082). Project aims to double the area of managed alvars in Estonia by restoring 2500 hectares of grasslands and encouraging local people and farmers to take up grazing. Since the beginning of project, we have gained considerable new knowledge regarding the best practice of large-scale grassland restoration starting from the awareness raising and public engagement to best techniques for actual restoration.

Already by 2017, restoration activities, vastly changing landscapes and awareness-raising activities have had considerable impact both on the public knowledge about the value of grasslands, as well as on economic and lifestyle choices among local people. Implementation of infrastructure necessary for grazing (fences, animal drinking places and shelters, gates), coupled with the support system for managing semi-natural areas have created incentive for local farmers to increase their livestock and move animals from cultural grasslands to restored alvars. By 2017, following the restoration of the first 1500 hectares of traditional grassland landscapes, 270 head of cattle and 400 sheep had been added to the herds of local farmers. In addition, 4 families had moved back to countryside and changed their profession to livestock farmers. Open grasslands have great aesthetical, cultural heritage and recreational value and several nearby tourism facilities noted the positive effect of grassland restoration on their activities, by boosting number of visitors and by increasing the opportunities to offer scenic nature tours [2].

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[2] Prangel, E. (2017). The provisioning of ecosystem services on open and successional alvar grasslands. Master thesis. University of Tartu. [in Estonian].



## Intermodel comparison of biodiversity and ecosystem services projections for the Shared Socio-Economic Pathways

(Oral)

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Scenarios are powerful tools to envision how nature might respond to different pathways of future human development and policy choices. Potential global trajectories for drivers of ecosystem change have been recently explored by the climate-science community. However, contrarily to what is common practice in the climate change modelling community, biodiversity and ecosystem services models are rarely used together to project potential consequences on future trajectories of human development.

Although targeting long-term analyses, with low sensitivity to short-term and local/regional dynamics, the shared socioeconomic pathways (SSPs) explore a wide range of human development pathways, from slow to fast rates of population growth, economic growth, technological development, trade development and implementation of environmental policies. The SSPs can be used in combination with representative concentration pathways (RCPs), which describe pathways of greenhouse gas emissions resulting in different climate change scenarios. Integrated assessment models and global climate models can translate relevant combinations of SSPs/RCPs into land-use change and climate change projections.

Here, existing biodiversity and ecosystem services models were used to translate these projections into potential impacts on nature, nature's contributions to people, and good quality of life. Although this approach does not account for drivers of change in biodiversity and ecosystem services operating at regional and subregional scales, it enables an assessment of impacts from projected changes in land use and climate at the global scale. In contrast with previous analyses, we used a wide range of models to assess the impact across diverse dimensions of biodiversity (for example, species richness, abundance, and composition) and ecosystem services (provisioning, regulating, and cultural services). Comparable metrics for biodiversity and ecosystem services (such as essential biodiversity variables, alpha diversity, range size change) were used to harmonize outputs from models addressing each of these dimensions. Although this use of scenarios based on combinations of SSPs/RCPs continued the tradition of viewing nature as the endpoint in a linear cascade of models, it allowed us to understand how the updated projection of future human development will continue the trends in biodiversity loss of the last century, thus failing to fulfil existing global biodiversity conservation targets.



## The role of old growth forests in carbon sequestration – do we know enough for scenario modelling?

(Oral)

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Increasing the area of unmanaged forests and lengthening the rotation in managed forests has been suggested as a possible strategy to increase carbon sequestration and biodiversity in forests simultaneously. However, since old growth forests are rare and usually not within commercial forestry, forest growth models have not been designed for such situations. The data available about forest growth and productivity is also focused in stands clearly below the age when stands are old in biological/ecological terms. Generally, there is the perception in forestry that growth declines in older stands, but the mechanisms and the time frame leading to this are unclear. Because of this, possible changes due to climate change also remain largely speculative. This presentation reviews (some of) the literature on the growth and carbon sequestration potential of old growth stands, aiming at prioritising research needs that allow us to include old stands more reliably in scenario analyses of the responses of forests to management actions and climate change.

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## Proposed mechanism for increased reproductive potential of wild boars under hunting pressure

(Oral)

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Throughout Europe and Asia, populations of wild boars (*Sus scrofa*) demonstrate a steady increase in recent decades. This results in increased conflicts between wild boars and humans, intensifying economic costs like epidemics to livestock and humans, damages to gardens in urban areas and agricultural crops. Culling wild boars is the most widespread management tool throughout the world in attempts to minimize these conflicts. Yet, studies demonstrate that populations of wild boars exposed to high hunting pressure have shorter generation times associated with higher reproduction rates. The mechanisms of this phenomenon have not been examined to date, thus favoring the culling practice to go undisturbed. Our research goal is to evaluate the effects of hunting on wild boars population structure, dynamics, behavior and reproduction in four different land uses: urban with and without hunting, non urban (agriculture and nature reserves) with and without hunting. To do so, we are using motion triggered cameras (monitoring vigilance behavior), giving up densities (GUDs) experiments and analysis of stress and reproduction hormones levels in hair. Our results, so far, show striking behavioral differences between boars in urban and open spaces regardless of hunting pressure based on GUD studies and analysis of videos. These experiments suggest a lower perceived risk of humans in urban areas, where boars consumed all the food provided in the GUD studies, and thus putatively affecting the reproduction potential of boars in human vicinity. Furthermore, we found that hunting in non-urbanized lands decreases the dispersal of the yearlings. These herds also showed a high level of vigilance compared to the urban herds. We suggest that the combination of vigilance and low dispersal rates may lead to increased reproductive potential.

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## Outdoor recreation causes effective habitat reduction in Capercaillie *Tetrao urogallus*: a major threat for geographically restricted populations

(Oral)

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Outdoor recreation inflicts a wide array of impacts on individual animals, many of them reflected in the avoidance of disturbed areas. The scale and spatial extent, however, at which wildlife populations are affected, are mostly unclear. Particularly in geographically isolated populations, where restricted habitat availability may preclude a relocation to undisturbed areas, effective habitat reduction may remain underestimated or even unnoticed, when animals stay in disturbed areas and only show small-scale responses. Based on telemetry data of 12 individuals, we investigated the spatial and seasonal effects of outdoor recreation, on western capercaillie *Tetrao urogallus*, considering two scales, homerange and within-homerange habitat selection. We determined the distance-thresholds up to which recreation infrastructures were avoided and estimated the extent of affected habitat for the isolated Black Forest (Southwestern Germany) study population. While outdoor recreation did not affect homerange selection, strong effects on habitat use within the homerange were detected: Distance to recreation infrastructure (hiking and cross-country skiing trails, ski pistes) was the main determinant of habitat selection in winter; in summer, mountain bike trails and hiker's restaurants were avoided up to an average distance of 145m (CI: 60-1092m). Around winter-infrastructure, relative avoidance was recorded up to 320m (CI: 36-327m), it was reduced, however, when dense understory provided visual cover. Of the entire population area, between 8-20% (summer) and 8-40% (winter) were affected by outdoor recreation, mainly in the high altitudes. Even without evident large-scale shifts in species distribution, local-scale avoidance of outdoor recreation can substantially contribute to effective habitat reduction. Based on our results we recommend a general reduction in recreation infrastructure density in key habitats, the establishment of undisturbed wildlife refuges with a diameter of at least 800m, as well as enhancing visual protection by maintaining a strip of dense understory along trails.



## Trade-offs between resource exploitation and biodiversity conservation in North Africa. Case study of Hammamet Protected Area (Tunisia)

(Oral)

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Tunisian natural environments have allowed the development of a remarkable both continental and marine biological diversity. This diversity is explained by the effect of several environmental variation factors such as geographical location, climatic zonation, soil properties, etc. However, these environments are obstructed by significant degradation as a result of climate change effects and human activities. This is the case of the Jbel Hammamet, a nature reserve located at the extreme north-east of Tunisian ridge. It is a natural forest of *Tetraclinis articulata* which was overexploited by the local population and overgrazing since ancient times. However, in order to evaluate its biodiversity, different methodological approaches have been used. The physical diagnosis was based on mapping of different natural components of study area, using GIS tools and field validation. The anthropogenic diagnosis was supported by a socio-economic survey of the local population, a total of 27 questions were asked to 100 selected residents. The analysis, of elaborated survey, resulted in obtaining different thematic maps that helped to identify the potentiality and constraints of the protected area. The resident population, at the Hammamet Nature Reserve, may be involved in the creation of income-generating activities, while preserving the natural heritage. In this way, projects enhancing the Jbel Hammamet reserve potentiality may benefit from the know-how and participatory approaches. In addition, with a view to conservation and participatory management, of the protected area. The obtained results lead to propose has confirmed that the development of ecotourism circus composed of a nine stopping stations to develop an ecotourim circus.

Key words : biodiversity, GIS, ecotourism

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## The Influence of Human Infrastructure on Mammal Community Composition - Lessons Learned from Israel's National Biodiversity Monitoring Program

(Oral)

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Anthropogenic activity may cause changes in species assemblages and affect top-down and bottom-up processes. As part of Hamaarag's National Terrestrial Biodiversity Monitoring Program, camera traps were used to collect data on multiple large mammal species. The data was used to unfold new insights on changes in large mammal densities, distribution, and species assemblages in relation to proximity to human infrastructure (settlements and agriculture). Eleven ecological units along Israel's steep climatic gradient were monitored, from north to south: herbaceous and dwarf scrubland, planted conifer forest in the Mediterranean zone (Judean Highlands, Mt. Carmel, Galilee), Mediterranean Maquis (Judean Highlands, Mt. Carmel, Galilee), Mediterranean-desert transition zone, planted conifer forests in the arid zone, Negev highland desert and Arava arid desert. Nine cameras were placed for 10 consecutive days at 80 plots across Israel, during two monitoring cycles (2012-2014 and 2015-2016), resulting in 720 camera traps pr. monitoring cycle and over 14,000 camera nights. To estimate species densities in relation to spatial predictors while accounting for imperfect detection, encounter data on 13 mammal species were fitted to individual species N-mixture models. Species estimations were thereafter used in non-metric multidimensional scaling (NMDS) based on Bray-Curtis dissimilarity, to evaluate dissimilarity in species assemblages among ecological units and proximity to anthropogenic activity. Mammal species varied in their response to anthropogenic infrastructure: Generalist meso-carnid species (golden jackal and red fox) and omnivorous wild boars were found in extreme large numbers near anthropogenic infrastructure, while species such as the endangered mountain gazelle and Dorcas gazelle, were negatively affected by human activity. Extreme over abundant meso-carnivores populations in mosaic landscapes, such as Israel's northern Mediterranean region, may push sensitive prey species to small isolated patches surrounded by humans and predators, while in southern arid areas, expansion of agriculture and settlements may further increase meso-carnivores populations affecting the ability of prey species to occupy and use such areas.

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## A promising new tool for enhancing grassland biodiversity in fragmented landscapes: high-diversity sowing in establishment gaps

(Oral)

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Halting the loss of grassland biodiversity and restoring degraded ecosystems are high priority tasks in the fragmented landscapes. In fragmented landscapes there are limited amount of propagule sources of grassland specialist species. Our aim was to develop and test a novel approach to increase the diversity of species-poor grasslands in fragmented agricultural landscape. We created establishment gaps by ploughing the dense grass sward and sowing a high-diversity seed mixture of 35 grassland specialist forb species. We established three grazed gaps (1×1 m, 2×2 m and 4×4 m) and one fenced gap (4×4 m) per site and monitored the presence and abundance of sown and non-sown species. We asked the following questions: (i) Which target species establish most successfully? (ii) What is the effect of establishment gap size on the establishment success of target species and weeds? (iii) What is the effect of management (grazed versus not managed) on the species composition of the establishment gaps? We showed that by creating establishment gaps and sowing diverse seed mixtures, we could overcome microsite and propagule limitation, successfully introducing target species into the species-poor grasslands. We found that all sown species established in the gaps, and the majority of the species maintained or even increased their first-year cover in the second year after sowing. Smaller gaps were characterised by lower cover of sown species and quite stochastic vegetation development compared to the larger ones. Weed cover was moderate in the first year and decreased significantly in the second year, regardless of gap size. Therefore, we recommend the use of larger establishment gaps in restoration practice. We found that the cover of sown species and weeds were similar in the grazed and unmanaged gaps. However, management by extensive grazing might be crucial in the long-term because livestock can disperse target species propagules and also create microsites. Our study showed that establishment gaps can serve as biodiversity hotspots in fragmented landscapes and can act as stepping stones for the dispersal of target species in the future (Valkó et al. 2016).

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## The GEO BON approach to globally coordinated biodiversity monitoring

(Oral)

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The agreement on the Aichi Biodiversity Targets by the Parties of the Convention on Biological Diversity (CBD), the Sustainable Development Goals of the UN Agenda 2030, and the establishment of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) are encouraging responses to the biodiversity crisis. However, for these international efforts to be successful, our ability to assess biodiversity change must drastically improve. While emerging technologies (such as eDNA) and an increased use of citizen science improve the quantity of and access to biodiversity observations, monitoring efforts are still spatially and temporally fragmented, and taxonomically biased.

In this context, the Group on Earth Observations Biodiversity Observation Network (GEO BON) was established in 2008 with the goal to improve the acquisition, coordination and delivery of biodiversity observations and related services to users including decision-makers and the scientific community [1]. This goal is achieved with the interconnection of two core components: the Essential Biodiversity Variables (EBVs) framework [2], and a system of coordinated Biodiversity Observation Networks (BONs).

The EBVs can be understood as the level of integration between raw biodiversity observations obtained via in-situ monitoring or remote sensing in space and time, and biodiversity indicators. Those indicators are for instance used to track progress towards international and national targets for biodiversity, and within IPBES assessments.

The BONs, which can be thematic, national, or regional, produce, test and apply tools to deliver EBV-relevant data that can be upscaled and downscaled to support sustainable development and conservation decisions. In particular, regional and thematic BONs connect monitoring efforts across different dimensions and scales of biodiversity while National BONs, which correspond to the operational scale of many monitoring initiatives, are directly oriented to serve the needs of national and sub-national policy-makers.

Here, we will discuss the approach for a coordinated observing system adopted by GEO BON, and review challenges and advances in its implementation, by focusing on its two core components – the EBVs as a standard framework for biodiversity monitoring, and the Biodiversity Observation Networks that support harmonised observation systems - while highlighting their societal relevance.

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## Landscape and habitat filters jointly drive richness and abundance of specialist plants in terrestrial grassland islands

(Oral)

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Land use changes have resulted in the loss and isolation of semi-natural habitats worldwide. In intensively used agricultural landscapes the remnants of natural flora only persist in small habitat islands embedded in a hostile matrix (Deák et al. 2016a). Species composition of small habitat islands is substantially influenced by habitat and landscape filters through persistence and dispersal traits of plant species. Due to the interaction of factors acting in different spatial scales, vegetation of habitat islands can be evaluated by a complex approach considering multiple spatial scales. We sampled grassland specialist plant species, local environmental factors (habitat filter) and the landscape composition (landscape filter) of 82 grassland islands in Hungary. We assessed the effects of slope, woody encroachment and disturbance, together with the level of isolation on the trait composition of grassland specialist plants. We studied the trait responses related to functional spatial connectivity (long-term dispersal ability by wind and animals) and temporal connectivity (clonality and seed bank) using model selection techniques. We found that isolation decreased the abundance of good dispersers due to the lack of directional vectors transferring seeds between suitable habitat patches. We found that clonal plants cope well with increasing woody encroachment due to their high resistance against environmental changes; however, they could not cope with high disturbance. Persistent seed bank did not support the survival of specialist species in the studied habitat islands. Steep slopes which provided favourable dry habitat conditions and environmental heterogeneity for specialist plants had an overall positive effect on their species richness. Grassland specialist plants were influenced by the interplay of landscape filters influencing their abundance, and habitat filters affecting plant species richness. Landscape filtering by isolation influenced the abundance of specialist plants by regulating seed dispersal. Habitat filters sorted species that could establish and persist at a site by influencing micro-site availability and quality (Deák et al. 2016b).

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## Finding solutions for the conservation of wood inhabiting fungi

(Oral)

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A large fraction of wood-inhabiting fungal species have declined because of forest loss and fragmentation, in addition to a decrease in dead wood. Current protected area networks are embedded in low quality matrices which in best case are native forests with low amounts of dead wood. This may affect the efficiency of current protected area networks in conserving wood-inhabiting fungal diversity. As I show in my research, small and isolated conservation sites in temperate Europe hold less threatened species than they potentially could, possibly due to dispersal limitation of some species (1). The most obvious solutions to this problem are either to increase the sizes of the present conservation sites as well as to set new conservation sites in the proximity of the existing ones, or to increase the volume of dead wood in the managed forests surrounding the existing conservation sites. A more novel and still largely unexplored option however is to reintroduce red-listed species artificially by inoculation (2). I will discuss the advantages and problems of all these options as potential solutions for conserving wood-inhabiting fungi at large scales.

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## Paris Agreement commitments and EU regulation of the LULUCF-sector - implications to forests in Finland and beyond

(Oral)

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The Paris Agreement sets a goal to limit the global average temperature increase to well-below 2°C above the pre-industrial level. This would require balance between GHG emissions and sinks within a few decades and even net negative emissions by the end of the century.

According to the Paris Agreement, the EU will reduce greenhouse gas (GHG) emissions by at least 40% by 2030, and it has to be prepared for more ambitious targets following 2030. Following the EU Effort sharing Regulation, Finland must reduce GHG emissions from agriculture and other non-emission trading (ET) sectors by 39% from the 2005 levels by 2030. A fraction of the target can be achieved with credits from LULUCF sector if they are a net sink. Forests have been net sinks with carbon sequestration capacity that compensates 10% of the total emissions in Europe and 40% in Finland. In Europe, forest carbon sinks (2021-20130) are accounted towards a country specific reference level, which is derived on the basis of forest management and harvests during the period on 2000-2009. The reference levels set targets to the forest carbon sinks, which may also affect plans for bioeconomy investments in Finland and beyond. Since the EU agreement allows transfers of carbon sink credits within the EU countries, it creates a high demand to increase transparency and to reduce uncertainty of the national GHG inventories of the LULUCF sector.

Finland and Europe can reach forest carbon sink targets, by maintaining positive balance between forest growth and harvests, by reducing GHG emissions of peatlands, and by reducing deforestation and enhancing afforestation. Currently, peat soil of croplands and forests is the largest source of GHG emissions in the Finnish LULUCF sector. Soil management has large potential to mitigate climate change, but cost-efficient and sustainable management methods need to be developed, their impact verified and the methods must be applied by landowners before the sector's mitigation potential will be realized. Mitigation of climate change by cost-efficient means of the LULUCF sector are essential for Finland's capacity to reduce emissions.





## Slow response of grassland specialists to habitat fragmentation in well-connected calcareous grasslands

(Oral)

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Due to the transition from traditional land use to modern agriculture throughout Europe, semi-natural grasslands are subject to severe environmental changes. Both agricultural intensification and abandonment have caused fragmentation of semi-natural grasslands in Europe with adverse effects on biodiversity. However, species extinction can possibly occur with a substantial delay to habitat deterioration. Meanwhile, there is increasing evidence that such time-delayed extinctions represent an essential but still less-considered challenge in the conservation of grassland biodiversity. In this study, we analyzed the effects of past and present landscape conditions on vascular plant, Orthoptera and butterfly specialists in calcareous grasslands in one of the German biodiversity hotspots and provide implications for conservation.

Patch area as well as patch connectivity significantly decreased from 1970 to 2015. However, this decrease was most dramatic between 1970 and 1990; since then further habitat fragmentation is proceeding at a much lower level as a result of intensified conservation measures. Due to regular management, the studied patches were generally characterized by a high habitat quality and were still large and well-connected compared to most other regions in Central Europe. The number of specialist vascular plant and butterfly species was positively related to both past and present fragment size. However, models including past patch area performed better in both species groups. In contrast, Orthoptera specialist species richness was in neither case affected by patch area. Additionally, the number of specialist species was better explained by past than present habitat connectivity across all species groups.

Our results clearly suggest that habitat specialists can persist in calcareous grasslands for several decades, despite increasing pressure of habitat fragmentation. In general, past landscape conditions were more strongly correlated to today's specialist species richness indicating the existence of an extinction debt across all species groups. Contrary to our expectations, this was also true for butterflies which are generally known to be relatively mobile and short-lived. However, due to regular management and still sufficient area and connectivity of the patches, even organisms that are more sensitive to fragmentation may persist in such well-connected landscapes. However, current patch area and connectivity were still important for the number of butterfly and plant specialists. In contrast, the current number of Orthoptera specialists within a patch seems to depend mainly on other factors such as habitat quality. Consequently, conservationists should focus on the maintenance of habitat quality in calcareous grasslands, as well as the restoration of former patches to counteract future biodiversity loss.



## When sustainable hunting brings to light the hidden value of natural habitats

(Oral)

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While natural habitats are usually regarded as lacking any economic value, as the latter is concealed, remaining outside of any economic trade, ecosystem services confer some value to land areas based on the services they provide for nature and people's welfare. However, agricultural areas, that provide explicit economic value to land, may do so at the expense of biodiversity, thereby limiting ecosystem services because of the lower species richness and abundance occurring there. Usually regarded as exacerbating this decrease, hunting can in fact improve ecosystem services where it is practiced, though it can also worsen ecosystem functioning and animal conservation when it is not practiced in a sustainable way and based on scientific evidence. Hence, by enhancing the conservation of game populations, the actions of hunters can benefit many other species from all taxa (including protected ones). In our presentation, we will focus on some relevant examples to illustrate a general framework of how sustainable hunting in France can act as a catalyst for game and non-game species. For example, the implementation of flower strips to provide a cover to grey partridges and the maintenance of ponds for water birds greatly increase the diversity of insects and birds that would, otherwise, merely be absent. The creation of game habitat by hunters, the improvement of its quality or the regulation of overabundant grazers at the request of nature managers, also enhances habitat quality for many other species, be they directly linked to game or not, thereby improving the overall biodiversity. Hunters also provide a plethora of data (citizen science) on population status and, if necessary, order etiological studies to pinpoint the causes of unexpected declines and, thereafter, act accordingly. Thus, by quantitatively and qualitatively monitoring some species and by collaborating with universities to promote practical habitat conservation actions, hunters contribute to population dynamics models. Therefore, when they collaborate with scientific institutions and seek to increase game densities (by planting edges, maintaining ponds, opposing the use of biocides, etc.), hunters also improve ecosystem services (provisioning, regulating and provisioning). Moreover, both the practice of hunting and the actions carried out by hunters aiming to provide game with food and shelter that also improve biological conservation in general, are environmentally and financially sustainable. This follows the guidelines of the IUCN that recommends the use of natural resources as an effective conservation method.



## Overall (first) results of the '100 questions for biodiversity conservation in Mediterranean-type regions of the world' initiative

(Oral)

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Mediterranean-type ecosystems (MTEs), with their characteristic climate, occur in just five regions of the world: the Mediterranean Basin, the Cape Region of South Africa, Southwestern and South Australia, California, and central Chile. In spite of their small geographic area, they harbour a significant and exclusive proportion of the planet's biodiversity. Biodiversity values in MTE are threatened by a range of factor including land use changes, overexploitation of natural resources, global climate changes, among others. Researchers have a key role in providing solutions for conserving biodiversity in face of these multiple stressors and socio-economic challenges.

Under the scope of the Society for Conservation Biology (SCB) – Europe Section and the International Society of Mediterranean Ecologists (ISOMED), a group of researchers from the five MTE regions of the world organized an initiative to identify the 100 priority questions that, if answered, would have a high probability of increasing the success of actions targeted at the conservation of biological diversity in the five Mediterranean regions of the world. We will present the first overall results of this exercise. A total of 1490 original questions were merged into a final 171 questions divided in 11 major topics. The three topics with higher importance were governance, climate change and habitat restoration. Further results on patterns across Mediterranean-type regions and stakeholder types, in order to identify topics of overall and regional importance, will be presented.

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## Loss in grassland plant diversity linked to landscape-wide land-use intensity rather than landscape structure

(Oral)

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Grazed semi-natural pastures provide keystone habitats for biodiversity in agricultural landscapes dominated by intensively managed land. However, such pastures are frequently isolated and embedded in intensively managed landscapes, and therefore the species composition of grassland plant communities depend on the structure of the surrounding landscape. In particular, both pollinator abundance and the share of insect-pollinated grassland plants decrease with increasing proportions of arable land in the surrounding landscape [1]. Whereas parallel declines in pollinators and insect-pollinated plants in pastures can be attributed to landscape effects, it is generally not known whether intensive agricultural practices or landscape simplification drives these declines. The main reason for this knowledge gap is the fact that estimating agricultural intensity across entire landscapes has hitherto been much more laborious compared to quantifying landscape structure. Capitalising on recent developments in remote sensing, we are now able to disentangle the effects of land-use intensity and landscape heterogeneity with higher accuracy than before. In 2017, we selected 29 grazed semi-natural pastures embedded in landscapes dominated by arable agriculture in southern Sweden to quantify the relative effects of land-use intensity and landscape structure on grassland plant communities. In total, we recorded 141 species of herbs and grasses. Using arable productivity as a proxy for agricultural land-use intensity, we found that plant species richness in pastures declined significantly with increasing land-use intensity in the surrounding agricultural landscapes. In addition, we found significant changes in plant community composition along our land-use intensity gradient. In contrast, we did not find any effects of increasing structural simplification of the agricultural landscapes surrounding our focal pastures. Our results suggest that grassland plant communities in pastures are primarily affected by increasing land-use intensity in the surrounding agricultural landscapes, rather than by increasing structural simplification of the landscapes.

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## Traditional semi-natural grassland management with heterogeneous mowing times enhances flower resources for pollinators in farmed landscapes.

(Oral)

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Semi-natural grasslands are essential habitats for pollinators. They provide high diversity of floral resources, but the amount of floral resources is strongly affected by the timing of mowing. For pollinator species that are active throughout the season, it is important that pollen and nectar are available over the entire summer at spatially relevant scales [1]. A key task for semi-natural grassland conservation is to understand the link between timing of mowing and the phenology of the plant species providing floral resources. Environmental schemes normally include recommendations for when to mow, but these are often simplifications of the traditional practices, which shaped the species rich meadows. Several of these schemes focus on one late cut [2]. In this project we investigated the linkage between flower resources for pollinators and traditional mowing practices of hay meadows. The study was performed in an agricultural landscape with a high cover of small parcels of semi-natural hay meadows in the village Botiza in Maramures, Romania where species richness of plants in the meadows is extremely high. By studying this low-intensity farmland we generated knowledge about management methods that can be used in other parts of Europe where such landscapes are lost. We botanically surveyed 37 meadows that were cut early, intermediate, or late in the season. The surveys were performed in the beginning of August, a couple of weeks before the late cut. We recorded all herb and scrub species, phenological stages and the number of reproductive units per species. These were used as indicators for flower resources for pollinators. Data were analysed in DCA and GLM. The species richness was not affected by the mowing time but the species composition of species flowering at late mown hay meadows were different compared to in the hay meadows mowed early or intermediately. The proportion of species flowering and flower density were highest in the early mown meadows. Estimations based on phenological stages showed that late mown meadows are the main pollen source in July, whereas meadows mown early are the main source in the end of the season. The results demonstrate that heterogeneous mowing times yields floral resources for pollinators throughout the summer season. Various mowing times at a scale relevant for pollinators therefore need to be considered in pollinator conservation in agro-ecosystems. This study (project no 230278) was funded by The Research Council of Norway and the Swedish Biodiversity Centre, (Swedish University of Agricultural Sciences) and the museum of the Romanian Peasant.

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## Species richness patterns of ground beetles (Coleoptera: Carabidae) in forest fragments

(Oral)

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Nineteen forest fragments were studied in the Bereg Plain, Hungary, and SW Ukraine. This area contains natural forest patches, mainly of oak and hornbeam. The aim of this study was to analyse the effect of fragmentation on the species richness of ground beetles (Coleoptera: Carabidae) living in natural forest fragments. Ground beetles present in the forest patches were categorized into generalists, forest specialists and edge-preferring species. For these categories we analysed the relationship between species richness and fragment area. Our research hypothesis was that the edge-preferring species and generalist species (species that occur also in the surrounding matrix) modifies the species-area relationship of the fragments causing a high species richness in the small forest fragments (spurious diversity).

We found that forest specialist species richness was correlated positively with forest patch size as predicted by the classical bio-geography. Forest patch size and the number of generalist species showed a marginally significant negative relationship, indicating that generalist species were more important in smaller patches. Edge-preferring species were shown to influence the species-area relationship; we found that the number of edge-preferring species increased with the edge:area ratio.

Our findings revealed that both generalist and edge-preferring species distort the species-area relationship; matrices surrounding the forest fragments provide colonists that do not necessarily distinguish the fragment from the matrix and can survive and reproduce there. We also found that edge-preferring species can further distort the species-area relationship, as smaller fragments have larger edge:core ratios.

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## The Austrian biodiversity monitoring “ÖBM Kulturlandschaft” and a unified biodiversity number for trend assessments

(Oral)

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The Austrian biodiversity monitoring ÖBM-Kulturlandschaft has a focus on habitat and species diversity in Austrian cultural landscapes (including alpine pastures) and started in the year 2017. The stratified random selection of the sampling sites is based on the 1 km<sup>2</sup> grid of Statistics Austria. A minimum of 50% of agricultural area within the 1 km<sup>2</sup> was the limit for considering a grid cell; 100 nested sampling plots are arranged hierarchically (i) remote sensing based landscape survey: 3 x 3 km<sup>2</sup> - landscape plots, (ii) habitat mapping: 625 m x 625 m test areas; and (iii) per test area: 10 test circles for surveys of vascular plants, grasshoppers and butterflies.

A rolling (staggered) survey is planned: in the first year of the survey, half of the 100 sampling plots have been covered, in the second survey year the remaining half of the sampling plots. The repetition of surveys should take place every three to five years. Remote sensing data will be applied within the framework of ÖBM-Kulturlandschaft at three different levels: (i) phenological characterizations of the habitat types within the 625 m x 625 m sampling plots, (ii) detection of changes in ecosystem functions (e.g. NDVI) and ecosystem structure (e.g. land cover) around the sampling plots at 3x3 km<sup>2</sup> and (iii) nation-wide analysis of land cover change with the COPERNICUS products available for the entire EU. The recording of habitat types is based on the red lists published by the Environment Agency Austria. Regarding organismic groups, the survey methods are closely aligned with those applied in the monitoring project Biodiversity-Nature-Safety (BINATS; Pascher et al. 2011) that focusses on maize and oilseed rape cultivation areas and it is planned to merge data from BINATS and ÖBM-Kulturlandschaft to provide overall results for the Austrian cultural landscapes. Vascular plants, grasshoppers and butterflies were chosen mainly for being optimal surrogates for overall biodiversity, suppliers of ecosystem services, and/or due to practical advantages in surveying.

Preliminary results from 2017 are that 69 species of grasshoppers (49% of Austrian species; n = 48 test areas) and 103 species of butterflies (48%, n=49) were detected. Average species richness was 10.6±4.6 for grasshoppers and 10.5±4.7 for butterflies per test area, and 3.9±2.9 for grasshoppers and 2.8±2.2 for butterflies per test circles.

A novel method for biodiversity accounting will be used to summarise the population change results of all species obtained during monitoring. With this method, measured population change results are weighted by the species' Red List category at the national and international scale and its dependence on the monitoring area (determined by habitat requirements and total range).

References:





## Toward practical conservation of fungal diversity: polypores reveal the history and guide the future of forest conservation

(Oral)

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National IUCN red lists are important information sources for assessing land use decisions from a biodiversity conservation perspective. If the assessments are detailed enough, they can be used as starting points for identifying the practical options for improving both targeted conservation management and land-use on a sectoral scale. We (1) assessed the IUCN red list status for all the 220 polypore species in Estonia, hemiboreal Europe; and (2) distinguished, for all 59 threatened species and in co-operation with practitioners, the most influential and feasible conservation options representing a broad range of approaches (site protection; prescriptions to land use; protection of individuals; active management; umbrella species). The red-list assessments clearly mirrored a predicted intensification of forestry (replacing historically low intensity of logging and largely natural regeneration), which were partly compensated by habitat improvement within the established reserve system. We thus found that a small number of specific management decisions (particularly in the forestry sector) is affecting most of the sensitive polypore species. The map of appropriate conservation options for threatened species included many alternatives to the traditional strict site protection for well-known threatened species, e.g.: (1) woodland key habitat assessment in sites hosting threatened species (enables to protect the best habitats); (2) controlling removal of dead-wood in specific places in the surroundings of known strictly protected locations, or in known unprotected locations; (3) protecting the fruit body and the substrate item that likely hosts (most of) its mycelium in various environments used by humans. Such collection of options indicates the need for conservation frameworks explicitly designed for fungi. As a general conclusion, we recommend systematic and multi-disciplinary assessments of sensitive taxon groups in order to understand the full effects of land use decisions on biodiversity and for identifying specific problems in conservation management practices and legislation.

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## Conservation values and threats in the Mediterranean North Africa

(Oral)

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The Mediterranean basin is the second largest hotspot in the world, the largest of the world's five Mediterranean-climate regions and the third richest hotspot in the world in terms of plant diversity. Inside this hotspot lies the Mediterranean North Africa subregion which covers parts of Morocco, Algeria, Tunisia, Libya and Egypt. Like the rest of the Mediterranean basin, this subregion contains an important terrestrial and marine biodiversity and a high level of endemism, due to its unique geomorphological characteristics and evolutionary history. This territory is composed of four types of terrestrial biomes, three freshwater biomes and one marine biome. The floristic diversity is the most outstanding with its huge diversity. Within this territory, we can find three of the ten major areas that serve as centers of plant diversity and endemism for the Mediterranean basin. The fauna is very diverse and is well represented by different groups of vertebrates (mammals, birds, reptiles and fish). The diversity of terrestrial and marine invertebrates is especially high but still little known. This diversity makes this sub-region one of the most important parts of the Mediterranean basin, e.g., Morocco is the second most speciose country in the Mediterranean basin and with an important level of endemism, 11% for fauna and 25% for flora. Furthermore, many species that are considered as threatened at a global level, or that have become extinct in other parts of the planet, can still be found in North Africa. This diversity of ecosystems and natural resources in North Africa provides countless irreplaceable services for the economy and well-being of the population. Also, most of the active population works in activities directly dependent on these services, like agriculture and stock-raising. Due to the long history of interactions between human activities and ecosystems in this region, a fragile balance has developed over the millennia. Unfortunately, this equilibrium is being constantly disturbed by the evergrowing demands for natural resources pushed by the growing population and the economic development in these five North African countries. This trend is associated with various threats, mainly overharvesting, natural system modification and urbanization. Moreover, the stress on ecosystems is heightened because of the arid conditions in North Africa and the problems related to desertification, in spite of the great capacity of adaptation to aridity developed by several species. Also, the effects of climate change will aggravate the situation in this region. Even though these environmental problems are endangering numerous species and ecosystems in North Africa, the conservation efforts are still facing many obstacles, mainly the fact that nature conservation can still be considered as a secondary priority by decision-makers in comparison to other, more pressing issues, like poverty, health and education.

Keywords: Mediterranean, biodiversity, endemism



## Priority questions for biodiversity conservation in the Mediterranean Basin

(Oral)

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The Mediterranean Basin is considered one of the world's biodiversity hotspots, harbouring particularly high species richness and endemism of taxonomic groups such as plants. This hotspot is unique at the global scale, because it has a history of intense anthropogenic influences that dates back to thousands of years, and where the current high-levels of biodiversity have thus been able to coexist with humans for millennia. Despite this long history of coexistence, biodiversity in the Mediterranean Basin is at risk due to a number of old and new anthropogenic stressors, including fast land use changes, overexploitation of natural resources, and global climate change. To tackle these problems, researchers should concentrate their efforts in answering questions that can have a true impact on the success of conservation programs, but there is at present considerable uncertainty on what these questions might be.

To identify these questions, a group of scientists from Portugal, Spain, France, Greece, Italy and Israel have worked to identify priority questions that, if answered, would have a high probability of increasing the success of actions targeted at the conservation of Mediterranean biological diversity. This was part of a larger initiative covering the five Mediterranean regions of the world (Mediterranean Basin, California, Australia, Chile and South Africa), which was organised under the scope of the Society for Conservation Biology (SCB) – Europe Section and the International Society of Mediterranean Ecologists (ISOMED). Here we present the first results of this exercise, which is expected to be extended in the near future to other countries in the Mediterranean Basin. The study was based on enquiries targeted at individuals from a number of stakeholder types, including research institutions, environmental non-governmental organizations, environmental consultancy companies, organizations linked to land management (e.g., farmers, hunters), governmental agencies, and large business corporations.



We obtained replies from 92 respondents, which suggested a total of 830 questions, divided in 11 major topics. After eliminating questions that were out of scope given the objectives of the study, the three topics most referred to by respondents were related to governance, species management, and farming and forestry, while other important topics were public participation and social sciences, climate change, and impact assessment. The results obtained highlight the importance of interdisciplinary research linking natural and social scientists, which is needed to understand how environmental and socioeconomic drivers interact to shape biodiversity patterns and trends, and to develop and optimise the models of governance and public engagement that are required to preserve biodiversity in the face of such drivers.

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## Susceptibility of European freshwater fish to climate change: species profiling based on life-history and environmental characteristics

(Oral)

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Climate change is expected to strongly affect freshwater fish communities. Combined with other anthropogenic impacts, it will influence species distributions, and contribute to population declines and local extinctions. To provide timely management and conservation, it is important to identify those species that will be most impacted by climate change and those that will be resilient. Species traits are considered as a promising source of information on characteristics that influence resilience to various environmental conditions and impacts. We collated life history traits and climatic niches of all European freshwater fish species and compared those identified as susceptible to climate change to those that are considered to be resilient. Species list (n = 441, following exclusion of mismatches) was obtained from the IUCN Red List database, including threat level classification, range map polygons, and information whether climate change was indicated as one of the threats. Life-history and bioclimatic spatial data were obtained from FishBase and WorldClim databases. Relationship between species susceptibility to climate change and 43 explanatory variables was assessed using boosted regression trees (BRT). Significant differences were observed between the two groups in their life-history and climatic niches, such as species body size, longevity, range size, distribution and thermal envelopes. We establish a list of species of highest priority for further research and monitoring regarding climate change susceptibility. Results will contribute to a better understanding of traits that are related to climate change susceptibility of European freshwater fish. Further research should be focused on the improvement of methods for climate change susceptibility assessments, which would allow more reliable and systematic species profiling.



## Farmland Biodiversity Monitoring Practice in Europe and North America

(Oral)

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Agriculture is one of the main causes for the strong declines in biodiversity over the last decades. To protect and promote farmland biodiversity effectively, politicians and farmers need information about the status and dynamics of biodiversity on agricultural land. We reviewed a number of large monitoring programs in Europe and North America and investigated design decisions, monitoring costs and informative value for stakeholders. Useful programs focus on the landscape scale and investigate the state and dynamics of habitats and one or better several organism groups, mainly plant species and faunal groups if financially feasible. They sample raw data stratified over intensive and remote areas and distribute one sample continuously over several years. Landscape sample units seem to be related to the grain size of the agricultural landscapes; they are smaller in Europe than in North America. To lower the costs of biodiversity monitoring programs remote sensing and genomic and citizen science approaches experience a high attention and will hopefully deliver good opportunities in the near future.

One of the recently implemented programmes is the Swiss Farmland Biodiversity Monitoring programme "ALL-EMA". To assess the state and the dynamics of species with a focus on habitats of the agri-environmental targets in Switzerland, a sampling design with weighted random sampling at several levels was used. Based on a highly standardized habitat mapping with a habitat key for reproducible recording, habitats of specific interest are sampled more intensively than other habitats. Synergies with the biodiversity monitoring of Switzerland allow ALL-EMA to use butterfly and bird data in addition to the recorded plant and habitat data. The electronic field data assessment allows a standardized, fast data processing. In 2020, the first main report about the state of farmland habitats and species is expected.

Herzog F., Franklin J.: State-of-the-art practices in farmland biodiversity monitoring for North America and Europe. *Ambio*, 45, (8), 2016, 857-871.

2018/06/12

11:15

Room: K308 Cabinet



## Projected changes in global mammalian diversity under contrasting RCP-SSP scenarios

(Oral)

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Abstract of this presentation is not public



## The zoogeographical domains: a new conservation target at global scale

(Oral)

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Zooregions are classifications of the Earth's surface based on characteristic species assemblages. Consequently, zooregions reflect how ecological, evolutionary, and historical processes have been acting over millions of years, arguably making them the largest entities to conserve the uniqueness of the species assemblages on Earth. Because species are distributed along zooregions heterogeneously, to conserve zooregions adequately, we need to protect their characteristic areas (transition, core or endemic areas), what we call the zoogeographical domains.

Here we propose a method to characterize the zoogeographical domains basing on four metrics, which are independently used in macroecological and biogeographical studies but have not been considered in combination before. These metrics are: (i) species turnover index, (ii) regional relative richness index, (iii) a species endemism index, and (iv) a species occupancy level index. To calculate these indexes, we used the delineation of the zooregions and the distribution of the characteristic and non-characteristic species within each zooregion. Then we used clustering methods to aggregate geographical areas with similar characteristics and defined the optimal number of zoogeographical domains using piecewise regression.

We applied the proposed method to identify zoogeographical domains in mammals revealing seven distinct domains: four describing diverse types of core-endemic areas, and three describing diverse types of transitional areas. Additional analyses show how human impact and protected areas are heterogeneously distributed among these seven zoogeographical domains, what suggests an unbalanced protection of the species assemblages. Our approach offers a new conceptual framework to characterize the largest forms of organization on Earth and identify concrete targets to ensure the uniqueness of biodiversity at global scale.

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## Searching for snares - How much effort is enough?

(Oral)

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The use of wire snares to hunt wildlife is prolific, particularly in the forests of Southeast Asia (1). Tackling this threat is a primary objective of law enforcement operations throughout protected areas, yet often efforts to remove snares are thwarted by a lack of information about hunter behaviour and an inability to detect snares. Even in areas of high snare abundance, rangers can spend many hours searching for snares with few results, eroding ranger morale, motivation and resources.

Understanding how best to allocate ranger search effort is of critical importance for protected area managers, especially in sites with exponential levels of snare hunting. Few studies systematically assess the factors that affect snare distribution (2), or explore efficiency in snare removal. Often studies rely on ranger-collected data through systems such as SMART. Whilst this data is undoubtedly useful for monitoring, data analyses typically fail to account for underlying biases, resulting in misleading conclusions being drawn.

Here we present a conceptual framework for evaluating the factors that influence snare detection by rangers. An experiment to calculate snare detectability in eastern Cambodia, carried out by Dr Hannah O'Kelly in 2011, achieved an average snare detection rate of about 30%, with variation between habitat and snare types. We introduce an experimental design which builds on that study (3), and aims to quantify how snare detectability varies with ranger search effort, whilst controlling for factors such as season, habitat, and ranger morale. We present our results, and detail the wider impact of the research for protected area management.

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11:45

Room: A1 Wilhelm



## Climate mitigation potential of wood sector sequestration and substitution

(Oral)

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Abstract of this presentation is not public



## Linking physical landscape properties to perceived landscape features: potentials in NILS monitoring program

(Oral)

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Key words: Monitoring, perception, indicators

Globally, land-use and climate change has resulted in a number of landscape transformations. At the same time, how humans use and perceive landscapes has changed and is changing. People's landscape perception depends on many different factors such as gender, age, sense of place, ownership and actual land-use interest. Despite the growing number of studies suggesting that certain biophysical landscape properties are perceived by humans in similar ways, independently of cultural background and personal preferences, few studies have determined the interactions between sense of place, demography and preferences for these landscape properties.

The aim of this study was to investigate the potential of linking perceived landscape features to biophysical landscape property data sampled in the NILS (National Inventory of Landscapes in Sweden) monitoring program. "Features" are e.g. descriptions of perceived things such as an open landscape and "properties" are measured field data such as cover of spruce. In doing that we aim at enabling the use of monitoring data as a proxy for evaluate landscape perception changes over time. We used the Swedish national environmental objectives as a framework policy, since those objectives include targets that are linked to landscape perception. So far, however, no indicators have been defined to follow them up. We collected information on how people with a professional background linked to mountain areas, such as officials at governmental organisations and business companies, perceive the Swedish mountains. In an enquiry the respondent's rated pre-defined attributes linked to perceptions of mountain landscapes, as well as described the perceptions with their own words. The output data were later subjectively linked to physical landscape properties monitored in the NILS program. The landscape feature primarily associated to Swedish mountains were "view", "openness" and "open landscapes", whereas "spruce" and "pine" that contradict openness were much lower rated. We suggest that by assessing physical landscape properties using monitoring data, it is possible to evaluate people's potentially positive or negative perceptions of landscapes, as well as changes in perceptions that may occur when the landscape change. These linkages could be used to evaluate the potential of a landscape to provide restoratives or aesthetical values of landscapes over time. Results from the evaluations could also be used for guiding landscape management to increase certain perception values and address negative impacts of land-use decisions on other values.



## Effects of mowing frequency on grassland flora and fauna: implications for the conservation of semi-natural grasslands in Europe

(Oral)

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To maintain the high biodiversity and preserve the conservation value of semi-natural grasslands, management like grazing or mowing is necessary. Given the limited resources available for management, and few remaining areas, the best management method and intensity should be used. However, the evaluation and comparison of effects of different management intensities on a larger scale is often challenging, as most studies have a limited scope (e.g. only investigating effects in one grassland or for one type of organism). In view of this, we used meta-analysis methods to explore effects of different mowing intensities on biodiversity on a European scale, to reach more robust conclusions. We included studies examining effects of annual mowing compared to both more and less frequent mowing, e.g. twice a year or every other year, on European grassland flora and fauna. Our results suggest that mowing more frequently than once per year has a more positive effect on grassland biodiversity, especially in more productive grasslands. However, differences in effects between frequencies were small, suggesting that mowing more seldom could be a viable management option. This meta-analysis is an example of how ecological knowledge can be compiled to contribute to evidence-based conservation policy and more cost-effective management.

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## The components of nature that provide wellbeing: Does biodiversity matters and for who?

(Oral)

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Species extinctions are continuing at alarming rates, despite considerable efforts on the part of conservationists. Human action is responsible for the biodiversity crisis, and the solutions to it largely depend on the way people interact with nature in the future. However, the same processes that threat biodiversity, such as urbanization, also increasingly separate the majority of the world's population from the experience of nature. This extinction of experience is profoundly concerning, as it affects the way people value and benefit from nature<sup>1</sup>. Conserving biodiversity in cities has been proposed as a win-win solution to jointly achieve ecological objectives and avert this extinction of experience. But to date, knowledge about the role that biodiversity plays in providing wellbeing benefits remains scarce, inconsistent and biased toward Anglo-Saxon culture<sup>2</sup>. Here, we explored the relationship between biodiversity and the subjective well-being of visitors of public gardens in Israel. During spring 2015, we sampled the diversity of birds, plants and butterflies and surveyed 600 visitors to assess the species richness they perceived, their subjective wellbeing, relatedness to nature and ecological knowledge. Linear models were used to investigate the relationships between these measures, while accounting for demographic variables. Results indicate that people do not perceive much of the biodiversity present in the gardens and that wellbeing-biodiversity relationships are mediated by relatedness to nature and not by ecological knowledge (species identification skills). Thus, people who perceived themselves as more related to nature benefited more from species-rich gardens, while there were no, or even negative effects, of biodiversity on wellbeing benefits for people who were less related to nature. Accordingly, we only found significant positive correlations between perceived and observed species richness for those respondents who were more connected to nature.

Our results highlight that integrating more biodiversity in cities can only take us part of the way in mitigating the detrimental impact of urbanization on people's experience of nature and wellbeing. Efforts should be also made to identify the means to enhance emotional connection to nature, the various components of nature that provide benefits to people and the dosage required to ensure the provision of these outcomes. This will enable a more profound understanding of the synergies and trade-offs between those benefiting components and other ecological indicators and socio-economic constraints, which in turn could help integrating nature-based solutions in urban planning.

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2018/06/12

12:30

Room: K301 Felix



**Are secondary woodlands providing suitable resources for biodiversity?  
Moths as a case study**

**(Oral)**

**Elisa Fuentes-Montemayor<sup>1</sup>✉, Kevin Watts<sup>1</sup>, Philip Sansum<sup>1</sup>, William Scott<sup>1</sup>,  
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Abstract of this presentation is not public



## Climate change affects Lepidoptera families in different ways

(Oral)

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Climate change and habitat conversion are major drivers of biodiversity loss and community shifts at local scale. The majority of terrestrial biodiversity is represented by insects, which are thought to be especially affected by climate change as their life cycles strongly depend on temperature. Within the insects Lepidoptera is a diverse order, which has been shown to react to global warming. However, most of the studies on changes of Lepidoptera communities are either temporally or spatially limited and miss therefore reliable information on development of diversities and communities at broader landscape levels and time ranges. We used data on macro-moths (Lepidoptera) in Bavaria (southern Germany), sampled over a period of about 40 years in order to detect changes in species diversities and community properties. Light trapping was applied at 2751 plot-dates on 373 unique forest plots spread over the whole geographic and elevational range of Bavaria. We caught about 800000 specimens from about 850 different macro Lepidoptera species. The two most dominant families were the Geometridae and Noctuidae with about 350000 specimens of 343 species and about 240000 specimens of 345 species, respectively. While overall species diversity remained constant before the 1990s and before the 2000s, it decreased significantly after the year 2000. The same pattern occurred with the Noctuidae subset while Geometridae showed an inferior diversity decline after the year 2000, where diversity was significantly lower than before 2000, but not than before 1990. This phenomenon may be due to the different biology of the two families. We conclude that conservation measures should first identify species or species groups which are especially threatened by global change and focus actions on these. Furthermore, this talk presents different aspects macro-moth community development such as mean color lightness and mean body size, linking changes to climate change.





## Unravelling the importance of High Nature Value farmlands for biodiversity conservation and provision of ecosystem services in the Mediterranean regions

(Oral)

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Through centuries, the intertwined relation between farmers and nature shaped a rich and diverse cultural and natural heritage, reflected as a wide range of agricultural landscapes, where low-intensity farming practices are known to support high levels of biodiversity and the wide provision of ecosystem services. The concept of High Nature Value farmlands (HNVf) was devised in the 90's as a tool to characterize and direct financial support to such agricultural landscapes. The nature value of HNVf stems from a high proportion of natural/semi-natural vegetation e.g. pastures and meadows, the presence of small-scale elements in the agricultural landscapes, (e.g. field margins, hedgerows), or the occurrence of agriculture-dependent species with conservation interest (e.g. farmland birds). HNVf are multifunctional landscapes, therefore contributing for the delivery of ecosystem services, namely provisioning (e.g. high-quality food, fibre and maintenance of genetic resources), cultural (e.g. recreation and agro- and ecotourism, maintenance of cultural heritage) and regulating services (e.g. climate regulation, pollination), sustained by key ecological supporting functions (e.g. primary production, nutrient cycling, soil formation). Bridging agro-biodiversity conservation with rural development policies, the HNV farmland concept goes beyond the classical approaches to conservation, acknowledging the importance of considering the social-ecological systems underlying HNV farming systems for as critical to protection of the rural environment by enhancing resilience and providing essential ecosystem services.

Recent estimates report that over 30% of EU farmlands are High Nature Value farmlands. Moreover, it is also estimated that ca. 50% off all species and 63 out of 231 habitat types of European conservation interest rely on the persistence of specific agricultural practices, namely those associated with HNV farming systems. However, social-ecological changes such as e.g. climate and land-use change (agricultural intensification or abandonment), rural-urban migration, market pressures and public policies, are currently threatening HNV farmlands, putting the persistence of the biodiversity supported by such farmlands at risk. This presentation will focus on the importance of High Nature Value farmlands for the conservation of biodiversity and the wide provision of ecosystem services in Mediterranean regions. Specifically, opportunities and challenges related to the future persistence of the social-ecological systems underlying HNVf will be discussed and illustrated, in the context of the conservation of biodiversity and the maintenance of ecosystem services delivered by such farmlands in the Mediterranean regions.

This research is being developed within the FARSYD project – 'FARming SYstems as tool to support policies for effective conservation and management of high nature value farmlands' (POCI-01-0145-FEDER-016664-PTDC/AAG-EC/5007/2014).

2018/06/12

12:15

Room: A2 Wivi



## Spatial prioritization for ecosystem services and carbon sequestration creates trade-offs with biodiversity in Europe

(Oral)

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Abstract of this presentation is not public



## The effects of fish stocking on food-web dynamics and ecosystem stability

(Oral)

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Fish stocking is used worldwide for conservation and management purposes but its effects on food-web dynamics and ecosystem stability are poorly known. To better understand these effects, an empirically validated network model was used to study a well-studied lake ecosystem. Two stocking scenarios with two native fish species valuable for fishing were simulated. In the first scenario, whitefish larvae were stocked in the ecosystem. This led to a minor increase in adult whitefish biomasses and decreased perch biomasses. In the second scenario, also perch larvae were stocked in the ecosystem. This led to a decrease in whitefish biomasses and in the biomass of the old perch, and destabilized the ecosystem. The effects of stocking depend on the species' position in the food web and thus cannot be assessed without considering interacting species. Our results show that fish stocking can change dynamics of an aquatic food web and lead to undesired outcomes from both management and conservation perspective.

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## Conservation value of low-productive forests measured as the amount and diversity of dead wood and saproxylic beetles

(Oral and Poster)

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In many managed landscapes a major part of all remaining unmanaged land is low-productive. Low-productive land is also often over-represented within protected areas, as it is less expensive to set aside. Despite this the relationship between productivity and conservational value of a site is not well known, although it has been hypothesized that biodiversity generally increases with productivity due to higher resource abundance and heterogeneity. If biodiversity is indeed higher in more productive land, there is a risk that an important part of diversity will remain unprotected when mainly low-productive land is set aside.

We examined the conservational value of low-productive forest land by comparing the species richness and composition of dead wood-dependent beetles, as well as the volume and diversity of dead wood, between low-productive (potential forest growth < 1 m<sup>3</sup>/ha/year) and productive Scots pine-dominated forests in Sweden. We surveyed 192 forest stands, including two types of low-productive forests (stands on thin, rocky soils and on mires; the main categories of low-productive forest in Fennoscandia), and two types of productive forests (older managed stands and unmanaged stands set aside for conservation purposes).

We found a total of 90 beetle species, 13 of which were red-listed. Species richness was generally higher in the productive forest types: both the total species number and number of red-listed species were highest in the productive set-asides and lowest in mires. Species richness was positively correlated with both volume and diversity of dead wood, but volume appeared to be a better predictor for the higher richness in productive forests. The species composition was generally similar among stand types, even though certain species were only found in the set-asides. None of the species were unique to low-productive forests, and the species assemblages in low-productive stands were thus subsets of those in productive set-asides.

We conclude that low-productive forests are less valuable for conservation than productive forest land, since they contained less dead wood and thus hosted lower beetle species richness. However, given the generally similar species composition among stand types, a comparable conservational effect could be obtained by setting aside a larger area of low-productive forest in comparison to the productive. For example, in terms of dead wood volumes, 1.8–3.6 ha of low-productive forest would have the same value as 1 ha of unmanaged productive forest. However, as productive forests harbored some unique species, they are not completely exchangeable.



## Understanding spatial-temporal changes in ecosystem services using mobile phone network data

(Oral and Poster)

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Climate change is predicted to have substantial impacts on ecosystem services [1]. In particular, seasonal outdoor recreation at coastal and mountain areas can be degraded and threatened. So far, many valuation studies have assessed recreational services over the world; however, the spatial and temporal limits of data prevented estimation of the reliable values of seasonal recreation services. Recently, to resolve these challenges in the context of ecosystem services, there is a growing body of literature on applications of social media data and the platforms, such as Twitter, Instagram, and Flickr [2, 3]; although few studies have evaluated the services in monetary terms.

The travel cost model, which is one of the traditional valuation methods, using mobile phone network data was applied to understand recreational ecosystem services at coastal and mountain areas in Japan. The data, which called Mobile Spatial Statistics (MSS), is derived from operational data of a mobile phone network on an hourly basis and non-self reported. Thus, to protect the mobile phone users' privacy, mesh aggregation has been implemented on the data by the company.

Our findings from the travel cost model with the unique mobile phone data demonstrated the ecosystem service values at coastal and mountain areas. We found the spatial-temporal differences in the estimated values; especially, the change on a daily basis in each recreational site implied the seasonal changes of ecosystem services associated with changes in temporal environmental conditions and qualities. Although our unique data enabled us to estimate the value by 500m grid cell, still it was difficult to identify what kinds of recreational activities were performed and whether or not the activities have negative impacts on biodiversity. Further studies are recommended to integrate other social media data with photos and texts into our approach to remedy these issues. Development of applications of new technologies and data sources into conservation science will enhance understanding ecosystem services and nature-human relationships and help decision making under climate change.

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## How (not) to protect and monitor the Siberian flying squirrel - an interdisciplinary synthesis

(Oral and Poster)

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Monitoring and evaluation are crucial components of informed decision making, but there is still a general lack of evaluation of the effectiveness of different conservation policies and practices. Also, many existing monitoring schemes can be inefficient use of resources. We have studied the effects and side-effects of legal protection of the Siberian flying squirrel *Pteromys volans* in Finland, and re-evaluated the methods and results of the monitoring scheme for the species. This presentation combines the results of four different studies.

Protection of the so called 'breeding sites or resting places' for the species has faced resistance. We explored reasons for negative attitudes by comparing the responses of persons with and without direct experience on protection. Forest owners have been mostly satisfied with the logging restrictions, but about half of the area occupied by the species in Finland could be owned by persons who would prefer not to have it on their lands. The issue is politicized: the species has become an example of top-down protection, resisted by forest owners out of principle.

We estimated the proportion of 'breeding sites or resting places' that have been considered in forest management and found that only 3% of all the potential sites that would have been located on logging areas could have been recognized (1). This, and negative attitudes toward the species, indicate severe problems with compliance of legislation. We also studied 100 sites delimited by environmental authority. Our results show that the narrow definition of the prohibition to 'deteriorate or destruct' the sites does not safeguard the ecological functionality of them (1).

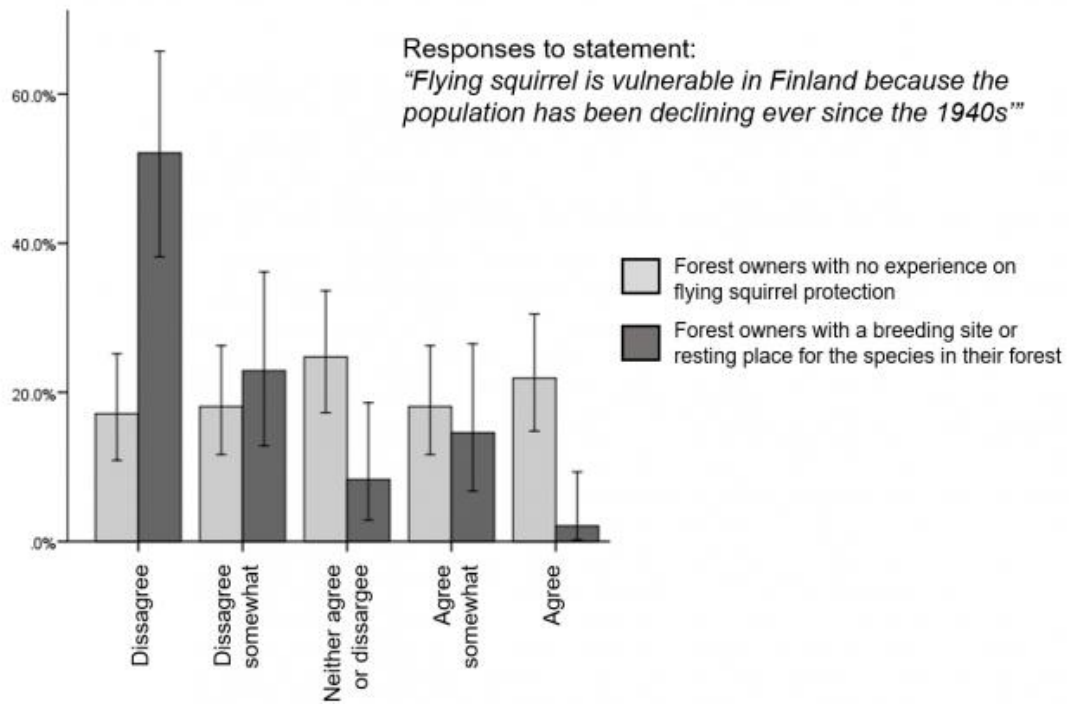
The national monitoring scheme reported 22.7% decline of occupancy during 2006-2015. If the proportional change in occupancy would correspond 1:1 with the proportional change in population size, the decline in population size would have been <30%. Based on this assumption the status of the species was down-listed from 'Vulnerable' to 'Near Threatened'.

We estimated a) the relationship between observed decline in occupancy and the true changes in the population size, and b) the possible causes of the change by: i) evaluating the sampling method, building both ii) a survival/colonization model with relevant habitat data, and iii) an individual-based simulator to test the relation between observed occupancy and actual number of individuals. Our simulation shows that population can decline faster than occupancy.

We should rethink the way the species is protected and how its status is evaluated. Protection of only known nest sites will not be effective in Finland. The raw occupancy data should be interpreted according to more realistic occupancy-abundance relationship.

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**Forest owners who have Siberian flying squirrels on their lands do not believe that the species is vulnerable.**







## Cloud water interception of epiphytic bryophytes in a Peruvian upper montane cloud forest: an experimental approach

(Oral and Poster)

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Epiphytic plants account for high proportion of biomass in tropical montane rain forests. In high-elevation cloud forests, where frequent fog passes through the canopy, the majority of this epiphytic biomass consists of bryophytes<sup>1</sup>. Together with physiological adaptations for water absorption and storage, bryophytes' abundance implies a regulatory role in the forest water cycle. Epiphytic bryophytes capture rain and fog droplets, potentially increasing water availability, and stabilize forest microclimate by slowly releasing the accumulated moisture. Their ecological impact on forest hydrology has been especially attributed to cloud water interception (CWI) during dry seasons<sup>2</sup>, but few studies have provided quantitative data to support this hypothesis<sup>3</sup>. We constructed an experimental design to measure the cloud water input into bryophyte assemblages on six artificial branches made out of plastic pipes. To contrast CWI efficiency to functional traits of bryophytes, we used four different dominant species (*Plagiochila* spp., *Frullania* sp, *Herbertus* sp. and *Radula* sp.) typical of different parts of the host tree. Our results show that bryophytes' water content changes following the daily fluctuations in temperature

and humidity and that the magnitude of this variation is species-dependent. These findings highlight the importance of species composition as well as biomass on the ecohydrological functioning of bryophyte communities, both of which should be noted in conservation planning and management.

**References:**

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## Using historical data to highlight population declines in the iconic Australian platypus

(Oral and Poster)

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Long-term population data is essential for accurately assessing species status and for the correct management of endangered species. However, not all species are easily monitored and have been historically overlooked, giving inadequate data to form population estimates. Analysis of historical data is a relatively new technique for conservation management, often providing long-term population changes which would be otherwise undetectable using contemporary ecological monitoring.

In this study we investigated long-term population changes for the iconic Australia platypus (*Ornithorhynchus anatinus*), by collating 257 years of historical data from newspaper archives, museums, natural history books, explorer journals and national Atlas data (1760-2017). The platypus is the most evolutionarily distinct mammal alive today, being the only member of the Ornithorhynchidae family and one of only five extant monotreme species that exist worldwide. The semi-aquatic mammal is endemic to creeks and rivers in eastern Australia and is threatened by river regulation and degradation, crayfish netting, predation, and pollution across its range. Despite the evolutionary uniqueness of the platypus, surprisingly little is known about its conservation status. The nocturnal and cryptic nature of the platypus, and the scarcity of long-term monitoring studies, has limited our capacity to assess changes in distribution and abundance, both historically and in more recent research. Thus, the conservation status of 'near threatened' (IUCN), and 'least concern' (Australian state legislation), may not reflect the true ecological status of the platypus.

Our historical analyses suggest historical platypus abundances far exceeded current observations. Further, our comprehensive assessment of distributional change suggests a range decline for the platypus. Periods of decline and low population numbers have resulted in an intergenerational loss of knowledge on platypus abundances, leading to the perception that these lower contemporary abundances are representative of baseline populations. This study highlights long-term declines in platypus populations, essential information for accurately assessing the conservation status of the platypus and for future management strategies of this declining iconic Australia mammal.

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## Transcriptomic variability in population responses of Atlantic cod to temperature

(Oral and Poster)

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Temperature has profound effects on ectotherm physiology, impacting metabolic and developmental rates, aerobic scope, and inducing cellular stress responses. The resulting phenotypic and fitness consequences ultimately drive population dynamics and species distributions (1). However, the molecular mechanisms underlying physiological responses to temperature are poorly understood (2), as are the spatial scales at which adaptation in thermal responses can occur (3). Yet, this knowledge can help us to understand how populations have adapted to their environments in the past, their contemporary plastic responses, and their potential for future adaptation in the face of anthropogenic climate change. We are interested in how Atlantic cod (*Gadus morhua*) populations inhabiting different thermal regimes along the Norwegian coast respond differently to changes in temperature. Using gene expression profiles obtained through RNA (transcript) sequencing, we show that rearing at ambient and warmer projected temperatures (+2°C and +4°C) induces changes in gene expression consistent with a severe and accelerated cellular stress response in larval cod while increasing growth and mortality and, thus, likely reducing fitness. We then integrate common-garden experiments across a range of temperatures with transcriptomics to demonstrate the potential for small-scale genetic differences in thermal responses in this highly mobile marine species and provide insight into the molecular basis of thermal adaptation in cod. We aim to inform predictions of the responses of wild cod populations to changing ocean temperatures to enable effective fisheries management in the face of global climate change.

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## Seal Exclusion Device in a pontoon trap for salmonids affects the size and numbers of caught fish

(Oral and Poster)

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Year	Test	Seal visits (no)	Frequency (visits per filmed hour)	Total time in trap or by SED (mm:ss)
2012	Diamond mesh SED	1	0.01	00:07
2012	Control	6	0.01	00:54
2016	Square mesh SED	1	0.01	05:13
2016	Diamond mesh SED	0	0.00	00:00
2016	Control	0	0.00	00:00

The pontoon trap is a successful means of mitigation in the conflict between coastal fishers and seals interacting with fishing gear. It distances caught fish from seals and is considered to be seal-safe in this respect [1]. The seals have had unlimited access to one of the final parts of the trap, the middle chamber. This leads to a risk of entanglement. In Finland the pontoon trap is considered to be the main cause of seals becoming bycatch [2]. Seals also damage and stress caught fish.

To prevent seals from entering the middle chamber two types of Seal Exclusion Devices (SEDs) were tested. The study used pontoon traps for salmon (*Salmo salar*) and brown trout (*Salmo trutta*). The SEDs were aluminium frames with Dyneema® yarn across the frame, in diamond or square mesh shapes. They were installed in the entrance of the middle chamber. The square mesh SED was rotated 45°. The control was an open frame. The hypothesis tested were (i) the SED would prevent seals from entering the middle chamber and (ii) the catch would increase. A negative side effect was expected. The SED would deter larger fish from entering. The collected data was the individual size of the fish and numbers of fish caught per soak day. Cameras were installed to record seal visits. The study was carried out over two years.

The visits of seals were too few to draw any inferences (Table 1). No seals were bycaught in any of the middle chambers.

Significantly larger salmonids were caught in the trap with the square mesh SED, followed by the diamond mesh SED. It is likely that the SEDs had a retaining effect on larger salmonids. For trout, significantly smaller fish were caught in the trap with the diamond mesh SED, suggesting that it was perceived as an obstacle. A possible

explanation is that 44 % of the area in the diamond mesh SED was quarter or half mesh, thus creating a visual disturbance. In the square mesh SED all mesh were full and of the same size.

The numbers of caught salmon and trout were significantly greater in traps with a SED, i.e. profitable from a fishers point of view.

With the growing populations of seals in the Baltic it becomes increasingly more important to reduce the bycatch of seals, while not affecting the catch. A SED in a pontoon trap will also decrease stress on caught fish.

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## Which traits predispose species to extinction? A review

(Oral and Poster)

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Biodiversity is shrinking rapidly and despite our efforts, only a small part of it has been redlisted. Identifying the traits that make species vulnerable might help us predict the outcome for those less known. We used machine learning algorithms to filter relevant publications among 2700 potential ones and collected a final list of 559 statistical models within 122 publications, from which we gathered information on trait responses to extinction risk, across all taxa, spatial scales and biogeographical realms, in what we think it is the most complete compilation up to date. This talk will explore gaps in the research: are taxa, or biogeographical regions equally sampled? Then we will answer to the question in the title by identifying which traits have been tested and which of those have been successful in explaining extinction risk patterns. Our meta-analyses reveal that habitat breadth and geographical range size are always negatively related to extinction risk, but body size, even taking the taxonomical group into account, does not show a clear unidirectional response. In the end, we will propose an alternative way to understand which traits the conservationists should be looking for, without having to deal with the lack of data and methodological constraints that current statistical models impose.

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## The influence of stand structure on spider species and guild diversity in plantations of contrasting tree species

(Oral and Poster)

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Forests are understood to have a major role in supporting life through habitat provision but they also provide multiple ecosystem services such as timber, recreation, climate change mitigation and soil and water protection. Having recognised that the way we use our forests damages them and is not sustainable in the long-term, Sustainable Forest Management principles were formulated to guide foresters to manage more resilient forests.

An increasing proportion of the world's forests are plantation (105 million hectares gained between 1990 and 2015) and there is a growing reliance on these rather than natural woodlands to deliver multiple ecosystem services across many countries. Plantations are increasingly recognised as having a potential role in supporting biodiversity. To understand how plantation forests can be used and managed sustainably in to the future requires a better understanding of the influence of changes in stand structure on biodiversity across different forest types.

Spiders play important functional roles in terrestrial ecosystems. As generalist predators, they help to maintain balance of food webs and control pest species but are also themselves a food source for other species. Despite this, our understanding of the impact of commercial plantation management on spider functional and taxonomic diversity in common commercial plantation types is limited.

This study determined ground-active spider assemblages in Sitka spruce and Scots pine plantation forests using a taxonomic and functional guild approach. The metrics were related to key drivers of change in forests, most notable stand structure across a clearfell forest harvesting cycle, and including long-term retention stands. 32 stands were located across the UK in clusters matched for site history, elevation and soil conditions. Spiders were sampled continuously from May to September in 2016 and 2017 using pitfall traps. Typically measured metrics of stand structure were recorded (canopy cover, stand density and diameter of trees).

Spider assemblages and functional guilds were affected by stand structure, with basal area a key parameter. Further, the impact of stand structure on spiders differed between tree species. Thresholds for structural parameters were determined, after which there were significant changes in assemblages. The results are discussed in the context of forest management and spider community resilience in commercial plantations.



## A joint SCB-Europe and SCB-Africa initiative: The 100 questions for biodiversity conservation in Mediterranean North Africa

(Oral and Poster)

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The Mediterranean region is a hotspot of biodiversity facing numerous environmental threats and socio-economic challenges. Researchers have a key role in providing pragmatic solutions for the conservation of biodiversity, and to this end, they need to be able to answer questions that are of interest to policy makers and land managers. Identifying the most important questions that need to be answered will guide scientific research to address the most pressing issues in a way that optimises nature protection while also meeting societal demands. Carried out jointly by the African and European sections of the Society for Conservation Biology as part of an ongoing exercise taking place in the five regions of the world with Mediterranean-type climates, this study aims to identify one hundred priority research questions that, if answered, could improve the effectiveness of conservation actions targeted at Mediterranean biodiversity in North Africa. Based on an adaptation of the approach developed by William J. Sutherland et al [Methods in Ecology and Evolution, 2, 3, (2011)] that seeks to maximise diversity, inclusiveness and openness, questions are collected in an anonymous way from environmental specialists working in a wide range of institutions (universities, consultancy firms, NGOs, businesses, cooperation agencies etc.) and having expertise in the region (Morocco, Algeria, Tunisia, Libya or Egypt). Relying on purposive sampling, participants are solicited through a variety of ways, including e-mail invitations, phone calls, meetings in person etc. The consultations are essentially conducted via a form embedded in the project website. Participants are asked to formulate questions that should address important gaps in knowledge and be answerable through a realistic research project (i.e. ideally translatable into an operational scientific hypothesis, with spatial and temporal scales that can reasonably be tackled by a research team). Classified into thematic categories of relevance to conservation (ecological management, agriculture, climate change, governance etc.), submitted questions will be sorted out, grouped by topic, eventually merged and rephrased. Their priority level will be evaluated, compared and ranked, following an iterative process of criteria-based assessment, voting and consensus-based discussions with a committee of experts. Narrowed down to 100 research questions, the final list will be compared with the set obtained from southern Europe, allowing the highlighting of divergence in issues and concerns across both margins of the Mediterranean Sea. This study may serve as a roadmap to aid research and decision-making in a way that is inclusive and comprehensive, reflecting conservation needs from different perspectives, indicating where efforts and resources should be directed, highlighting potential opportunities for enhancement and possibly bringing to light issues that are poorly recognised or newly emerging.





## Species distribution models as a useful tool in conservation programs: the case of the Northern Bald Ibis

(Oral and Poster)

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The Northern Bald Ibis (*Geronticus eremita*) is one of the most endangered species on the planet. Its original distribution covered from Syria and Turkey (with migrant populations) to Morocco (where the species was sedentary). Over the last century, the species had suffered an extreme decline in its population size, and is now considered to be critically endangered. Nowadays, the original distribution range of the species is restricted to the Agadir region in Morocco. In Europe the Northern Bald Ibis was extinct 400 years ago, and the species is only present in Spain and Austria, and this is due to two different conservation projects, i.e.e. the Eremita project and a LIFE+ project, respectively, with introduced animals born and raised in captivity. The aim of this project is to characterize those past and present areas used by the Northern Bald Ibis in their natural distribution in Morocco, identifying the most favorable areas for the assessment of the species in Morocco and also for making it possible to reintroduce this species to Europe. We used species distribution models with a presence/absence database obtained from bibliography and a set of environmental variables. Spatial variables were combined obtaining a trend surface variable, which is a purely spatial descriptor of the cohesion trend in the distribution of the species regarding its history and population dynamics. Another model was built using only environmental variables to identify those areas which are favorable for the species in relation to the environment, without the effects of the population's cohesion trend. Environmental obtained models were extrapolated to Andalusia, Spain, where the Eremita Project aims to introduce individuals, breaking the historic natural cohesion of the populations. Obtained models classified the areas into 'favorable', 'unfavorable' or 'uncertain'. Using these models we built maps which show that the most favorable regions are in the north of Morocco (environmental model), the middle Atlas (spatial model) and the oriental and occidental coast (both models). Models obtained in the European regions show that the areas where the species is being introduced are not the most favorable for the species, and in the case of Andalusia, introduced individuals have moved to favorable places in the North of Morocco, where the species was not present in the past. Moreover, for the first time there have been new records of this species on the occidental coast of Morocco, where the models also predict a maximum in the favorability. All of the assessments in the obtained models demonstrate the importance of this methodology in the design of conservation programs for the Northern Bald Ibis, which allows us to identify those areas where the species is likely to survive, and allow us to focus our conservation efforts and introduction programs on those areas. This methodology could be used to detect the best places to introduce new individuals or to create protected areas.



## Disentangling complex sustainability issues in global food systems

(Oral)

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Global relationships of demand, supply and trade of international commodities increasingly present a challenge for the conservation of threatened ecosystems. These dynamics cross sectors and scales. Food supply chains connect consumers to distant ecosystems where commodities are produced, traded and exported for the production of products in other industry sectors. Such is the case of soybeans. While soybean oil is the second most consumed oil in the world, around 75% of soybean production is used for animal feed. Thus changes in demand for meat products in places like Europe or China can have serious environmental as well as social impacts on source countries such as Brazil. Production of soy is overtaking huge areas in fragile ecosystems such as the Brazilian Cerrado, The Amazon, The Chaco and the Atlantic Forests of South America. Biodiversity impact is thus effectively exported via international trade in food commodities. However there is lack of transparency around flows of commodities and the roles of different actors, and there is a lack of understanding on barriers to sustainable production and trade. This talk will introduce the use of mental models on supply chain actors as a new method to work on supply chain governance given the cross-scale nature of supply chain impacts and the cross-scale actor engagement that is needed to address impacts within supply chains. It will include a brief overview of a project using mental models currently being carried out by the Luc Hoffmann Institute in collaboration with several WWF offices, academic and research institutions including The University of Queensland, the Stockholm Environment Institute, and the World Conservation Monitoring Centre. The project aims to inform strategies for concerted action via the sharing of mental models.

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## Towards a sustainable insect food production system

(Oral)

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Insect production has been suggested as a food production system that could be more sustainable than many conventional livestock systems. Insects are a promising source of nutrients for humans containing high amounts of good quality protein, fatty acids, vitamins and minerals. A sustainable insect industry could have large impacts on land use, ecology and conservation. However, much around insects as a food source are unknown and only a small number of species have been used as livestock. Plenty of new information and understanding is needed if we are to develop food production systems and mass rearing of insects. The promise and also challenge of this food system is to develop it in a sustainable manner that permeates all parts of the production chain. This means that choice of species, rearing facilities, and resource use in terms of feed and energy are core components that needs to be evaluated within a sustainable framework. We suggest important key factors within these components that can guide the way for the future development of insect as minilivestock. These include that insect species chosen should be native so they do not contribute to the increasing invasion problem facing both natural and production systems. The species should have a potential to utilise plant products that cannot be used for humans as food. The animals thereby do not compete with humans for food resources, as is the case of many current food systems. Promising insect taxa are leaf chewers, which include species from the families' orthoptera, coleoptera and phasmatodea. An evaluation of sustainable resource and energy use indicate that western countries relying heavily on fossil fuel will have harder to reach goals in these areas of the food system.

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## Sustainability performance of national bio-economies

(Oral)

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Despite the current drop in price, many fossil fuel resources are becoming increasingly scarce and their consumption is associated with climate change and harmful effects on ecosystems and human health. At the same time, population growth and corresponding pressures on natural resources have risen beyond safe ecological limits. In response to these societal challenges, countries have adopted ambitious global goals such as the 2°C limit to global warming, the Aichi Biodiversity Targets, and the Sustainable Development Goals. However, this unprecedented global awareness has yet to be matched with appropriate action towards achieving these goals and targets. An increasing number of countries look to the bio-economy as a strategy to reduce reliance on fossil fuel and enable sustainable development through a "biologization" of the regular economy. At global scale, however, bio-economies are diverse with sectors, such as agriculture, forestry, energy, chemicals & pharmaceuticals as well as science and education. We thus also expect large variation in the factors driving sustainability outcomes of bio-based development strategies and the appropriate strategies to promote them. In this study, we develop a typology of bio-economies based on country-specific characteristics. We describe five different bio-economy types with varying degrees of importance of the primary and the high-tech sector. While the importance of the high-tech sector is mirrored by the availability of skills, the importance of the primary sector for the national economy is apparently not dependent on the amount of bioproductive land but rather determined by lower levels of skill availability. In terms of sustainability performance, indicators suggest that diversified high-tech economies have experienced a slight improvement especially in terms of resource consumption and material footprints. Levels remain however at the highest levels compared to all other types with large amounts of resources and raw materials being imported from other countries, especially for non-food purposes. Increased competition between food, energy and the environment can push innovations for more efficient use of land, biomass and other resources but it can also increase imports of biomass, especially primary raw materials and associated externalization effects of environmental costs. In an increasingly telecoupled world, these results highlight the following priorities for sustainable development: the necessity of developed high-tech bio-economies to further decrease their environmental footprint domestically and internationally and the importance of biotechnology innovation transfer after critical and comprehensive sustainability assessments.





## Multispecies wild plant lawns in Moscow legislation

(Oral)

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Growing urbanization requires a new approach to the input of city green spaces in biodiversity conservation.

The green places in residential areas and transport networks were studied as habitats for common plant and insect species as well as ecological corridors for rare species. We consider the nature preservation to provide a low-cost care for green areas.

Federal Construction Rules and Regulations (SNiP) 2.07.01-89 requires 40 % of a city area being designated for greenery for enhancing urban environment. Moscow's official statistics shows green areas having occupied 45,000 ha of 107,000 ha in the 1990s; including 23,000 ha of natural areas and 18,300 ha of areas to be landscaped.

Due to lack of money meadow-like multispecies lawns prevailed on Moscow streets and in residential quarters till the middle of 1990s. They kept there more than 100 species of wild plants and several hundred species of invertebrates and were eco-corridors for insects. This helped to reduce the isolation of natural areas from each other and increased the survival of local species populations.

Such natural to semi-natural areas ratio and a unique wedge-like structure of Moscow's green places have preserved in Moscow up to 70% of insect species.

Large-scale lawn-mowing has begun in mid-1990s and led to lost wild native plants together with anthophilous and grass-inhabiting invertebrates.

The destruction of tall multi-species lawns was not a violation of any law. Both the Federal and Moscow City Rules for Creating, Managing, and Protecting Greenery provided for only two types of grass cover for residential developments and transport networks: a lawn parterre (1-2 grasses) and an ordinary lawn (3-5 grasses). The grass shall not be higher than 10-15 cm in an ordinary lawn, flowering plants are not allowed there.

The "meadow lawn" was allowed only for large parks and forest parks, where we need meadows but not lawns.

The "meadow lawn" according to the Care Charts (lists of mandatory works) must be completely mowed twice per summer, that leads to the animals' death.

This is in a contradiction with the Federal Law "On the protection of the environment" of 10.01.2002 № 7-FZ.

We have prepared the modern version of the mentioned Moscow Rules (№ 743-PP of 10.09.2002, as amended on 27.02.2007, № 121-PP) introducing "multispecies lawn" as a new category of biodiversity-supportive lawn comprising native wild plants. This new category is applicable to residential areas. Its basic regime is once-a-year mowing of no more than 30 to 50% of the surface. This saves a fodder base for insects in the summer and places for wintering. Quality indicators include the presence of plant and insect species of Moscow Red List.

Unfortunately, the Care Charts for the multispecies lawn have not been adopted yet. This impedes its implementation. The main problem is that municipal enterprises are interested in obtaining funds just for expensive lawn care.

Herbage options	Annual labor cost (man-hours per ar)	Number of herb mowing	Watering	Cleaning of fallen leaves	Biodiversity	
					plants	animals
* "parterre lawn"	140,9	20	+	+	1-2 gramineous species	part of soil fauna
* "ordinary lawn"	105,9	16	+	+	5-6 gramineous species	part of soil fauna
* "meadow lawn"	9,9	2	-	-	multispecies herbaceous cover	animals perish twice per summer
** multispecies wild plant lawn and meadow on SPNAs	2,0	<sup>1</sup> / <sub>3</sub> or <sup>1</sup> / <sub>2</sub> of the surface once-a-year	-	-	multispecies herbaceous cover	maximum biodiversity in a given location

\* - Standard Operating Regulation for the Maintenance of Landscaped Areas of the 1<sup>st</sup> category in the City of Moscow (04.06.2013 No. 05-14-172/3).

\*\* - The proposed standard mode.

Pic.1. Management of various lawns and wild herbaceous vegetation in Moscow









## Natural Climate Solutions. What are the natural sinks, what capacity they offer, how they can be maximized?

(Oral)

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Better stewardship of land is needed to achieve the Paris Climate Agreement goal of holding warming below 2°C; however, confusion persists about the specific set of land stewardship options available and their mitigation potential. To address this, we identify and quantify “natural climate solutions” (NCS): 20 conservation, restoration, and improved land management actions that increase carbon storage and/or avoid greenhouse gas emissions across global forests, wetlands, grasslands, and agricultural lands. We find that the maximum potential of NCS – when constrained by food security, fiber security, and biodiversity conservation – is 23.8 PgCO<sub>2</sub>e yr<sup>-1</sup> (95% CI 20.3 - 37.4). This is ≥30% higher than prior estimates, which did not include the full range of options and safeguards considered here. About half of this maximum (11.3 PgCO<sub>2</sub>e yr<sup>-1</sup>) represents cost effective climate mitigation, assuming the social cost of CO<sub>2</sub> pollution is ≥100 USD MgCO<sub>2</sub>e<sup>-1</sup> by 2030. Natural climate solutions can provide 37% of cost effective CO<sub>2</sub> mitigation needed through 2030 for a >66% chance of holding warming below 2°C. One-third of this cost effective NCS mitigation can be delivered at or below 10 USD MgCO<sub>2</sub>e<sup>-1</sup>.

We map country-level mitigation potential for 10 priority types of NCS actions. From these maps we identify groups of countries, each with a similar set of dominant NCS opportunities. For some country groups, NCS opportunities are dominated by restoration actions in forests, agricultural lands, and/or wetlands. In others country groups, mitigation potential is dominated by conservation of existing forests, grasslands, and wetlands.

Most NCS actions – if effectively implemented – also offer water filtration, flood buffering, soil health, biodiversity habitat, and enhanced climate resilience. Work remains to better constrain uncertainty of NCS mitigation estimates. Nevertheless, existing knowledge reported here provides a robust basis for immediate global action to improve ecosystem stewardship as a major solution to climate change.

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## BRINGING BACK ECOLOGICAL FLOWS: THE CASE OF MIGRATORY FISH AND THE REGULATION OF HYDROPOWER IN FINLAND

(Oral)

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Most of the large Finnish rivers were licensed and built for hydropower after the Second World War. The need for electricity at that period triumphed over all the other interests, leading to a significant decrease in migratory fish species, such as salmon and trout.

Throughout their life span, licenses for hydroelectric operations have enjoyed strict protection against administrative or legal review that would result in significant economic losses to the operator. In this way, the Finnish legal framework has been highly resistant and maladaptive in the face of bringing back ecological flows and restoring migratory fish species to the Finnish rivers.

Nevertheless, presently the Finnish Government's clear goal is to introduce fish passages and the natural reproductive cycle of migratory fish species in built and regulated rivers in which the ecological continuum of migratory fish is currently blocked. Considering significant normative inputs stemming especially from the EU Water Framework Directive (WFD), the presentation discusses possible legal avenues for restoring ecological flows in the built Finnish rivers.

We argue that the current obligations stemming from the Finnish Water Law – and their interpretation in relation to migratory fish – are outdated and even legally problematic. Overall, neither the Finnish legislature, nor the Finnish water administration have reacted quickly enough to the changes in circumstances caused by the development of EU law, the declining importance of hydropower for the Finnish energy policy, and the current knowledge of the ecological importance of migratory fish species for the river ecosystems. Finnish Water Law already contains some tools for reviewing fisheries regulations in existing water permits, but also legislative changes are required to implement and to enforce the obligations stemming from the WFD in adaptive manner.

It must be noted, however, that the review of fisheries regulations in water permits is a multidimensional and river-specific task. Technically, a fish passage and restoration measures as well as monitoring of the success of measures may be required. Cooperation between authorities and hydropower companies is recommended but authorities must also be able to take necessary measures to bring back ecological flows in the case of unsuccessful cooperation. Furthermore, the water authorities need to have adaptive legal tools fit for this purpose.

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## Landowners' preferences, motivations and needs to inform voluntary private land conservation policy in a conservation priority area

(Oral)

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The Uruguayan savanna ecoregion in South America is considered critically endangered mostly because of land use change and intensification to commercial agriculture and afforestation. In Uruguay, the National System of Protected Areas (SNAP) covers only ~1% of the land, while more than 90% of the land is privately owned and under different production regimes. Consequently, the implementation of conservation actions depends mostly on landowners' willingness to collaborate and on their management capabilities. Uruguay is signatory of the CBD and has committed to achieve biodiversity conservation in a sustainable manner that does not affect local stakeholders negatively. Therefore, there is a need to develop and implement national voluntary private land conservation (VPLC) strategies to complement protected areas with other effective area-based conservation measures. VPLC has the potential to increase the area under protection, and increase ecological, economic and social connectivity, as well as the involvement of different stakeholders in landscape management. Many strategies and incentives have been developed worldwide to promote VPLC, but their success is generally context-dependent. To develop adequate VPLC policies that increase landowners' involvement and ensure their long-term commitment it is necessary to understand their perspectives and preferences regarding biodiversity conservation. With this aim, in collaboration with the SNAP, we conducted semi-structured interviews with traditional cattle ranching landowners in a priority area for biodiversity and ecosystem services conservation in Uruguay. We followed a non-probability sampling approach consisting on stakeholders' analysis, purposeful and snowball sampling and respondent-driven sampling. We conducted 11 interviews following the sample size saturation principle. We assessed the dependability, credibility, confirmability, and transferability of the research design, conduct, and interpretation. The results revealed landowners' strong sense of place and their voluntary support to biodiversity conservation, given that their income and lifestyle strongly depend on the ecosystem services provided by native ecosystems (e.g. grasslands, forests). Their conservation motivations are mostly intrinsic (autonomy, competence, and relatedness; according to the self-determination theory). In order to improve their practices, they prefer facilitative incentives such as education programs and technical assistance and cost-share incentives to be able to improve their infrastructure (e.g. fencing for grassland management). Both the approach and the findings are crucial to bridge the science-implementation gap, to identify appropriate strategies to promote VPLC and to enhance landowners' willingness to get involved in conservation actions. This was the first study to address the landowners' perspectives on VPLC in Uruguay and the results will inform policy making at the local and national level.



## Habitat suitability models for the Siberian jay (*Perisoreus infaustus*) from Citizen Science and systematic monitoring data: incorporating information about the reporting process

(Oral)

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Opportunistically collected presence-only data contributed by volunteer reporters, so called Citizen Science data, are increasingly available for species and regions that lack systematic surveys. However, it is unclear if or how much the biases in opportunistically collected data influence different habitat suitability modelling methods and hence if they can be used with confidence to address different conservation questions.

We evaluated habitat suitability models with opportunistically collected observations against models with systematically collected observations for a forest bird species, the Siberian jay (*Perisoreus infaustus*) in Sweden. Citizen Science data were obtained from the Swedish Species Observation System and systematically collected data from the Swedish Bird Survey.

The opportunistically collected presence-only data were enhanced by adding high-quality inferred species absences. We obtained these by combining information on reporting behaviour and species identification skills of a few, very active reporters with their observations. We evaluated logistic regression with inferred absences, two versions of MaxEnt, a model combining presence-absence with presence-only observations and a Bayesian site-occupancy-detection model.

All modelling methods produced nationwide habitat suitability maps of Siberian jay that agreed well with results from systematically collected data. At finer geographic scales there were differences among methods. Logistic regression with inferred absences produced results most similar to those from the systematic survey.

Adding high-quality inferred absences to opportunistically collected data is likely possible for many less common species. They may facilitate the modelling and prediction of species distributions in areas or for species for which systematically collected data are not available.

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## Long-term bird population changes in the protected areas of Finland under climate change

(Oral)

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### Long-term bird population changes in the protected areas of Finland under climate change

Climate warming causes poleward shifts of species ranges and populations. Also in Finland both ranges (Ref. 1) and mean weighted densities (2) of species have shifted northwards during the past 40 years. Moreover, climate change and other human influences such as land use and hunting may cause changes in population sizes. Protected area (PA) network is one of the key instruments to maintain biodiversity in a changing climate and alleviate abrupt changes in species distributions and densities (3). In order to analyze the ability of nature reserves to maintain populations we compared the observed changes of bird species in over 250 protected areas in Finland between two time slices, 1981-1999 and 2000-2017. The data are large with over 9,100 km of line transects censused in the first and 10,400 km in the latter period. Between these two periods, the total bird density in protected areas declined by about 10%. The decline in total bird density was the largest in the southern PAs showing an overall northward shift in mean weighted bird density in the PA network. In particular, long-distant migrants overwintering in Africa and in Southeast Asia (e.g. willow warbler *Phylloscopus trochilus* and rustic bunting *Emberiza rustica*) and northern species (e.g. brambling *Fringilla montifringilla*) declined considerably, while many southern species increased. Both decreased and increased species showed a pattern of northward shift in their abundances in the PA network in line with the climate change predictions. Protected areas have been established particularly to preserve old-growth forests and many resident, non-migratory species preferring these habitats either remained stable (e.g. Siberian tit *Poecile cinctus*, Siberian jay *Perisoreus infaustus*) or even increased (three-toed woodpecker *Picoides tridactylus*) in PAs. This shows that by protecting old-growth forests it is possible to enhance preservation of species in these habitats even under changing climate. However, global climate change and direct human influence appear to affect migratory birds considerably, causing the decline of populations and impoverishment of bird communities in the boreal PAs.

Our work is part of three-year project of evaluation of protected area network in the changing climate (SUMI).

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## Don't you understand, or should I draw?

(Oral)

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I will show and tell about my thoughts and experiences as an environmental cartoonist and illustrator.

I have done political cartoons, informative educational illustrations and also popularization of scientific research.

I often work together with experts and scientists, changing and testing ideas and checking the facts.

With the help of some hopefully illustrative illustrations I will ponder for example these questions:

How to make abstract or complicated ideas visible? Environmental issues are often complicated. One has to seek the balance between communicating the point and keeping it simple.

How to wake up public interest, but avoid trolling or click baiting.

Is it a threat for your credibility as a researcher, if you use humor or funny pictures?

Ways to make a graph easier to understand for non-scientists, stakeholders and decision makers.

Where to draw the line between an informative scientific illustration and a political cartoon? Conservation biology studies the real world facts. But conservation biology often has to have an influence on political processes to achieve its desired outcomes.

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## Directions in Conservation Biology Revisited

(Oral)

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In any scientific endeavour, the object is to understand how the natural world works. In applied sciences this endeavour is further motivated by a need to predict the effectiveness of management interventions based on scientific data, results or theories.. Conservation biology, which is at its roots an applied science emerged as a science in the 1980's. Although it profits from older disciplines such as ecology, it is still a relatively young science. In his seminal paper from 1994, G. Caughley (Directions in Conservation Biology, *J. Anim. Ecol.* 63: 215-244) identified two paradigms in conservation biology. He proposed that while the small population paradigm (concerned with the viability of small populations) is theory laden, the declining population paradigm (concerned with declining populations) was scant of theoretical basis and was carried out mainly as a series of case studies often with limited general interest. To which extent these statements are still justified as conservation biology as a scientific field has grown older remains largely unstudied.

In this talk, we will present the results from a review based on a random sample of papers published in the main conservation and applied ecology journals across the last decades. We will limit our review to studies that present (and analyse) empirical data from the natural world. Thus, the papers we include and that broadly falls within the frames of the ecological disciplines, and we disregard papers that belong mainly within the social sciences or forum articles. We first present a summary of the relative frequency of experimental versus observational/correlative studies. Then we will then focus on how frequently individual studies mainly i) describe associations among variables, ii) document causal effects, or iii) mainly present updated parameter estimates (e.g. demographic rates from new study sites). Furthermore, we assess the frequency of clearly stated hypothesis from which logical and testable predictions are deduced. When hypothesis are present we assess their generality and boldness in terms of taxonomic and environmental coverage. Finally, for the papers that state clearly testable predictions we assess to which extent they make formal statistical assessments of the resulting models' predictive capabilities.

The ultimate goal of conservation biology is to make a difference in the real world, but the impact of science on conservation outcomes is often hotly contested. We argue that conservation biologists ought to pay attention the philosophy of science and the philosophy of biology, and that a better understanding of how conservation biology as a science is carried out is timely.



## Quick LiDAR-based characterization of forest vertical structure to support forest management actions

(Oral)

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Vertical arrangement of vegetation components is important for understanding forest environment, being both a product and driver of ecosystem processes and biological diversity. Features of stand level spatial distribution provides key information on forest ecosystems' composition, functioning, and dynamics. Characterization of vertical structure and its complexity helps to assess forest stand response to various disturbances and clarify how current management affects biodiversity. Recent advantages in applying LiDAR data for estimating three dimensional forest stand structure across a range of scales gives novel informational tools for planning and assessing actions on forest management and conservation. Existing techniques often require prior information about stand characteristics or rely on pre-defined height and diameter thresholds.

In the study, we present an approach to characterize vertical forest structure based on echo distributions from airborne laser scanning (ALS). We developed a method using ALS data combined with a statistical estimation of vegetation components' density to determinate canopy layers spatial distribution. The method allows us to obtain a morphometric characteristic of each layer, to determine the vertical complexity of a forest stand, and to derive canopy structure types. Since the developed method does not require ground reference data for calculations, the result can be obtained much faster than using other similar methods.

The proposed approach was tested at Zemborzyce study site (E22°31'45" N51°09'38"), located within a deciduous mixed forest in the south east of Lublin, Poland. These forests has a complex structure, up to four layers: mature dominant species and a slightly lower layer of mature trees, a shrub layer, and understory layer of grasses and other herbaceous plants. A LiDAR dataset flown in 2014 was obtained from The John Paul II Catholic University of Lublin. The characterization of forest vertical structure at the study site is resulted in a set of maps representing vegetation density at each canopy layer as well as fifteen canopy structure types describing the forest vertical complexity of the study site. Obtained maps were validated using forest inventory data and showed promising results. We conclude that our method gives a new robust and reliable approach to characterization of forest vertical structure and enables an efficient monitoring of canopy structure, making possible a quick respond to sudden disturbances such as fires and windfalls.



## Recovering and restoring deleted salmonid populations

(Oral)

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Salmon and trout have been considered as an umbrella species indicating a good status of the ecosystem. They have a notable existence value producing variety of ecosystem services but moreover, indicating healthy rivers, they can be seen as the key species for stream restoration and adapting human induced changes (e.g. climate change). In less than hundred years we have lost the genetic diversity of salmon by hydropower production all over the country and the Baltic Sea region. Besides hydropower salmonid populations have encountered challenges by habitat loss due timber floating, overall human impact on catchment scale deteriorating water quality and effective fisheries which have all been stressing populations.

Basically the loss of salmon catch has been usually compensated by stocking hatchery reared juvenile salmon to be fished during the sea migration. This compensation has been paid for people, not to the lost river ecosystem. Implementing ecological flow to a single hydropower plant may enhance specific situations like extreme flash floods or zero discharges but it merely solves one challenge. For salmonids, if natural reproduction habitats are available in the upper reaches of the river, could a fishway passing the dam be enough - at least for adult upstream migration. Smoltified juveniles do not generally find a safe downstream migration route and turbines and increased predation in low flow sections between hydropower plants are major threats.



When the total river system is used for hydropower production it means a chain of plants. For example the main stream of the river Oulujoki (107 km) with eight hydropower plants leaves the stream without visible drop and natural flowing water. In these kinds of environments the only possibility for salmonid population would be reconstruction of a habitat compensation sites for every dam, especially downstream, to reestablish the population. With this action approximately 20 % of the original salmonid production is estimated to be possible to compensate. A compensation channel could work as a nature-like fishway but moreover it would support a complete riverine habitat for salmon reproduction. Reproduction channels are studied to host higher densities of juveniles than natural rivers (Imatra brook: 150 brown trout juveniles/100 m<sup>2</sup>) probably due to controlled discharges and possibility to optimize the quality of needed habitat types.

In some cases population compensation in the same river can be seen impossible e.g. by water quality problems or physical limits for construction. In these cases we should be able to raise stream ecosystems to the spotlight and make compensation in a nearby watercourse possible. Until now compensation has been targeted to compensate loss for fishery and to mitigate the losses for local residents. Habitat compensation should contain calculations of lost habitat areas and natural reproduction rates.

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## The remnant natural boreal forest green belt of the Scandinavian mountain range

(Oral)

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To meet environmental goals and principles of sustainable forest and landscape management, arguments and knowledge accumulate on the need to increase forest protection and expanding restoration and conservation-oriented management. Certain attention has been given to regions where large, contiguous natural forest areas still remain, and to interior forest core areas that due to distance to edge disturbance have developed continuity characteristics. A general assumption is that large continuity areas contain highly valuable ecosystem attributes that should be preserved per se, but also to spread into the surrounding forest landscape. In this study we analyzed the structural and functional connectivity of boreal continuity forests. We analyzed a comprehensive data set consisting of a remote sensing-based chronosequence mapping covering 11.7 million ha of the boreal biome in Sweden, where forests in that have not been subject to harvesting during the last 60-70 years have been identified. This data represents a high-resolution, complete and consistent trajectory of remnant forest patches that broadly covers the most intensive, industrial forest management era. Our study objectives were to analyze the structural and functional connectivity characteristics, to assess the center to periphery and matrix relationships for interior forest core areas, and to define existing larger, connected components of remaining natural forest as landscape-level hotspots for a functional green infrastructure. Through density and network analyses we defined a “green belt” consisting of connected natural and near-natural forest south-to-north along the foothills zone of the Scandinavian mountain range. We also found a more or less completely disrupted connection west-to-east with a few isolated components in the inland and coastal areas. The forest land area outside the components represent a peripheral matrix where continuity values are lost but where directed restoration and adapted forest management should be directed to support the ecological functionality of protected forests.



## Urban parks and forests reduce physiological stress while cities do not: comparisons of visual virtual realities, bird songs and natural smells

(Oral)

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Stress is an increasing global health problem and particularly profound in cities. Previous research has showed that experiences of urban greenspaces have beneficial consequences for well-being and positive effects on stress recovery. However, at the same time as these are becoming more recognised for their ecosystem services increasing urbanisation continue to reduce and fragment urban green spaces.

The predominating numbers of existing studies linking urban greenspaces and well-being are still based on self-estimations, lack detailed description of urban green quality such as types of nature, time of exposure and which physiological mechanisms that are affected. Here we compared the effects of physiological stress recovery by combing visual virtual settings of 360 degrees photos with associated olfactory (smells) and auditory (bird songs and noise). 154 respondents were randomised into a park, forest and urban setting. Stress was induced with mild electricity and skin conductance was used as stress reduction indicator. The results showed that there was no significant stress reduction in city centre but in park and forest. High perceived pleasantness in a setting was correlated to lower physiological stress responses for sound and olfactory but not for the visual component. Our findings show that parks as well as forest seem to be important components for stress reduction but it is also important to manage or design these habitats so that bird songs and smells can be perceived. The links between urban greenspaces, human health and spatial planning are complex and are in need of further transdisciplinary studies to contribute to the creation of truly sustainable cities.



## If I laugh: the role of humour in reaching new audiences

(Oral)

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In an increasingly digital world growing number of people are obtaining their information about nature through television programmes and online. Whilst viewing figures for BBC Natural History programming is the highest it has ever been, children are spending less time outdoors than ever. Whilst it has been shown that the most successful behavioural change campaigns revolve around positive messaging, the messages behind conservation based articles and television programmes are increasingly negative. This discourages those who avoid the negative emotions that this messaging evokes from engaging with content about the natural world. Here I demonstrate how humour can be an effective tool for reaching out to people that do not typically engage with programming and online content on the topics of nature and conservation. I will present a number of examples from my own experiences as a popular science writer and social media user to demonstrate how humorous topics that appear unrelated to conservation can be used to communicate conservation messaging to large numbers of people, and inform people about the natural world in the process.

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## Shrub growth and expansion in the Arctic tundra: an assessment of controlling factors using an evidence-based approach.

(Oral)

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### Background

Woody shrubs have increased in biomass and expanded into new areas throughout the Pan-Arctic tundra biome in recent decades, which has been linked to a biome-wide observed increase in productivity [1]. Experimental, observational, and socio-ecological research suggests that air temperature—and to a lesser degree precipitation—trends have been the predominant drivers of this change. However, a progressive decoupling of these drivers from Arctic vegetation productivity has been reported, and since 2010, vegetation productivity has also been declining.

### Method

We explored the potential of using systematic evaluation methodologies [2] to determine the extent and characteristics of the published evidence for temperature-precipitation - and other - controls on Arctic shrub growth and expansion. We created a protocol to (a) identify the suite of controls that may be operating on shrub growth and expansion, and (b) map the evidence through space and time.

### Results

We found evidence for a suite of 23 proximal controls that operate directly on shrub growth and expansion; the evidence base focused predominantly on just four controls (air temperature, soil moisture, herbivory, and snow dynamics). 65% of evidence was generated in the warmest tundra climates, while 24% was from only one of 28 floristic sectors. Temporal limitations beyond 10 years existed for most controls, while the use of space-for-time approaches was high, with 14% of the evidence derived via experimental approaches.

### Conclusions

The findings suggest that the current evidence base is not sufficiently robust or comprehensive at present to answer key questions of Pan-Arctic shrub change [3]. We suggest future directions that could strengthen the evidence, and lead to an understanding of the key mechanisms driving changes in Arctic shrub environments.

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## #DamOrNot: bridging science and current affairs through an educational Twitter game

(Oral)

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Do you know how many rivers you crossed over on your journey to school or work today? How many of those rivers have culverts that could act as barriers to the movement of fishes, materials, or even water? Or, did you hear about the political tensions related to the construction of the Renaissance Dam in Ethiopia? These are the types of questions we address in the game #DamOrNot. #DamOrNot is an educational game that runs on a weekly basis on the social media platform, Twitter. Every Tuesday I share an image of a landscape and I ask those following the DamOrNot hashtag to identify dams, weirs, roads, or other potential infrastructure, as well as potential impacts of the structures, why we are visiting a particular place, and with what certainty they can identify the infrastructure. The goal is for participants to both take a step in a scientist's shoes, and to think about water systems management, and the challenges faced. In this talk I will introduce the #DamOrNot game, discuss how I link science and current affairs to engage with people about infrastructure, review ways of measuring engagement with the game, as well as highlight next steps for expanding the game to other media.

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## Old-growth forests in Bulgaria: distribution, characteristics and conservation issues

(Oral)

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Natural diversity of relief, climate variability, geographical as well as historical reasons contribute to the presence of old-growth forest patches in various forest types in Bulgaria. For reasons of biodiversity protection, scientific studies and forest certification several projects aimed at locating and collecting data for old-growth forests in Bulgaria. Our aim is to summarize the available findings and contribute for a general map of these forests. The sources of data combine inventory data, including fieldwork collection of forest structure data by members of our team, and verification of satellite and aerial images. Most widely distributed old-growth forests in the country are *Fagus sylvatica* in the Balkan Range Mountains. Isolated patches of old oak forests were preserved in the lower mountains and lowlands. Coniferous forests were preserved on hardly accessible steep slopes or deep valleys in the high mountains in southern Bulgaria. Of them most impressive are *Pinus peuce* and *Pinus heldreichii* forests in the Pirin Mountains, *Picea abies* forests in Rila and Rhodopes Mts., *Pinus nigra* in the Rhodopes and beech-fir-spruce forests in isolated locations. There is also one *Juniperus excelsa* forest, which although affected in the past by selective logging and pasturing, still preserves the largest species locality on the Balkan Peninsula with trees often exceeding 150-200 years.

Old-growth beech forests are characterized by numerous small-sized gaps. Dead wood amount largely varies depending of site condition and past disturbances but rarely exceeds 100 m<sup>3</sup>/ha. DBH distributions resemble a rotated sigmoidal curve (Zlatanov et al. 2013). Old-growth *Picea*-dominated forests are characterized by younger and older patches resulting from windthrows and rarely fires of various sizes. Dead wood often exceeds 70-100 m<sup>3</sup>/ha. DBH distribution is resembles J-reversed. Typical for old-growth pine forests in the Pirin Mts. is high number of live old and dead trees with DBH often exceeding 100 cm and age > 500. Most important disturbances were fires, avalanches and rarely windthrows (Panayotov et al. 2017). Numerous fire traces in old *Pinus nigra* forests show that they were shaped by periodic fires. However, present day fire exclusion and past management guide dynamics towards increase of deciduous species in the understory. The total amount of deadwood rarely exceeds 30-40 m<sup>3</sup>/ha. The biggest threat to old-growth forests in Bulgaria is logging, including the potentially desired sanitary fellings in National Parks. In few locations conflicts arise also from desires to expand tourist infrastructure in old-growth forests.

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UNIVERSITY OF JYVÄSKYLÄ



## Assessing the resilience of ecosystem functions in Mediterranean wetlands

(Oral)

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Research has shown the importance of considering functional diversity when constructing planetary safety boundaries for biodiversity. This is becoming a highly debated topic within the scientific community and it is increasingly getting attention in the policy arena. Within this framework, functional traits would possibly be a good measure of the change in biosphere integrity or – in other words – biodiversity loss. Although several attempts have been made at local scale for measuring a boundary based on functional traits, establishing indicators to estimate the resilience of ecosystem functioning at broader scales is a challenging endeavour. Data availability restricts our ability to operationalize many of these indices in certain biomes. As an example, data on how wetland ecosystems have been changing in the Mediterranean area, and the consequences in terms of biodiversity, functions, and ecosystem services, are patchy or meagre at best; hence, we count on few metrics on their current status and trends at regional or international scales. In this study, we aim to determine the resilience of ecological functioning of Mediterranean wetlands by focusing on the Camargue delta, one of Europe's most biodiversity rich wetland in the Mediterranean basin. We assess changes in species richness and abundance from the 1970s to present time. To obtain data over a sufficiently long time period on species presence/absence and abundance, we organised a series of iterative consultation of experts to collect data for several taxonomic groups, i.e. birds, mammals, reptiles, amphibians, vascular plants, fish and two invertebrate groups (Odonata and Orthoptera). Using information on approximately 2000 species gathered over a five-month extensive collection period, we present the first attempt to compute a functional-type-based index for the Camargue. We also reflect on how our computations can be improved to better capture the reality of Mediterranean wetland ecosystems. The development of this type of indices can be of paramount importance for measuring progress towards the Aichi Targets and in the context of the post-2020 Strategic Agenda of the Convention on Biological Diversity. Determining the key components of biodiversity which are crucial for humanity, for instance through the estimation of the resilience of ecosystem functions, is necessary for studying, reporting, and managing biodiversity change at a global level.

2018/06/12

15:00

Room: K301 Felix



## Human recreation decreases maternal antibodies in bird chicks: an overlooked effect of disturbance

(Oral)

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Abstract of this presentation is not public



## Salmon conservation: Does it pay off?

(Oral)

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Migratory salmonids faces many threats from various sources as hydropower, aquaculture, pollution, invasive species, road and railroad construction, habitat degradation and climate changes. In order to conserve or restore salmon populations, economic benefits associated with the salmon are often mentioned as the reason to put effort and money into conservation. Salmon is an important recreational species and anglers worldwide are attracted to salmon rivers each summer. The direct benefits are quite easily calculated, and usually falls short of the benefits from competing industries, like hydropower and aquaculture production. The direct benefits are what economists label use values. The use value is for example the answer to the question. How much are you willing to pay to fish for salmon in this river. When we aggregate the numbers from all anglers, we are able to calculate the angler (consumer surplus). In addition, we have to take into account the direct spin offs, that is the value of accommodation, guiding, and spending at the local restaurants and shops. In addition, every species on earth are associated with an existence value. This non-use value is the value people put on knowing wild salmon exist, without any intention to ever fish, watch or eat one. Still, the use and non-use values together are not usually enough to compete with the income from for example hydropower and aquaculture production. However, one of the reasons there still are salmon producing rivers is that restrictions are put on such commercial sectors in order to conserve the wild salmon. In Norway, every hydropower producer are required to keep the water flow above a certain threshold, and are in most cases also required to compensate for their damaging effect on natural production by financing hatcheries. This arrangement arose from what we in environmental economics call the polluter pay principle. In order to use the resources and extract benefits, the industry is required to pay for their damage in other sectors. However, as seen in e.g. Norway, this may not be enough to conserve salmon populations.

This paper introduce a new way of thinking conservation. Instead of balancing costs and benefits of salmon conservation with the costs imposed on other commercial sectors, one should strengthen the polluter pay principle to conserve salmon. When an industry is allowed to use resources in a way that threaten the salmon species, one should impose a restriction that secure salmon populations. Hence, the restriction on e.g. hydropower production should be that the salmon is conserved, and then the implicit cost of the optimization problem, the shadow value, give us the direct cost of salmon conservation.



## Genetics And Introgression: The Use Of Genetics And Genomics To Manage Interactions Between Wild And Non-Native Atlantic Salmon.

(Oral)

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DOI: 10.17011/conference/eccb2018/107155

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Atlantic salmon in Europe inhabit a diverse range of habitats: from cold northern to warm southern rivers, from high mountain streams to lowland farmland, and from rich eutrophic to nutrient poor oligotrophic waters. Such diversity in environments brings with it diversity in selection pressures and, over time, results in diversity in life history characteristics and associated local adaptations. Different selective pressures and adaptive responses are seen when fish are reared in non-natural environments such as hatcheries. Whilst for fish used for stocking, a hatchery may aim to retain as much wild natural genetic variation as possible, selection for traits associated with a domesticated environment is still a significant, if unintentional, force. In contrast, for those fish used in aquaculture, directional selection for commercially advantageous traits is the main aim of breeding programmes. In both of these situations the results of selection may reduce the fitness of fish in a wild situation, and, if subsequent interactions occur, hybridisation and introgression of the non-native genomes into the wild can decrease the fitness of hybrid individuals and populations as a whole.

Genetic and genomic techniques can be used to help managers understand such interactions and so proved a unique approach to potentially reduce the impact of genetic introgression on wild populations. The first and perhaps most important question for managers is what is the proportion of non-native fish present in a system? Genetic approaches can screen wild and non-native stocks and, using techniques such as Genetic Stock Identification, identify the origin of individuals found within a fishery. More sophisticated analysis can allow the proportion of hybrids to be estimated and proportions of admixture determined for individual fish and populations as a whole. Such information can be used for identifying problematic situations thus helping manager's make informed decisions on both hatchery use and aquaculture facility siting and practices.

Whilst such genetic approaches can provide invaluable insights into the interactions between and introgression of non-native genomes into wild populations, they are challenging to undertake in some situations. For example, such techniques may be more problematic where historic reference samples are unavailable, if there are multiple potential sources of non-native fish, and/or if the traditional genetic differences between the non-native stocks and the wild fish are fairly small. Recent advances in genomics may provide new tools to investigate such situations, including the discovery of new markers and studies of epigenetic changes.

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## Hype or hero: will blockchain boost conservation?

(Oral)

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Blockchain technology has recently been heralded as the solution to all sorts of societal problems, from fraud, to human-trafficking, to energy inefficiency. Blockchain technology has also been presented as a possible mechanism to reach environmental and conservation goals.

As a blockchain provides a transparent ledger of all transactions, supply-chains recorded on blockchains would make them far more transparent. This opens up the possibility for businesses and consumers to more accurately determine the origin of products, from tuna to timber, and for certification systems to be made more robust. Digital cryptocurrencies could also facilitate peer-to-peer conservation payments. Cryptocurrency transactions are instant, transparent and permanently recorded; they do not require bank accounts and international transaction fees are small. Rather than donations being collected, pooled and distributed by organisations, they can be sent directly to individuals or projects worldwide – an encouragement to donors. Similar tokens could create more efficient payments for environmental services (PES) schemes. In theory, by removing the barriers to funding, a peer-to-peer conservation platform could empower anyone, anywhere to do conservation work – ranging from urban ecological restoration, to human-wildlife conflict prevention. Blockchain technology has also been tipped to improve environmental governance via increased transparency and decentralisation. For instance, The IUCN have recently launched their ‘Green List Standard’ token on the blockchain, which they claim will improved protected area governance.

However, to-date there has been limited critical reflection on the credibility of these claims. This presentation will both outline and challenge recent developments in so-called ‘crypto-conservation’. The aim is to introduce the wider conservation audience to the technology, so that more practitioners and researchers can explore new possible applications of blockchain for conservation, but also so that they might be better equipped to challenge such claims.

Baynham-Herd, Z., 2017. Technology: Enlist blockchain to boost conservation. *Nature*, 548(7669), p.523.

Chapron, G., 2017. The environment needs cryptogovernance. *Nature*, 545(7655), p.403.

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## Breeding habitat of a mysterious forest bird – the woodcock in the Swiss Prealps

(Oral)

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The woodcock (*Scolopax rusticola*) is classified as vulnerable on the Red List of breeding bird species in Switzerland. In the past decades, the woodcock abandoned most breeding habitats in the lowlands and in the eastern part of Jura Mountains, and populations nowadays are restricted to areas in the Alps and the western parts of the Jura Mountains. The reasons for the decline are largely unknown. Moreover, there are no studies about breeding habitat use in eastern Switzerland. In this study we assessed the habitat use at a small scale in the forest reserve Amden (St. Gallen) in the eastern Prealps during the breeding season. To detect woodcock presence we used a non-invasive method of sampling indirect traces. We compared 30 plots with woodcock presence with 30 randomly selected control plots with respect to site characteristics, forest stands, structure elements and soil characteristics. In a multivariate logistic regression we identified the most important factors discriminating woodcock plots from random plots. Important habitat features were horizontal dead wood, grass and fern canopy cover, earthworm weight and soil resistance. The number of horizontal dead wood and fern canopy cover was much higher in woodcock plots than in matched control plots. Woodcock preferred soils with high biomass of earthworms and a low penetration resistance. Thus, food resources and accessibility and predator avoidance were the most important factors of habitat selection by woodcock in this study. Based on these results, an effective conservation of woodcock should favour open forest structures, cover elements, a lush field layer and humid soils with a high density of earthworms.

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## European Old-growth Forests in a Global Context: Expanding our Conception of Late-Successional Forests to Account for Structural and Functional Variability

(Oral)

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How do structure and function in European old-growth forests compare to other temperate regions? Are old-growth characteristics shared universally or are there regional differences reflecting variation in growth, stand dynamics, and disturbance history? We tested the hypothesis that important ecological functions are provided universally by old-growth temperate forests, such as high carbon storage and co-varying habitat complexity. We pooled site-specific ( $n = 501$ ) forest inventory datasets representative of eight ecoregions: U.S. Pacific Northwest; U.S. Northeast; U.S. Mid-Atlantic; Southern Europe; Central Europe; Southern Chile; Northeastern China; and Temperate Australia. We used NMDS to analyze similarity/dissimilarity in stand structure among and within the ecoregions, broadly defined forest types, by mature vs. old-growth age class. Dimensionality of the data was assessed using the Monte Carlo permutation procedure with 50 runs of randomized data. Post-hoc tests employed bi-plots and Kendall's Tau. The results reveal a wide range of structural variability within and among late-successional temperate forest systems. There is structural dissimilarity between mature and old-growth, but also a very high degree of overlap among both age classes and sub-regions. Ordination results did show distinct inter-regional variation in old-growth forest structure, with the Carpathians and Alps most similar to the U.S. Northeast and least similar to the U.S. Pacific Northwest and the southern hemisphere. When old-growth is assessed by forest type, a clear gradient of structural complexity emerges. Evergreen broadleaf and needleleaf forests occupy one end of this spectrum, mixed conifer-deciduous systems are intermediate, and deciduous broadleaved forests exhibit lower relative values for structural indicators. Live aboveground biomass, downed coarse woody debris, and tree density are the top ranked indicators explaining directionality in the data both for inter and intra-regional variability. Compared to other regions, European forests exhibit greater contrast between age classes for mean basal area, downed coarse woody debris, and aboveground biomass (live and dead), but have similar variability around means as that exhibited globally. As is true globally and for Europe specifically, conservation of late-successional forests provides both carbon storage benefits and structurally complex habitats. Yet the results also show tremendous variability within and among systems. In some cases, structural characteristics typically associated with old-growth may be equally if not more pronounced in mature forests, depending on site characteristics and disturbance history. This suggests a need to broaden our conception of late-successional dynamics, and to move away from overly narrow or rigid classification criteria not accommodating of this range of variability. Primary forest mapping needs to account for variability in stand development processes.



## Identifying drivers of illegal goose hunting and evaluating the effectiveness of management strategies to avoid conservation conflicts

(Oral)

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Combining social research with modelling tools to simulate decision making, can help identify potential win-win conservation strategies that address the needs of biodiversity conservation and local people, thus avoiding potential conservation conflicts [1]. The migratory Lesser White-fronted Goose (LWfG) is globally threatened and under international protection across the flyway. Illegal hunting, including at important staging grounds in Central Asia, has been identified as a major cause of LWfG population declines. However, the economic, social and demographic drivers of goose hunting in general across the region, and illegal hunting of LWfG in particular remain unclear, thus hindering our ability to address this conservation conflict effectively. Using the staging grounds of Northern Kazakhstan as a case study, we used specialised questioning techniques to interview hunters and elucidate the potential social, economic and demographic drivers of goose hunting across the region [2]. We then identified and incorporated important social, economic and demographic parameters into models of LWfG population dynamics and stakeholder decision making under different hunting management scenarios using the newly developed Generalised Management Strategy Evaluation (GMSE) tool [3]. Through combining a detailed understanding of the system's ecology and socioeconomics, we identify potential hunting management strategies that consider the needs of species conservation and local people, thereby reducing the potential for conservation conflicts in rural Kazakhstan.

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[2] Nuno, A. & St. John, F. 2015. How to ask sensitive questions in conservation: a review of specialized questioning techniques. *Biol. Conserv.* 189, 5–15. doi: <https://doi.org/10.1016/j.biocon.2014.09.047>

[3] Duthie, A.B. et al., 2017. GMSE: an R package for generalised management strategy evaluation. *Methods Ecol Evol* (in review). Preprint available on bioRxiv. doi: <https://doi.org/10.1101/221432>



UNIVERSITY OF JYVÄSKYLÄ



## Grassroots economics for conservation: instruments and alliances for a new economic order

(Oral)

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Economic frameworks in conservation have so far mostly focused on the macro scale of human-environmental relations and top-down policy instruments. These approaches have been invaluable in streamlining ecological discourse into the leading global institutions, and advancing the fundamental field of ecological economics. However, the international socio-economic context has profoundly mutated since those frameworks were first conceived in the late 1900s. Some drastic and apparently unrelated changes include: the spectacular growth of non-Western economies; the gravest economic crisis since 1929; growing inequality between the wealthiest 1% and the rest of the human population; increasing preying on natural resources driven by profit and attained through illegal means; unprecedented low confidence in financial and administrative institutions; and technological innovations aiming to downsize the role of intermediaries in those same institutions. This new economic order clearly poses great challenges but may also present unexpected opportunities. For these to be seized, however, a new array of tools and approaches need to be developed. We argue that conservationists should increasingly team up with unorthodox economists and social activists to test the effectiveness of alternative economic instruments. These may include decentralized distribution networks, complementary currencies, and peer-review-based certifications. By sustaining communities and livelihoods, grassroots instruments of this kind can equally act as means of economic resistance and contribute to protecting local natural resources. As such, they can represent an ideal complement to the macro-economic frameworks currently applied in conservation.

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## Towards a Michelin Guide for wading birds: food availability of wetlands in a migration bottleneck in western Greece

(Oral)

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To fuel their flights, wading birds rely on abundant and high-quality food supply along their migratory route. The time spent in flight in fact represents only a small part of the migration period when compared to the time spent at stopovers. Especially in proximity of major barriers, the conditions at a single site can have a large effect on further travel stages. The Ionian flyway is considered such a migration bottleneck, where flight routes converge along a chain of coastal wetlands.

To gain insight in its function as stopover site for wading birds, the goal of this study was (1) to quantify the refuelling capacity of western Greek wetlands and (2) assess which habitat characteristics are related to high food availability. In a wider framework, both goals support the development of connectivity models that, in addition to spatial characteristics of wetland networks, incorporate the energetic component of migration to evaluate the relative importance of sites.

During autumn (2016) and spring (2017) migration seasons, we sampled benthic macroinvertebrates at 90 locations in four wetlands protected under the European Natura 2000 legislation, i.e. the Kalamas delta and the Amvrakikos, Messolonghi and Gialova lagoons. By using a multilevel core sampling device, we separated prey fractions that are accessible to different wading bird species, depending on their bill length. Invertebrates were identified, weighed and their biomass and nutritional quality (fat and protein content) was determined. Additionally, for each sampling location, information on environmental parameters, wading bird abundance and foraging intensity was collected. We show the first results of the sampling campaigns and discuss the implications for aligning Natura 2000 habitat types with patterns of prey availability and quality.



## Will aspen (*Populus tremula*) disappear from protected old-growth forest areas: long-term patterns of aspen dynamics

(Oral)

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Conservation of forest biodiversity often relies on protected areas. However, protected areas cover only a marginal proportion of land. Furthermore, their characteristics may change, for example, due to natural succession. European aspen (*Populus tremula*) is a keystone species for boreal forest biodiversity but there is an obvious risk of disappearance of aspen from nature reserves as a result of stand succession. More specifically, the long-term dynamics of aspen populations in conservation areas is not known empirically. For example, it is unclear if there is recruitment to balance the mature tree mortality and maintain long-term persistence of aspen in these areas.

In order to evaluate aspen dynamics in protected forests, we conducted areawide, full-coverage surveys in 15 nature reserves in North Karelia, Finland to see if a lack of recruitment is seen in the long-term age-distribution of aspen. These surveys were conducted twice over a span of 18 years, one being in 1999(1) and the other in 2017.

We found declines of on average 75 % for dead aspens and 41 % for living aspens per area, with similar declines per ha, and in volume per area and per ha between 1999 and 2017. Human-caused notching had increased the amount of dead wood in 1999 way beyond a natural level, which was also reflected in the deadwood to living wood ratio. The recent estimate from 2017 probably reflects naturally occurring mortality patterns of aspen as the deadwood to living wood ratio declined. Tentative analyses also indicate distribution shifts in diameter at breast height and decay classes (separated in fallen, standing whole trees and standing broken trees) during this 18 year period. Moreover, it appears that there is a continuous lack of recruitment despite a high amount of regeneration in each area. The current recruitment occurs primarily on open areas and edges, often adjacent to managed forests or roads bordering the conservation areas.

Our study showcases the highly dynamic nature of forest conservation areas, due to naturally occurring stand succession, and its possible consequences for biodiversity. Aspen maintains a diverse group of other species. If aspen vanishes from conservation areas like the ones studied, it may lead to the extinction of several other species. It seems evident that conservation of aspen-associated species is impossible only with the current network of conservation areas. The solution is likely to be found in managing the surrounding commercial forests for these species, although further research into this issue is required.

1. Kouki, J., Arnold, K., & Martikainen, P. (2004). Long-term persistence of aspen - a key host for many threatened species - is endangered in old-growth conservation areas in Finland. *Journal for Nature Conservation*, 12(1), 41-52. doi:10.1016/j.jnc.2003.08.002





## The role of private persons in the protection of ecosystems in the French Law. The case of Notre-Dame-des-Landes.

(Oral)

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Two main lines answer the conference themes. One tables the balance, between the protection of ecosystems and the human activities, in terms of legal interests. Another addresses the issue of the management of ecosystems with legal instruments.

The protection of ecosystems is a public interest, that is a need to the benefit of all and outweighs private interests[1]. These different interests converge on the legal principle of complementarity between ecosystems and professional or business activities (agriculture, aquaculture, sustainability of forest management)[2]. The understanding of the linkages between these various sectors and ecosystems precedes the willingness to act with more responsibility according to the principle of ecological solidarity to switch from action to a commitment[3]. Does the desire to act to protect ecosystems only answer to economic advantages[4] ? The facts show different patterns to rethink the action of private persons. On a cultural and spiritual level, protecting ecosystems affects the person's identity, collective imagination and the sense of belonging to a community. At a political level, protecting ecosystems expresses a real need to participate in the res publicae as a citizen in a given society. The private interests can refer to altruism and solidarity since they would offer more protection to ecosystems than the economic vision of public interest viewed by the State.

Protecting measures lead sometimes to develop human, material and financial resources and should be secured legally for the long term. In order to achieve this, the French law provides a wide range of instruments to frame the action of private persons. Their effectiveness to manage ecosystems depends on criteria such as adaptability to the specific feature of ecosystems, the range of protecting measures and a long-term perspective as opposed to the contract used for short-term results.

1. D. TRUCHET, Droit administratif, PUF, Thémis droit, 6e éd., 2015

2. Art. L 110-1-II 8° C. env.

3. R. Mathevet & al.

4. J. BENTHAM, An introduction to the principles of morals and Legislation, L.J. Lafleur, New-York, Hafner Press, 1948, p. 100.

2018/06/12

15:30

Room: K308 Cabinet



## Socio-economic correlates of environmental degradation among African nations

(Oral)

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Abstract of this presentation is not public



## Landlocked Salmon and Trout in the Lake Vänern-River Klarälven ecosystem – What can we do for the wild fish?

(Oral)

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Populations of migratory salmon and trout have worldwide shown a decline due to human activities. Over the years numerous measures have been undertaken to maintain these populations, and conservation of migratory salmonids requires understanding of their ecology at multiple scales, combined with assessing anthropogenic impacts. The regulated River Klarälven and Lake Vänern host endemic populations of landlocked Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*). The historically high abundances of the salmonids in the River Klarälven in the early 1800s have decreased dramatically, reaching all-time lows after the completion of all nine Swedish hydroelectric power stations in the 1960s. After an extensive stocking program and transportation of spawners past eight hydroelectric plants, catches from commercial, maintenance and sport fishing have again increased (1). Recently, increases in the proportion of wild salmon returning to the River Klarälven have generated interest in establishment of wild salmon inhabiting the entire River Klarälven, including upstream of the Norwegian border. How well are we equipped to meet these new dreams, taking into account our limited knowledge of the species' different life stages (2), coordination between different actors involved in the conservation processes, and our skills to communicate and understand everybody's role in this conservation process (3)?

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2. Norrgård JR, Greenberg LA, Piccolo JJ, Schmitz M, Bergman E. 2013. Multiplicative loss of landlocked Atlantic Salmon *Salmo salar* L. smolts during downstream migration through multiple dams. *River Research and Applications* 29:1306-1317.
3. Bergman E, Norrgård JR, Piccolo JJ, Gustafsson P, Nilsson F, Hart PJB. 2012. Atlantic Salmon and Brown Trout in Lake Vänern: A proposal for a co-management system. *Aquatic Ecosystem Health and Management* 17:365-373.



## Journecology - Engaging media for worldwide scientific research

(Oral)

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At each moment, the world is more connected than it has ever been before, and the power of social media can give people global presence whilst staying within their bedrooms. With the ever-tightening grip of climate change, communicating science effectively is imperative, yet we live in a fleeting online world where the average tweet lives for just 15 minutes before dissolving into history. Engaging audiences from the offset is vital, and this is our goal at Journecology, an exciting new media platform for environmental initiatives worldwide. Journecology was established after the realisation that so much fantastic research becomes lost in the academic bubble, rather than being distributed in a friendlier format to a wider audience. We aim to work alongside scientific initiatives across the globe and accurately portray their research to simultaneously increase awareness, funding opportunities and outreach. Journecology prioritises visual media to engage, producing specifically targeted video outputs across online platforms. Our combination of travel with science draws upon the vast and open-minded tourism community to circulate these outputs, whilst providing a visually diverse backdrop for our work. At this talk I will present the 'journey' of Journecology thus far, outlining what we have learnt, and how we intend to take it to the next level.

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## Insect assemblages of urban grasslands

(Oral)

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Grassland habitats of the temperate region are of critical importance for the conservation of biodiversity. In Finland, 28% of threatened species, 30% of threatened butterfly species, 25% of threatened vascular plant species, 39% of regionally extinct (RE) species and 70% of threatened bee species are associated with cultural grassland habitats (Ref. 1). In this study, I sampled the vascular plant, carabid beetle and bee assemblages of grassland habitats in the metropolitan region of Helsinki under different levels of urbanization and management, during 2008-2012. I found recorded 252 plant species, and found that there was a correlation between number of plant species and site area, implying that site size and isolation restrict the size of plant assemblages. Also sites with high levels of nutrients had reduced plant species richness, however management by mowing reduced the level of nutrients, even in highly urbanized areas affected by deposition of nitrogen from traffic fumes (Ref. 2). A total of 72 bee species were recorded. The species that managed to persist in urbanized areas were characterized by having greater flight ranges. Species with long colony cycles, small- to medium-sized colonies and late emerging queens (e.g. *B. soroeensis*) were negatively affected by urbanization, whereas species with the opposite traits (e.g. *B. lapidarius*) were better able to persist in urban areas. Solitary bee species were sensitive to the amount of urban infrastructure adjacent to the grassland.

The carabid material comprised 78 species, with complex patterns of response to level of urbanization. Of those captured in sufficient numbers to test this in a GLMM, 10 were sensitive to urbanization, and two were more abundant under high urbanization. The highest level of species diversity was recorded from dry and managed meadows. NMDS ordination showed that habitat moisture level was a strong determinant of assemblage composition (Ref. 3).

I conclude that the primary strategy for promoting the biodiversity of semi-natural grasslands should be to enhance their coverage and connectivity. It is also necessary to ensure the implementation of appropriate management regimes, and to similarly manage adjacent areas of potential grassland habitat. Dry meadows and those with calcareous soils should be prioritized, as they have higher value for many taxa. Further study is necessary on the functions of these taxa and their trophic interactions.

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## Cumulative Human Impacts on biRd Populations (CHIRP): A multi-tiered approach to conserving the near-threatened Eurasian Oystercatcher

(Oral)

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The Eurasian Oystercatcher (*Haematopus ostralegus*) is a partially migratory meadow bird, and wading bird, that has declined substantially in recent decades. The cause of the decline may be due to several threats which vary in space and time. For example, some threats occur principally in winter like climate change, human disturbance or competition whilst others occur in summer, of which some only occur inland like agricultural intensification whilst shellfisheries or flooding are in coastal areas. Therefore, the relative impact of these threats, and how these impacts accumulate across the annual cycle will depend upon where an individual is in space and time, i.e. where it breeds and winters. The project CHIRP aims to quantify these cumulative human impacts through several sub-projects that focus on threats during the winter and summer period and combines these into a migratory network metapopulation model. The metapopulation model aims to identify the relative, and cumulative, impact of these multiple threats so that conservation actions can be prioritised. In this talk we first describe CHIRP and then focus on the first results that describe seasonal survival and migratory connectivity of the oystercatcher. Collaborative colour-ringing projects between researchers and citizen scientists allowed us to track annual movements across large geographical areas. We have collected data from more than 4,600 oystercatchers with over 51,000 observations, predominantly by citizen scientists. We performed a seasonal multi-state (5 geographical areas within the Netherlands) live- and dead-recoveries analysis under varying model structures to account for biological and data complexity. Coastal breeding populations were largely sedentary but inland breeding populations were migratory. The direction of migration varied among areas, which has not been described previously. Our results indicated that survival was lower during spring than autumn and that survival was lower in inland areas compared with coastal areas. A concerning result was that survival of individuals over-wintering in the Wadden Sea, an internationally important site for over-wintering shorebirds, appeared to decline during the study period. We discuss the outcomes of our study, and how citizen science was integral for conducting this study. Our findings identify how the demographic rates of the oystercatcher vary in space and time, knowledge vital for generating hypotheses and prioritising future research into the causes of decline.





## The Finnish National Urban Park (NUP) Concept as a tool for promoting biodiversity in urban areas

(Oral)

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The Finnish National Urban Park (NUP) Concept as a tool for promoting biodiversity in urban areas

The world's first national city park was founded in Sweden in 1995 mainly to protect the royal green areas and earlier hunting park from urban pressure. The Swedish case raised the debate in Finland on how to build cities in a more sustainable way, protecting nature and green spaces. As a result of the debate Finnish National Urban Park (NUP) concept was taken as part of the Land Use and Building Act, which came into force 1.1.2000. The intention of the Finnish NUP Act is stated in section 68 in chapter 9:

"A national urban park (NUP) may be established to protect and maintain the beauty of the cultural or natural landscape, biodiversity (add. 2009), historical characteristics or related values concern-ing the townscaping, social, recreational or other special values of an area in an urban environ-ment."

What is notable in Finnish legislation is that the NUP decision is always dependent on the initia-tive of the local authorities and that the NUP area is formed by the plans made by a municipality. The decision to establish a national urban park can be made by the Ministry of the Environment only at the request of the municipality. The decision will be followed by a management plan drawn up by the local authority and approved by the Ministry of the Environment. Regulations concerning the national urban park must be taken into account in planning the areas of the park and in other planning and decision-making affecting the area. The Ministry of the Environment has prepared four technical criteria that cities can use to identify a suitable area for a national urban park. Criteria for national urban parks are following: 1. Breadth of content, 2. Extent and contigu-ousness, 3. Ecology and continuity, 4. Urban centrality. The area must meet all of the above men-tioned criteria in order to obtain the status of a national urban park.

Unlike in Sweden, in Finland, no law was made for just one particular area, but the aim was to create a network of national urban parks with different roles. National urban parks are part of the Finnish biodiversity strategy. In each of the national parks, there are historic buildings and blocks, parks, recreational areas and urban nature. However in most national urban parks natural heritage forms the biggest part of the area. In all NUPs there are one or more protected areas, Natura 2000 –sites, old growth forests – even sea, lake and river ecosystems from the bottom to the archipelagos. According to the criteria of extend and contiguousness/ecology and continuity many national ur-ban parks are connected to national parks or protected land- or seasapes.

Today, the network of NUPs includes areas from nine cities. The biggest NUP site is under preparation in City of Kokkola on the Western uplift cost of Finland. Helsinki, the capital of Finland has also started started a preliminary study of the national urban park.



## Taking a more nuanced look at demand reduction

(Oral)

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The illegal wildlife trade is a multibillion dollar industry, and a major cause of wildlife declines (Nellemann et al. 2014). It can contribute to the spread of invasive species and diseases, and the loss of biodiversity in ecosystems can have knock-on effects on their stability, productivity, and efficiency. Conservationists increasingly recognise the importance of demand-side interventions in the form of demand reduction, with multiple calls for demand reduction in both the academic and grey literature (e.g. (Challender et al. 2014; Burgess 2016)). Demand reduction campaigns are just beginning to be implemented in the conservation sector. However, much of these developments have neglected other sectors such as public health or international development which have used behaviour change approaches for years. In this talk I examine how conservation scientists can learn from the successes of these other fields, and suggest that at present we may be overly optimistic about the potential of demand reduction for achieving radical behaviour change. Understanding how we could maximise the success of demand reduction campaigns could help to cement the place of behaviour change approaches within conservation but it is extremely difficult to achieve, even considering the resources and longevity of practitioners in other fields. Success is often partial and costly, more difficult to achieve when there is less room to manoeuvre, and depends on product characteristics. I advocate for whole systems approaches that may help us address the unintended consequences of our interventions in complex environments.

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## Panel discussion on trade-offs between forest use, climate mitigation and society

(Oral)

**Timo Vesala<sup>1</sup>, Hanna Aho<sup>1</sup>, Felix Creutzig<sup>1</sup>✉, Heikki Granholm<sup>1</sup>, Bronson Griscom<sup>1</sup>✉, Ilkka Herlin<sup>1</sup>, Matti Kahra<sup>1</sup>, Mauri Pekkari<sup>1</sup>**

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Time window for the success in the restricting global warming under 2°C is closing rapidly. The Paris Agreement calls for even more stringent measures. We need urgent and effective measures for reducing greenhouse gas (GHG) emissions and strengthening carbon sinks. The lively political discussions observed both at national level and EU/international level on how climate objectives could be fulfilled together with other needs of societies ask for clear messages from scientific community.

Most of the mitigation scenarios show the temperature overshooting or rely on significant amount of ‘negative emissions’ during latter part of the 21st century. Currently, increasing forest and land carbon stocks are the most cost-efficient and feasible carbon dioxide removal measures to generate the negative emissions required. Scenarios striving for the objectives of Paris Agreement show already in mid-century considerable increase in use of bioenergy. The pressure of simultaneous increased forest and land carbon stocks and increased biomass harvest for energy and materials illuminates the need for dedicated analyses of mitigation options and possible trade-offs between these two sub-objectives.

In this symposium, we seek answers for these questions through four different topics. In order to stabilize global warming under 2 °C, 1) what is the potential of so called natural climate solutions, and 2) what is the potential of bioenergy to decarbonize the energy sector. Considering the alternative ways to use biomass as natural carbon sink or substitute for non-renewable raw materials, 3) can material use of wood provide more climate benefits than energy use of wood, and 4) what are the trade-offs between forest management as natural climate solutions to sequester carbon and forest management as the source of raw materials for substitutions of non-renewable raw materials

2018/06/12

15:00

Room: K307 Elsi



## Perceptions of biodiversity and sounds in urban areas affect momentary subjective well-being: a case study in Georgetown, Guyana

(Oral)

Jessica Fisher<sup>1</sup>✉, Jake E. Bicknell<sup>1</sup>, Damian Fernandes<sup>2</sup>, William Hayes<sup>1</sup>, Jay Mistry<sup>3</sup>, Katherine N Irvine<sup>4</sup>, Zoe G Davies<sup>1</sup>

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Abstract of this presentation is not public



## Dam removals in river restoration - bending the curve of weakened endangered status of migratory fish in Finland

(Oral)

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The endangered status of fishes in Finland has continuously weakened at each official assessment. WWF Finland (World Wide Fund for Nature) aims at bending this curve. Especially the migratory fish species bear high extinction risk, with habitat destruction identified as a major pressure. In Finnish waters there are thousands of obstacles hindering or halting fish migration and their natural life cycle. WWF Finland has launched a dam removal project, targeting foremost obsolete dams that are not used for hydropower. Simultaneously other restoration measures such as recreation of spawning sites are applied in the same water ways. Large scale awareness raising activities are carried out with partners, to affirm the general conception and acceptance of dam removals among water owners and general public.

WWF is also a partner in Dam Removal Europe network. Its ambition is to restore rivers in Europe, that used to be of high natural or cultural importance, by removing dams. The best practices in dam removals are also shared in this network alongside with data mapping of existing and removed obstacles in European waters.

There are many rivers in Europe which would ecologically flourish if the obsolete dams and weirs could be removed. Consequently, the European WWF offices will have river restoration, dam removals, and nature-based solutions in flood protection in their future agenda. WWF is also defending the existing EU water legislation that is currently under an attack, and opposing any new dams in Europe. There are further plans for great number of ecologically damaging dams especially in Turkey and in the Balkan region.

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## Combining historical and ecological data: Impact of past population history on forest structure and fungal diversity in Russian Karelia

(Oral)

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Before 19th century, the impact of forest industry on forests of Russian Karelia was minimal, and, in the first half of the 20th century, very large areas of western taiga remained beyond the limit of economic profitability of timber industry. However, the Karelian people populated the boreal forests of Karelia and their villages had spread all over the region. The livelihood of these villages based largely on small-scale farming including slash and burn agriculture. In addition, in the cold northern climate, the firewood was extracted from forests in very large quantities. In the political turmoil of 20th century Russia, the significant part of remote villages were decimated, but their impact on landscape and forest structure remains.

We have been able to combine the information about the location and population size of historic villages and forest structure. We used two large areas of ancient landscape as case studies, in order to demonstrate that the signs of land use of past human populations are still visible in the forests of Karelian Republic, Russian Federation. These areas were Kostomuksha Strict Nature Reserve and Kalevala National Park in the west and Vodlozero National Park in the east. From the western area, we collected field data about the forest structure and presence of fungi. From the eastern area, we used forest inventory data.

The stand age, and diversity of dead wood increased with the distance from the old villages (0-2 km). In very large scale (0-20 km), human impact may have changed the tree species composition favoring fire tolerant pine over less tolerant spruce. In general, the fungal diversity has recovered after the abandonment of the villages in nearby forests. However, we found that the rare wood inhabiting fungi had not been able to colonize forest stands with the same rate of the common species.

We conclude that the current forest landscape of Karelia composes of different layers of historic and more recent forest use activities of the society. It is obvious, that we need to incorporate all these layers, if we wish to understand the present pattern of the forest biodiversity. Moreover, landscapes that are shaped by historic human activity but are preserved from recent industrial forestry, i.e. historic landscapes, may serve as “living archives” for various ecological research. For example, as source of information about the ability of forest ecosystem functions or properties to recover from disturbance, e.g. recovery of stand and tree species structure, carbon balance of soils, species diversity and trophic webs. This kind of information may be most valuable when modern society tries to find the ways to mitigate the adverse effects of environmental change of the 21st century.





## Butterflies in the city: ecological filtering of urban landscape

(Oral)

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With the expansion of urban areas and the increasing valuation of ecosystem services for the citizenship, promoting biodiversity conservation in cities is now a priority. However, urban environments represent one of the most modified landscapes that species are facing, and this affects their distribution and occupancy, which potentially can lead to biodiversity homogenisation. Using butterflies as study system, we evidenced an ecological filter of species traits by the urban landscape and therefore a biotic homogenisation from a functional point of view. Our first scan evidenced that butterfly species in the city were mostly those highly dispersive, highly reproductive and generalist feeders. This ecological filter was mostly driven by the density of the built matrix, the garden isolation and the abundance of semi-natural grassland vegetation. Taking in account the different effect of the urban landscape on the species traits we modelled potential realistic management scenarios for three species models: low dispersive, low reproductive specialist species (Type 1, T1); medium dispersive, medium reproductive generalist species (T2); high dispersive, high reproductive generalist species (T3). Management scenarios were based on increased habitat quality of the gardens and increased connectivity. To do so we used spatially explicit individual-based modelling coupling demographic and mechanistic dispersal models in RangeShifter. Increasing the garden habitat quality increased the occupancy of all three type of species but to a contrasting degree (28, 57 and 90% occupancy probability for T1, T2 and T3 if tripling habitat quality); being T3 the most frequent across the city at all management scenarios (3.2 and two times more than T1 and T3). Reducing the built density and the garden isolation have a stronger positive effect on T1 and T2 with double and 1.2 times increases of their occupancy with reductions of 10% of the built matrix. Our results highlight the primary negative effect of the built matrix on urban biodiversity and the need to reduced the built density and the garden isolation via urban planning to promote biodiversity in the cities.



## The sounds of science: the importance of audio in science outreach and education

(Oral)

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Podcasting emerged over the first decade of the 21st Century as a relatively cheap and easy way for communicators to create and disseminate audio content. Audience engagement with podcasts continues to increase year on year; in 2017, 40% of people polled had ever listened to a podcast--an increase of 4% on the previous year's statistics (1). At the same time, talk radio, which has been popular for nearly a century, continues to thrive; an estimated 90% of the population tune in, and listen to an average of some 21 hours of radio, each week (2). Cumulatively, then, audio platforms offer scientists, researchers, and educators an opportunity to reach audiences in a creative and engaging way without having to invest heavily in training, tools, or dissemination. Further, audio formats can be used to enhance the student experience and provide budding scientists with an opportunity to produce outputs that are not only educational to audiences, but also useful in honing transferable skills and emphasising to students the importance of engaging in 'scicomm' as professionals (3). This presentation will explore the possibilities of podcasting and radio outreach opportunities by examining typical audiences, describing the production process, discussing tips for determining one's niche and brand and producing engaging material, and highlighting ways that audio activity can dovetail with, and support, other forms of scicomm. The discussion will draw from the literature, examine case studies, and include anecdotes from the presenter's own experiences as a radio show host, podcaster, and multimedia science communicator.

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## The Paris agreement promises? How to stay below 1.5-2 C warming, and what does it mean in the context of sinks and sources/Global bioenergy potential

(Oral)

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Scenarios that keep temperatures below 1.5°C or 2°C global warming strongly suggest that so-called negative emissions are necessary component to achieve these targets. Bioenergy with carbon sequestration and storage (BECCS) keep being the technology of choice of modellers. This talk first outlines climate targets and delineates necessary versus desirable use of negative emissions. I then discuss the use of BECCS in scenarios. Finally, I focus on recent understanding of the potential on bioenergy and outline further strategies.

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## Using genomic data to guide the conservation and management of migratory salmonids.

(Oral)

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The development of new genomic tools for migratory salmonids is enabling us to explore in unprecedented detail the genetic basis of local adaptation in these species. This, in turn, will allow us to design more effective conservation and restoration strategies and better predict the impact of environmental change on salmonid populations. Surprisingly, several ecologically important adaptations that enable salmonids to exploit different niches have turned out to be underlain by single regions of the genome with large effects. These include genes that determine spawning site selection in sockeye salmon, genes that underlie the timing of spawning migration in steelhead and chinook salmon, and genes determining age at maturity in Atlantic salmon. In some cases, changes at the same locus may repeatedly underlie specific environmental adaptations in multiple species. Further, studies at the genomic level may reveal unexpectedly strong differentiation among populations that were previously considered to be ecologically interchangeable. In this talk, I will focus on work identifying regions of the genome underlying local adaptation in Atlantic salmon at microgeographic, regional, and continental scales. I will demonstrate how this new information can improve our management of the species.

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## Habitat selection of an old-growth forest specialist in managed forests

(Oral)

**Antonia Ettwein<sup>1</sup>✉, Gilberto Pasinelli<sup>1</sup>, Pius Korner<sup>1</sup>, Michael Lanz<sup>1</sup>**

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Old-growth specialists are among the species that are affected the most by commercial forestry, and as a result, many of these species are in decline. Knowing their habitat requirements is crucial for their effective conservation. The white-backed woodpecker (*Dendrocopos leucotos*) is one such species that is negatively affected by intensive forest management. Because the species is highly dependent on the availability of high amounts of dead wood, it typically occurs in primeval forests. As a consequence, it has become a victim of habitat loss in several European countries. We investigated habitat selection of the white-backed woodpecker in Western Austria, Eastern Switzerland and Liechtenstein. Here, most forests are managed. This raises the question which factors enable the occurrence of an old-growth forest habitat specialist in a landscape with forests which are predominantly managed. The aim of this study was to reveal patterns in habitat selection of the white-backed woodpecker in order to develop measures for the conservation of the species.

We recorded presence/absence of the species in 62 1 km<sup>2</sup> plots in 2015 and 2016 with two within-season replicate surveys in each year, as well as habitat structure. We used dynamic site-occupancy models to compare a priori expectations on relationships between occupancy probability and habitat covariates. Each model was run at two spatial scales to find out whether white-backed woodpecker occurrence is better explained by habitat structure over a large area (1 km<sup>2</sup>) or by habitat composition of small patches rich in dead wood (0.25 km<sup>2</sup>). Occupancy probability was best explained by covariates describing forest structure: it was positively correlated with the average diameter at breast height of live trees, the number of live trees with dead branches, the proportion of deciduous trees, and the area covered with forest within the plots. The analyses at different spatial scales indicated that small patches with high amounts of dead wood containing these factors are sufficient for the occurrence of white-backed woodpeckers in the study area.

Altogether, forest management in white-backed woodpecker habitats is possible, but should not be done intensively. Patches with old deciduous forests and high quantities of dead wood should be retained or created to enhance habitat quality for this species.

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## Changing forest stakeholders' perception of ecosystem services with linguistic nudging

(Oral)

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Forest owners and professionals are key in facilitating transition to sustainable forest management as they can influence the processes of future forest practices and use. Recently, an emerging literature has examined the effects that viewing different types of information may have on stakeholder perceptions in the context of forest management. These studies have demonstrated a link between information interventions and preference change, but only to some degree. Therefore, there is a need to further explore individuals' reactions to information on forest-based (ES) and to link these reactions to the design of policy instruments.

Contributing to this gap, we explore whether Finnish forest owners' and forestry professionals' perceptions could be nudged towards more sustainable management by adjusting a policy text's metaphorical content. In Finland, the official instructions recommend even-aged rotation forest management (RFM). Yet, owners and professionals have flexibility in choosing their management practices, and they could, for example, apply continuous-cover forest (CCF) practices, which in some areas and contexts have been shown to offer more ES and yield significantly less negative impacts on biodiversity than RFM [1].

We set up a nationwide survey, gathering 2113 responses from private forest owners and 1452 from forest professionals. The survey included a questionnaire collecting background information and the nudge. In the nudge part, the participants were asked to read a short text written by an expert on various aspects related to RFM and CCF. We designed four versions of the text presented, each of them with a different metaphorical emphasis, either business-as-usual, neutral, minor favouring towards CCF and major emphasis towards CCF. Each participant read one version and was then asked to rate the preference (worth striving for), plausibility (convincing, feels real, realistic) and understandability of the text (clear, coherent, well written).

We investigated the effect of respondent characteristics and the effect of nudge on reported stance on CCF. Professionals provided more negative feedback on CCF than owners and this more negative as one increased the nudging in favor of CCF, while the forest owners' opinion became more positive. The results also indicate that age and gender are determining variables in the nudge. Age affects in different manners between the stakeholder groups. Women, regardless of being professionals or owners, showed higher stance on CCF than men. Our study highlights the existing opinion divide towards CCF between key private forest owners and forest professionals in Finland. The opposite reaction of the stakeholder groups to the nudge highlights challenges of one-fits-all policy instruments to make policies more palatable.

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## Cleanliness, order and beauty are central values influencing the acceptance of biodiverse lawns across Europe - a cross-continental interview study

(Oral)

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Regularly managed lawns are emblematic features of urban green spaces. They provide utility and aesthetic values, but often exhibit low species-richness and high management costs. Management interventions that convert such lawns into meadows could help mitigate the loss of a) native species and endangered semi-natural habitats from urban areas and b) the contacts between urban residents and biodiversity. However, socially sustainable planning and design, and hence long-term success of such interventions, needs to be based on an understanding of the values (utility, aesthetics or biodiversity) urban residents place on different types of lawns.

We surveyed the values European urban residents' link with lawns of different management types, how these values relate to ways of lawn use and how values and uses are linked with the acceptance of meadow-like lawns. Organized by a consortium of 22 researchers across Europe, the study is based on more than 1700 face-to-face interviews from 19 cities. The lawn-attributed values were extracted by classifying open-ended questions on lawn preference according to existing value typologies. The variation in the value data was condensed to major gradients and clusters of variation with principal component analysis (PCA) and weighted pair-group method with averaging (WPGMA). These were related to personal and city-specific attributes with generalized linear mixed models (GLMM).

According to the first results, the majority of variation in the values associated with short cut vs. meadow-like lawns reflect divisions of preferences to wildness, beauty, and evidence of care and cleanliness. Urban residents value low-growing lawns either due to their recreation utility or due to perceived cleanliness and care. Tall-growing lawns, in turn, are valued through their beauty and wildness. Valuation of wildness and naturalness in lawns in general is a strong and significant predictor for residents' positivity towards increasing the area of meadow-like lawns in cities. Value conflicts arise both within value categories (e.g. opposite views on beauty) and between value categories (e.g. preference for football vs. tall grass meadow).

The diversity of values attributed to lawns highlights that a diverse set of management regimes is an alternative for the current monopoly of short cut lawns. The results imply that introducing biodiversity conservation into urban green space management on a large scale has wide public support. However, evidence of care and cleanliness are required to satisfy the need for order, and lawns reserved for utility functions to satisfy the need for recreation. Participatory planning with urban stakeholders on lawn location and design would ensure that the conservation potential as well as recreational and aesthetic utilities of lawns are taken into account in urban green space planning.



## Taking Science to the Streets

(Oral)

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Soapbox Science is a world-wide, grass-roots approach to bringing the science done by women to people on the streets, especially those who wouldn't otherwise have come across science in their daily lives. Large proportions of the public only hear about science passively via TV(1) and think that scientists are poor communicators(2). On top of this, many opportunities to engage with scientists face-to-face are elitist, non-inclusive and don't reach those people in urban areas who do not have the time, inclination or funds to visit science festivals, museums or events(3). Soapbox Scientists are real-life scientists, who are at the cutting-edge of scientific research. They stand on soapboxes in busy streets and talk directly to the passers-by, with no middle man, no powerpoint slide, no amphitheatre, just their passion for the natural world and some cool props! 2017 also saw the start of our new Art & Science events, which encourage collaboration between artists and scientists in order to come up with new, innovative ways of presenting research to the public. Allowing people to question, heckle, probe and be inspired by top environmental researchers, as well as showing them that scientists are relatable and trustworthy, is essential for empowering the public with a knowledge base on which they can form opinions on conservation issues in the media, and act based on sound science and reliable recommendations.

(1) NERC- Public Insight Research. (2017). (2) Castell et al. BIS 2, (2014). (3) Office of Science and Technology (2000).

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## In-stream restoration in forestry impacted catchments: benefits to stream habitats, brown trout populations and society

(Oral)

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Forestry and wood industry have formed a foundation for Finland's national economy, yet inevitably at the expense of aquatic environments. From 1940s to 1970s, to provide energy resources for the industry sector, majority of large rivers were dammed for hydropower, blocking off their longitudinal connectivity. Concurrently, majority of the stream channels were dredged to facilitate timber transportation from headwaters to downriver factories. While most large rivers remain blocked, the timber floating ceased in the 1980s, and legislation imposing restoration as well as intensive restoration programs have been established ever since.

Habitat restoration has mostly been motivated by the enhancement of recreational fisheries through the provision of better living conditions for salmonids. The measures have included construction of in-stream structures, such as weirs, flow deflectors, boulder dams and gravel beds, and recently also installation of large wood. Based on before-after-restoration measurements of physical variables and habitat-hydraulic modeling, the measures have been effective in enhancing complexity of stream beds and hydraulic conditions, thus potentially increasing the availability of suitable habitat for juvenile brown trout. The increase in habitat heterogeneity has been persistent over time, and has also shown positive signs in functional processes of stream ecosystem. Nevertheless, overall substrate variability in restored streams has remained lower than in natural streams, especially with a shortage of gravel beds for brown trout spawning.

Sound ecological monitoring of restoration projects has been limited in Finland. A few long term before-after-restoration monitoring of brown trout densities, together with a meta-analytical synthesis of all good-quality monitoring data, have indicated an overall positive effect on brown trout parr densities. Yet, the absolute juvenile brown trout density in post-management streams has mainly remained lower than in natural reference streams. In addition, brown trout responses have varied strongly between restored streams.

The strong context-dependency in restoration outcomes is explained mainly by catchment scale (e.g. river basin size, dominant geology) and local (potential interspecific competition, fisheries management) factors. Among the local fisheries management measures, loosely restricted fishing has diluted the positive effects of restoration, and stocking by eggs and parr have either been ineffective or affected negatively brown trout's response to restoration. Stream-specific differences have also been observed in the delivery of ecosystem services, mainly reflecting stakeholder perceptions of landscape values and fish provisioning. Yet, stream restoration in its present form has a strong public acceptance in Finland, mainly because it is considered beneficial for recreationally important fish, ecotourism, and the well-being of local people.



## Planet fever call's for ecosystem indicator of wellbeing. The Madeira island case-study

(Oral)

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Life on Earth rises and evolves predominantly through the thermodynamic imperative of maximizing the dissipation of solar photon flux. Evolution and natural succession promotes the creation of biological structures and processes that capture and dissipate the solar energy and ecosystems become more efficient when they exhibit optimum conditions in three principal functional characteristics: biomass, information and networks. The synergistic properties of complex structures, higher biomass and greater functional diversity also provides the system with resilience .

With the great acceleration characteristic of the Anthropocene, the impacts of human activities on the structure and functioning of the Earth System are profound enough to distinguish the present state of the system from the Holocene . Human activities are reducing the efficient functioning of ecosystems by degrading natural complexity.

To foster and monitor the necessary transition, there's a need to implement a radical ecosystem approach, with simple indicators of ecosystem health, supported by a solid theory and framework . The indicator should be accurate and reproducible, reflect the systems condition as a whole, easy to implement and accepted as being scientifically sound.

In our study, remote sensing techniques were used to analyse in detail the biomass cover, surface temperature and vegetation complexity of the main land cover types in Madeira Island. The research focused on typical examples of natural and cultural landscapes including Laurissilva natural forest and banana plantations as two representative ends of vegetation spectrum.

The findings revealed it was possible to distinguish between ecosystem types using thermodynamic principles and employing simple remote sensing measurements. For a given incident photon flux, older ecosystems with longer and more complete adaptive cycles, have greater entropy production and thus a lower temperature. Modification and conversion of natural ecosystems reduces complexity, which induces more extreme temperature fluctuation.



## Association between awareness of environmental consequences, materialism and environmental philanthropic behavior among potential online donors

(Oral and Poster)

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Despite its importance for conservation organizations, environmental philanthropic behavior that consists of donations of both money and time, has so far been an understudied phenomenon within pro-environmental behavior (1, 2). The decision to donate either money or time to conservation purposes may arise from different motivations that influence in the background. Motivations behind environmental philanthropic behavior may also differ from motivations regarding participation in other forms of pro-environmental behavior (2) or from motivations to donate to other charitable sectors. Nowadays numerous people are following conservation organizations' social media channels, and thus form a new segment of potential donors. By conducting a questionnaire survey targeted to potential online donors (n=2079) we explored possible connections between egoistic, altruistic and biospheric awareness of environmental consequences and materialism and different forms of self-reported environmental philanthropic behavior. The respondents were also asked to allocate a 10€ incentive gift to one of five real donation targets. We used logistic regressions and censored regression model to analyse the data. Roughly half of the respondents had donated in real life, and one fifth had volunteered to environmental causes. We found that respondents living in the countryside volunteered (i.e. donated time) more likely than urban dwellers, and respondents with higher income were more inclined to donate money than to volunteer. In addition, both biospheric and egoistic concerns were positively related to self-reported environmental philanthropic behavior, while the relationship between materialism and environmental philanthropic behavior was negative. Materialism was associated with preferring a charismatic (flagship) species when choosing a donation target in the choice experiment, whereas biospheric concerns were related to choosing a general donation to biodiversity conservation. Thus, our results highlight the importance of catering for the diverse motivations behind environmental philanthropic behavior in conservation marketing campaigns. Potential donors with egoistic concerns or living in rural settings could be offered possibilities to engage in voluntary work related to surrounding natural settings. Furthermore, while traditional flagship species seem to appeal to donors with materialistic values, donors with biospheric concerns form a segment that prefers targets with broader biodiversity benefits.

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## A policy analysis of biodiversity conservation in the Overseas Entities of the European Union

(Oral and Poster)

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The European Union (EU) includes 34 Overseas Entities (OEs): nine Outermost Regions and 25 Overseas Countries and Territories. As most OEs are tropical islands, over 80 % of the EU's biodiversity resides in OEs, with an overall very high endemism level. OEs mostly thus represent regions of high conservation relevance. OEs cover an area of 4.4 million km<sup>2</sup> (with Greenland constituting about half of this area), equivalent in size to continental Europe. With over 15 million km<sup>2</sup>, their combined Exclusive Economic Zone make it the most extensive in the world. The European Union's Overseas Entities are linked to six Member States: Denmark (Greenland), France (e.g. French Guiana, Réunion, French Polynesia), the Netherlands (Curaçao and other Caribbean islands), Portugal (Azores, Madeira), Spain (Canary Islands) and the United Kingdom (e.g. islands in all oceans, such as Saint Helena, Ascension and Tristan da Cunha in the Atlantic, Pitcairn Islands in the Pacific, or Cayman Islands in the Caribbean). There are significant differences between the OEs themselves in terms of the degree of autonomy from the Member States they are linked to, their economic and social development as well as their particular geography and climate. However, they do share common characteristics, among others: parliamentary democracies, lack of political sovereignty, and very small populations. As regards biodiversity conservation, there is a policy gap - the EU Nature Directives apply only in the Outermost Regions Canary Islands, Azores and Madeira. Otherwise, the OEs have their own individual conservation regulations, many of these relatively weak. Similarly, the cooperation in conservation governance differs between the association of EU member states and corresponding OEs. The 34 OEs are widely scattered, which may a prominent reason for a concurrent knowledge gap of biodiversity and conservation policy in OEs among conservation biologists. This lack of knowledge may have a comparable dimension among non-Europeans, i.e. in the regions where the OE are situated, except in their more immediate vicinity. This lack of knowledge translates in a conservation advocacy gap. This work represents the first ever policy analysis of biodiversity conservation in the European Union's Overseas Entities. It intends to raise awareness among conservation scientists of how many OEs exist, their identity, where they are situated, the conservation status of the local biodiversity and existing management regimes, including protected areas.





## Ecosystem based analysis of the condition of the German forest

(Oral and Poster)

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Germany ranks among the densely wooded countries in Europe. One third is forested and the timber stocks in Germany account for 336 m<sup>3</sup> per hectare. Forestry claims to occupy a leading place compared with other European countries. For more than 30 years the aim of forestry is to implement close-to-nature forest management throughout Germany. This objective has in Germany already generated an increasing proportion of structurally diverse mixed stands, long regeneration periods and natural rejuvenation methods. The good condition of German forests is the consequence of the silvicultural actions of many forest owners and foresters and the result of a forestry policy based on balance and sustainability. These are statements from the Federal Ministry of Food and Agriculture based on The Third National Forest Inventory, 2014. But is this the truth? In this study we developed an ecosystem-based analysis to assess the condition of the German forest using also the data from the National Forest Inventory and data showing the potential natural vegetation in Germany. Those data sets were processed and grouped into 22 different forest ecosystems. For the analysis we used criteria taken from natural conservation assessments such as 'threat' and 'naturally' but also new developed criteria like 'management' and 'protection status'. (Usher & Erz, 1994). The criteria were quantified using indicators derived from the National Forest Inventory ending in a new developed ecosystem-based evaluation scheme. The results show different statements compared to the Ministry of Food and Agriculture. The German forest is in a critical condition after aggregating all 22 forest ecosystems. Some forest ecosystems, especially acidic mixed oak forest or the wavy hair-grass beech forest are even in a very critical condition. Additionally, the mentioned close-to-nature forest management has to be questioned, since one fifth of all forest ecosystems show very critical management results. The conclusion regarding the good condition of the German forest which is stated in the Third National Forest Inventory is questionable, if one is using an ecosystem based approach that is based on reference values provided by nature, a different result occur. These results should be discussed in forestry and politics and a measure catalog for forest ecosystems which are in critical and very critical conditions should be implemented.



## Where science meets art: using science-fiction as a medium for science communication

(Oral and Poster)

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As the world becomes more urbanized than ever before, society has continued to grow dissociated from nature and our impact on it. Too often, nature is taken for granted and treated as a luxury: we retreat into nature to escape from our stressful daily routines. Popular media, such as science-fiction, often shows nature as a threat that can destroy us. While this makes for good entertainment, science-fiction is also unique, in that it can provide a structure for societal evolution. What if the dialogue changed? What if prevalent themes portrayed how society can not only coexist with, but integrate and benefit from nature? Science-fiction has the ability to encourage the public to be more mindful of their relationship with nature. Writing science-fiction novels has also given me an opportunity to develop educational resources in written and video format, as well as raise funds for environmental organizations. In doing so, I have witnessed firsthand how my own efforts have inspired readers and viewers to take on scientific pursuits and make environmentally-conscious changes in their own lives. This shows the impact science-fiction can have when presented responsibly, and with a purpose. If we shift the dialogue, perhaps we can inspire our urbanized society to establish a beneficial, yet mutual relationship with nature.

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## Of people and trees: exploring the spatio-temporal dynamics of urban and periurban dwellers' social representations of trees.

(Oral and Poster)

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Almost 40 years ago, Pyle [1] started to warn the scientific community about the progressive disconnection between urban dwellers and nature. This so-called "extinction of experience" may affect individual relationships toward elements of nature in the everyday life, such as knowledge, emotions, attitudes and practices. It may also affect social representations (SRs) of these elements of nature, i.e., collective elaborations "of a social object by the community for the purpose of behaving and communicating" [2]. In turn, varying SRs are linked with different prioritization in conservation policies.

Here, we explored the hypothesis of "extinction of experience" regarding such a valued component of urban nature (e.g. [3]), by characterizing individual relationships with, and social representations of trees, in varying urbanization contexts and for different generations of people, in Paris area (France). We computed a questionnaire comprising: (1) a free-listing task and three open-ended questions to elicit the SRs of "tree"; (2) closed-ended questions to evaluate individual relationship to them; (3) socio-demographic variables. We administered the questionnaire face-to-face with 80 people from 8 to 93 years old in the city of Dugny, and online with 454 people from 18 to 85 years old living in urban and sub-urban areas. We analyzed the words elicited through the free-listing task with rank-frequency analyses to elicit the content and structure of the social representation. Individual relationships to trees were characterized using a multivariate analysis and a classification algorithm. We then extracted the main lexical worlds used by respondents from a lexical analysis of the open-ended questions. We showed three main dimensions in the social representations of urban trees: (1) trees are considered as key components of nature through their perceived function of providing oxygen, (2) they are perceived through an aesthetic dimension; (3) they hold important symbolic and affective representations. Multivariate analyses showed that urban people closer to trees associated them more frequently to their ecological functions. By comparing the SR of younger and older people in our sample, we studied the temporal dynamics of the social representations of trees. Combining qualitative and quantitative analyses allowed us to suggest a loss of autonomy of the concept of trees vis-à-vis the broader and less specific concept of "nature" that dominates the social representation, together with a decreasing association between trees and "forest" through time. These results invite us to question the ways to integrate trees in cities and sub-urban agricultural landscapes in a way that promotes physical and emotional experiences with trees.

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## The importance of the Ethical Review Process (ERP) in Conservation

(Oral and Poster)

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Decisions in conservation, as in other fields, are very often controversial and involve important ethical issues. The inclusion of the Ethical Review Process (ERP) in conservation projects is therefore of paramount importance to try to ensure that all concerns and stakeholders are considered and addressed, and that decisions are made on the basis of a rational decision-making process. The ERP is a critical reasoning process, based on tools and methodologies, for providing advice on ethically relevant issues or revising already existing policies and choices. Among the immediate results of its application are consistency and transparency in communication with institutions and with the public. The interdisciplinary research group of Padua University is testing the inclusion of ERP in conservation projects of different scale, both in-situ and ex-situ. Some examples are provided. On a local scale, in collaboration with WWF, we are investigating attitudes and ethical awareness of inhabitants and visitors in situ, using Likert scale items, in order to promote the conservation of local species. At a national level, we are performing a study on threats and obstacles to the conservation of Italian species belonging to *Testudines* taxon interviewing experts and using ethical Delphi methodology. In zoos, we designed a six-step protocol, using ethical matrices, to evaluate animal-visitor interactions, which we are testing in different species. In Europe, we are investigating zoos' ethical reputation, using questionnaires for visitors and non-visitors in collaboration with Goethe University, Frankfurt. In South Africa, in collaboration with local universities and organizations, we are applying ethical matrix and expert consensus methodologies to evaluate elephants' management in semi-captive situations and wild dogs management in protected areas. The ERP is showing to be of help, at different levels, to highlight conflicts and resolutions, to promote dialogue and collaboration among ecologists, landowners, local institutions, zoos managers and the public. It is also of great importance to promote inclusiveness and conservation education.

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## Water as a multifaceted environmental filter of tundra vegetation

(Oral and Poster)

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The hydrological cycle of tundra has intensified due to accelerated environmental changes. Climatic changes affect tundra vegetation by altering water conditions (1). Plant-available water mediates climate change impacts, namely against rising temperatures and changing snow dynamics (2). Vegetation is limited by water resources, but water forms also major stress and disturbance. However, climate change impact studies often cover water inadequately in cold regions, which are assumed to be energy-limited ecosystems (3). Thus, we used statistical modelling methods to test if the inclusion of different water factors improved species distribution, species richness, and community composition models of vascular plants, mosses, and lichens in tundra.

We collected occurrence data of 289 species on 378 1 m<sup>2</sup> plots in European mountain tundra. We also recorded eight environmental predictors comprising of direct and resource predictors of the species. The predictors consisted of three water-related factors – namely water resources (soil moisture level), water stress (soil moisture change), and water disturbance (fluvial accumulation and erosion) – and five other factors, namely temperature (growing degree day), nutrients (soil pH), light (radiation), cryogenic processes (solifluction and cryoturbation), and biota (dominant species coverage).

All water aspects represented independent hydrological gradients of the landscape, with evidently differing responses from individual species to community level. The predictive performance of SDMs mostly improved, after considering the water-related predictors in the models: the average AUC values for vascular plants increased from 0.807 to 0.836 ( $P \leq 0.01$ ), for mosses from 0.687 to 0.727 (not significant), and lichens from 0.667 to 0.668 (ns). The predictive performance of all species richness models also improved significantly ( $P \leq 0.001$ ): mean R<sup>2</sup> for vascular plants improved from 0.427 to 0.568, for mosses from 0.097 to 0.193, and for lichens from 0.271 to 0.335. In the NMDS plots, water disturbance and resources were within the most strongly correlating variables ( $R^2 = 0.232$  and 0.191).

While controlling all other key environmental gradients, these aspects proved to be crucial environmental drivers from species to community level. We showed that the three water aspects represent independent variables in tundra. Each water aspect has different impacts on the distribution of individual species, spatial variation in species richness, and community composition of three taxonomical groups. Our results highlight the role of water as a multifaceted driver of vegetation, and acknowledging uncertainties in the anticipated hydrological changes in tundra, there are possibly ecological surprises ahead for these vulnerable environments.

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(3) le Roux et al. (2013). *Glob Chang Biol*







## Potential conflicts between microalgal biodiesel production and areas of high ecological importance at national scales

(Oral and Poster)

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Current bioenergy production systems—aimed at replacing fossil fuels in the transport sector—have been linked to a wide range of environmental impacts, including biodiversity losses. This is mainly because they derive from food crops (i.e., maize, sugarcane, oil palm, soybeans, and rapeseed, among others), leading to direct and indirect land-use changes in areas of high biodiversity value. However, the potential impacts of novel, non-food based bioenergy production systems on biodiversity remains unclear. Microalgal production systems, which make use of microscopic prokaryotic and eukaryotic photosynthetic organisms, have the potential to become a future source of biofuels for the transport sector, though little is known about the potential conflicts of large-scale microalgal cultivation and biodiversity losses. Here, we use a GIS-based Multiple-Criteria Decision Analysis (MCDA) to select the most suitable areas for large-scale microalgal cultivation. We then explore a scenario in which 30% of transportation demand is met from algal biofuels, showing countries where minimal or maximal conflicts between microalgal cultivation and presence of areas of high ecological importance are expected to occur. Our results illustrate the countries in which algal biofuel production can be scaled up while avoiding significant impacts to biodiversity.



## Environmental correlates of the conservation value of boreal headwater streams and their riparian forests

(Oral and Poster)

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Headwater streams and their riparian forests are considered as biodiversity hotspots and key habitats for the conservation of aquatic and terrestrial biota [1, 2]. However, most previous research has focused on single organism groups and studies providing a more comprehensive assessment of the conservation status of both stream and riparian fauna and flora do not exist. We used data ranging from near-pristine to strongly modified boreal headwater streams and their riparian forests to assess which in situ and larger scale environmental factors are the best determinants of the overall conservation value of sites. We then evaluated validity of the selected variables in predicting the conservation value of 15 independent test sites. Specifically, we asked whether GIS-derived environmental variables can provide more (or equally) accurate predictions of the conservation value compared to more laborious in situ variables. Our data comprised species-level information on stream-dwelling bryophytes, diatoms and macroinvertebrates and riparian birds, vascular plants, bryophytes, polyphores and insects (nematocerans, trichopterans, and coleopterans). We calculated the overall conservation score (0-1) for each study site by averaging standardized i) total species richness, ii) rarity-weighted species richness (RWR) and Pielou's evenness ( $J'$ ) (calculated for each organism group separately) and total number of endangered taxa (summed across all 10 organism groups). Next, we used hierarchical partitioning to evaluate the independent contribution of 25 in situ environmental variables and 19 GIS-variables in determining the conservation status of the study sites. Among the in situ variables, the cover of coniferous trees, amount of decaying wood and forest shading contributed most (28%, 25%, and 11%, respectively) to the conservation score. Drainage intensity (20%), average tree diameter (18%; 100 m buffer) and a number of forest ditches draining into the stream (17%) were the best GIS predictors. Both in situ and GIS variables had, however, only moderate (23.7% and 24.6%, respectively) prediction success when the selected environmental variables were fitted to independent data. Our results therefore suggest that although it is possible to identify environmental variables strongly related to conservation value of a site, using this information for predictive purposes remains challenging. This might be due to fact that different biodiversity facets tend to show variable responses to environmental gradients, resulting in no net change in the overall conservation score regardless of alteration of site integrity. Nevertheless, our study underlines the importance of the protection of mature riparian forests and avoidance of peatland drainage to maintain headwater streams and their riparian surroundings as key habitats for biodiversity conservation.

<sup>1</sup> Marczak L.B. et al. 2010. *Ecol Appl.*, 20, 126-134.

<sup>2</sup> Finn D.S. et al. 2011. *J. N. Am. Benthol. Soc.*, 30, 963-980.



## Contrasting wildlife and livestock impacts on plant biomass dynamics inside and outside the Serengeti National Park, Tanzania

(Oral and Poster)

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African savannahs represent one of the world's most productive ecosystems and one of the last vestiges of diverse wild herbivore populations. Accompanying human population growth, livestock is replacing wildlife as the dominant herbivore. To understand the impact of this shift in herbivore assemblage, we established a network of exclosures across a rainfall gradient contrasting pastoral and wildlife management around the Serengeti National Park, Tanzania. Small-scale exclosures and open plots were established underneath leguminous and non-leguminous trees and outside canopies to account for the landscape structure. Every month herbaceous biomass was estimated non-destructively in 128 plots using a calibrated pasture disc. For each site, monthly herbivore dung surveys were used to estimate the herbivore assemblage. Additionally, plant community composition was surveyed and root biomass determined via ingrowth cores. After the first year, aboveground biomass was most strongly associated with plant species composition with greater production for communities in the drier region. On average, the greatest aboveground biomass occurred inside exclosures underneath leguminous trees. Meanwhile, root biomass production was highest in the wetter region suggesting a shift of investment from belowground than aboveground across the rainfall gradient. Herbivore assemblage varied in space and time, but did not consistently influence aboveground biomass accrual. Thus, our results suggest plant biomass production across wild and domestic herbivore assemblages relates mainly to plant species composition and these species' adaption to climate variability. We discuss our results in the context of a changing savannah landscape involving people, wildlife and climate seasonality.



## Biogeographic Basis of the Russian Ecological Network

(Oral and Poster)

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DOI: 10.17011/conference/eccb2018/108155

Russian Ecological Network is an important part of the Pan-European Ecological Network (PEEN). Development of the Ecological Network should apply on both national and Pan-European conservation priorities. The coherence between these groups of priorities decrease in Russia from the West to the East, from the North to the South, from valleys to mountains, as well as from birds to mammals, fishes, reptiles and amphibians, invertebrates, and plants. For this reason, we reveal the Core Areas of the PEEN – Areas of Special Conservation Interest for species and habitats of European importance – by the presence in the same time of ecologically similar but even more vulnerable species and habitats, these ones protected on the national or even local level. Therefore, we have harmonised national and Pan-European conservation priorities in a synergizing manner: species and habitats of European importance are protected in favourable conditions and species and habitats of national priorities are protected in areas of European importance!

When having identified the landscape matrix as embracing and connecting Core Areas, we have excluded from consideration cities and towns with surrounding 10-kilometter buffer zones, open mining, and badlands. So, we have identified several integrated systems of territories, where natural communities predominate (Natural Backbones or Natural Frames) including the Great Eurasian Natural Tract as expanded in the Forest and Arctic zones between the Pacific and Northern Scandinavia. Russian Concept of the Transition to the Sustainable Development (1996) mentions “the world largest array of natural ecosystems (8 mln sq km)” – now we have mapped it. It’s not the same as twenty years ago but we consider it remaining a true World Natural Heritage and ensuring ecosystem services at the global level.

When having studied the fragmented regions, we have identified the corridors on satellite images as being visually like the habitats of the Core Areas to be connected.

Core Areas and ecological linkages between them decrease from the East to the West and from the North to the South. In Russia, the European part of the Steppe corridor is more fragmented than Asian one.

Distribution of Protected Areas makes a solid legal basis for the future ecological network but needs to be supported by other types of Protected Areas as Water Protecting Belts, Protective Forests and some other.

We thank Russian Geographical Society for supporting the presented study by the grant No 25/2017/RGS-RFBR.



2018/06/12

15:00

Room: K308 Cabinet



UNIVERSITY OF JYVÄSKYLÄ



## EU policy and the Earth system: how Planetary Boundaries can help bring them into line

(Oral and Poster)

**Tiina Häyhä<sup>1</sup>✉, Holger Hoff<sup>2</sup>, Sarah Cornell<sup>1</sup>, Paul Lucas<sup>3</sup>, Detlef van Vuuren<sup>3</sup>**

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Abstract of this presentation is not public



## Hydrological disturbances and naturalness of aapa mires in Finland

(Oral and Poster)

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Peatlands comprise one of the key elements in the boreal landscape. In Finland, almost one third of the land area is covered by different types of peatlands. Half of the Finnish peatland area has been drained, however, and in Southern half of the country, 75 % is drained (1). While drainage has increased forest growth, it has also caused manifold ecological consequences. For example, the state of the remaining undrained peatlands is affected by drainage of surrounding areas and fragmentation.

The undrained peatland area in Finland consists of various sizes of peatland patches that often, at least in the southern areas, are not intact peatland ecosystems but only remnant patches of formerly much larger peatland complexes. How is the surrounding land use affecting the undrained patches? Especially aapa mires and related minerogenic peatlands, which are common in the boreal zone, are dependent on water inflow from upper catchment areas and, thus, sensitive to changes in catchment hydrology. If water inflow from surrounding areas diminishes, an aapa mire may start to develop into ombrotrophic (rain fed) bog (2). This kind of shift means a profound change in the structure and functions of a peatland ecosystem. It can be conceptualized as an ecosystem collapse, in which one ecosystem ceases to exist, and a new type of ecosystem springs up (3).

We conducted a GIS analysis based on Finnish national land survey's digital map data, air photos, and LIDAR based terrain model. The objective was to yield information on the hydrological naturalness of the remaining undrained peatlands in Finland and to assess the disturbances the surrounding land use exerts on aapa mires. We investigated the amount and size classes of undrained peatland patches and the drainage state of their margins. Then we chose a sample of large (more than 50 hectares) peatland patches (n = 120) containing aapa type vegetation patterns, delineated catchment areas of the aapa mires, and quantified the hydrologic disturbances on them.

Results show the amount of undrained peatlands, how disturbed are their margins, and the average state of hydrological naturalness of large aapa mires in different climatic zones of Finland. Ultimate target of the study is not only to improve the knowledge on the current state of Finnish peatlands, but the results are also prerequisite for assessing the future changes of peatlands in the project SHIFTMIRE: Ecosystem shift potential of northern mires in response to hydrological change, funded by the Academy of Finland.

(1) LUKE 2017. Forest resources. Natural Resources Institute Finland, Helsinki. Web publication: <http://stat.luke.fi/en/tilasto/6221>.

(2) Tahvanainen, T. 2011. Abrupt ombrotrophication of a boreal aapa mire triggered by hydrological disturbance in the catchment. *Journal of Ecology* 99, 404–415.

(3) Keith D.A. et al. 2015. The IUCN Red List of Ecosystems: motivations, challenges and applications. *Conservation Letters* 8, 214–226.



2018/06/13

11:15


Room: K308 Cabinet



## Predictors of wolf poaching in a legally harvested wolf population

(Oral)

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Abstract of this presentation is not public



## Performance and conservation of a refugial beech (*Fagus sylvatica*) stand in SW France

(Oral)

Arndt Hampe<sup>1</sup>✉, Adib Ouayjan<sup>1</sup>, Marion Walbott<sup>1</sup>, Didier Bert<sup>1</sup>, Emmanuel Corcket<sup>1</sup>, Alexis Ducouso<sup>1</sup>, Rémy Petit<sup>1</sup>

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The identification and conservation of microrefugia that allow local species persistence in otherwise inhospitable landscapes is now receiving great attention. Yet it remains little understood how the interplay of the local abiotic and biotic environment influences the dynamics, performance and perspectives of refugial populations, especially for large keystone species such as forest trees. Here we present a case study from an emblematic refugial stand of European beech (*Fagus sylvatica*) in SW France. The gorges of the Ciron River serve today as interglacial refugium to a small and isolated beech population at precisely the same place that already served as a putative glacial refugium to the species. Microclimate varies considerably between the central and the peripheral parts of the valley, where the species is restricted. Genetic analyses show that the beech population experiences very limited gene flow and an unprecedented frequency of sib mating. These processes, together with an apparently great historical stability of the refugial population, have resulted in an outstandingly strong and extensive spatial genetic structure. Dendroecological studies indicate that interannual variation in tree growth is primarily triggered by the water balance during the growing period. However, the population has so far been relatively little affected by modern climate warming and projections do not suggest a major drop in tree growth over the coming few decades. Overall, the Ciron refugial beech stand represents a highly suited model for monitoring fine-scale ecological processes and their relationship with microclimate in a refugial setting. A detailed understanding of its functioning should help inform strategies for conserving and managing refugial forest tree populations, a major challenge in southern and central European mountain ranges.

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2018/06/13

12:45

Room: K301 Felix



## Importance of modern RS-monitoring for EU

(Oral)

Frank Wassen<sup>1</sup>

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Abstract of this presentation is not public



## eDNA metabarcoding of rivers: Is all eDNA everywhere, all the time?

(Oral)

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Environmental DNA metabarcoding has become a popular tool for the assessment of freshwater biodiversity, but it is largely unclear how sampling time and location influence the assessment of communities. Abiotic factors in rivers can change on small spatial and temporal scale and might greatly influence eDNA metabarcoding results. In this study, we sampled three German rivers at four locations per sampling site: 1. Left river side, surface water, 2. Right river side, surface water, 3. Left side, close to the riverbed, 4. Right side, close to the riverbed. For the rivers Ruhr and Möhne, sampling was conducted three times in spring, each sampling one week apart. The Ruhr was again sampled in autumn and the Gillbach was sampled in winter. Sequencing on an Illumina MiSeq with degenerate COI primers Bf2/BR2 revealed diverse communities (6493 Operational taxonomic units, OTUs), which largely differed between rivers. Communities changed significantly over time in the Ruhr, but not in the Möhne. Sampling location influenced recovered communities in the Möhne and in the Ruhr in autumn. Our results have important implications for future eDNA studies, which should take into account that not all eDNA in rivers is everywhere, and not at all times.

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2018/06/13

12:00

Room: A3 Wolmar



## Genetic Identification of the source of the North American population of *Pseudogymnoascus destructans*, the invasive fungus causing White-Nose Disease in Bats

(Oral)

Surendra Ranpal<sup>1</sup>, R-M Stecker<sup>2</sup>, Nicola Fischer<sup>2</sup>, Andrea Altewischer<sup>2</sup>, N Toshkova<sup>2</sup>, V Zhelyazkova<sup>2</sup>, Marcus Fritze<sup>2</sup>, Serena Dool<sup>2</sup>, Sébastien Puechmaille<sup>2</sup>

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Abstract of this presentation is not public



## The role of soft law vs hard law instruments in the enforcement of biodiversity offsets and their impacts on stakeholders

(Oral)

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DOI: 10.17011/conference/eccb2018/107565

The enforcement of biodiversity offsets is of utmost important for their effectiveness. According to many studies, the principal reasons offsets fail to achieve their intended purpose in regulatory systems are the lack of clear and unambiguous policy requirements, insufficient political will to require high standards, and inadequate monitoring, oversight and enforcement (Pilgrim and Ekstrom 2014). While many studies have been conducted on the standards that biodiversity offsets should meet in order to reach a no net loss of biodiversity, enforcement issues are often understudied. Yet, in the absence of adequate enforcement strategies, developers and offset suppliers are not incentivised to implement high quality offsets. In order to ensure their effectiveness, biodiversity offsets must be incorporated in binding legal tool and stated in terms that are sufficiently precise as to their content and objectives to generate enforceable obligations. In addition, responsible parties should be clearly identified (developer, offset suppliers and bank sponsors, intermediaries, ...). Whereas developers are often the only party legally liable in first-party offsets, banking schemes usually operate a transfer of responsibility to the bank sponsors. The major advantage of transferring the responsibility of the biodiversity offsets measure is to facilitate the enforcement of the measures. If the project fails, public authorities can deal with the failure directly with the person in charge of implementing the measures instead of having to pursue each developer separately. Furthermore, public authorities should have at their disposal a variety of enforcement tools from monitoring powers to the application of several remedies. In this regard, the nature of enforcement means may have important impacts on stakeholders (Earnhart and Glicksman 2015). Whereas some public authorities rely on strong legal remedies (penalties, injunctive relief, forced execution), others adopt cooperative strategies (negotiation and adaptation of offset requirements) or economic approaches (financial guarantees, accreditation, progressive release of biodiversity credits). Lastly, public enforcement may be complemented by private enforcement through the use of conservation easements or citizen suits provisions (Owley 2013).

1. Pilgrim JD and Ekstrom JMM, Technical Conditions for Positive Outcomes from Biodiversity Offsets: An Input Paper for the IUCN Technical Study Group on Biodiversity Offsets (IUCN, Gland, Switzerland, 2014)
2. Earnhart DH and Glicksman RL, 'Coercive vs. Cooperative Enforcement: Effect of Enforcement Approach on Environmental Management' 42 International Review of Law and Economics 135
3. Owley J, 'From Citizen Suits to Conservation Easements: The Increasing Private Role in Public Permit Enforcement' (2013) 43 Environmental Law Reporter 10486





## Going with the flow: Using waterways to invasive terrestrial species

(Oral)

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Environmental DNA (eDNA) offers an opportunity for detection and monitoring of invasive vertebrate species. This approach is ideal for species that are semi-aquatic or terrestrial species that frequently interact with water. For example, feral swine (*Sus scrofa*), which are invasive across a significant portion of the U.S., are not semi-aquatic but they routinely wallow in water. Burmese pythons (*Python bivittatus*), which are invasive in south Florida, are a semi-aquatic species. Both species cause significant impacts to native species and ecosystems and thus are of interest to managers. We designed species specific primers, tested various approaches to DNA isolation and concentration, and quantified our limits of detection and quantification. We also assessed persistence of eDNA in the target environment. Our work demonstrates the importance of pen tests with target species to optimize the eDNA assay and further field testing as a pilot study before full studies may be successful. In our pilot field studies we implemented modeling to assess what factors influenced our probability of detection and the laboratory methods that most influenced detection as well. Finally, we developed a method for rapid and easy field collection of samples. The field of eDNA is rapidly developing and much of the knowledge is housed within laboratory personnel rather than in publications. It is my goal to have an open discussion about laboratory and field techniques to further the sharing and integration of knowledge between practitioners and those interested in applying these methods in wildlife conservation.

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2018/06/13

11:00

Room: K301 Felix



## Satellite data infrastructure and applications for ecosystem observations

(Oral)

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Abstract of this presentation is not public

2018/06/13

11:30

Room: K307 Elsi



## Characterizing microrefugia for boreal forest species

(Oral)

**Caroline Greiser<sup>1</sup>✉, Johan Ehrlén<sup>1</sup>, Miska Luoto<sup>2</sup>, Eric Meineri<sup>3</sup>, Kristoffer Hylander<sup>1</sup>**

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Abstract of this presentation is not public



## How much is enough – estimating set-aside areas in naturally disturbed forests

(Oral)

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DOI: 10.17011/conference/eccb2018/107644

The amount of naturally disturbed forests in the Northern Hemisphere has increased as a consequence of global change. Natural disturbances, such as wildfires, windstorms and insect outbreaks affect billions of trees and cause significant economic losses. Post-disturbance logging is a common practice globally to 'salvage' some of these economic returns. However, salvage logging can have negative effects on ecosystem functioning and biodiversity. Those taxa, which depend on deadwood (i.e. saproxylic), are most affected. Hence, scientists increasingly encourage the retention of disturbance-affected areas as a main tool to omit the negative effects of salvage logging on biodiversity. However, this retention compels forests managers on balancing between conservation of wood-dependent taxa and capturing economic returns. Therefore, it is important to know, how much biodiversity can be preserved if certain portions (e.g. 50 %) of disturbance-affected stands are salvage logged. We compiled data from published studies from North America (USA, Canada) and Europe (Spain, Switzerland, Germany and Poland) that compared species richness of nine taxonomic groups in salvaged and unsalvaged disturbance-affected forest stands. We modelled the conservation value of disturbance-affected stands with different portions of simulated salvage logging. The conservation value was defined as the sum of species occurring in unsalvaged plots relative to the cover of unsalvaged plots. The results showed that the number of species in unsalvaged plots decreased proportionally to the decrease of unsalvaged plots' cover. Therefore, by retaining 50 % of the disturbance-affected plots, approximately 50 % of the species occurring in unsalvaged plots, mainly deadwood dependent species, was preserved. However, there were differences between the taxonomic groups. For instance, the conservation value of saproxylic taxa (saproxylic beetles, fungi, epixylic mosses and lichens) decreased steeper compared to non-saproxylic taxa (plants, epigaic mosses, spiders, carabids and birds). This finding indicates that depending on the retention strategy decision makers could facilitate different taxonomic groups. In the talk, the effect of different retention scenarios on different taxa will be illustrated. Furthermore, the best strategies for managing naturally disturbed forests will be highlighted.



## The many ways topography buffers responses to climate change

(Oral)

**Bente J Graae**<sup>1</sup>✉, **Vigdis Vandvik**<sup>2</sup>, **W Scott Armbruster**<sup>3</sup>, **Jonathan Lenoir**<sup>4</sup>

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During climate change, populations have two survival options - they can remain in situ and tolerate the new climatic conditions ('stay'), or they can migrate to track their climatic niches elsewhere ('go'). Staying requires broad climatic tolerances, niche shifts due to changing biotic interactions, acclimation through plasticity, or rapid genetic adaptation. Going, in contrast, requires good dispersal and colonization capacities. However, both the magnitude of climate change experienced locally and the capacities required for staying or going in response to climate change are not constant across landscapes, but affected by local microclimatic variation associated with topographic complexity. We combine frameworks from population and community ecology to develop a theory for the effects of landscape topographic complexity on the immediate stay or go opportunities of local populations and communities, and on the selective pressures that may have affected the stay or go capacities of the species. With example landscapes we present population processes and community dynamics that we expect all to be dependent on the topography of the landscape that accommodate the populations and communities. We thereafter synthesize how these topography related changes in dynamics may shape the responses of populations and communities to climate change.

We predict that populations and communities of topographically complex landscapes should be more resistant and resilient to climate change than those of topographically homogeneous landscapes. However, mass effects in heterogeneous landscapes as well as extinction lags in homogeneous landscapes may mask these landscape differences under rapidly changing climates.

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## Voluntary vs. compliance regimes for the implementation of biodiversity offsets

(Oral)

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DOI: 10.17011/conference/eccb2018/108167

The discussion about voluntary vs. mandatory offsets has risen to particular attention with the planned No Net Loss initiative of the EU and the envisaged introduction of a mandatory compensation scheme at EU level. However, biodiversity offsets are far more complex than this distinction of two types of biodiversity offsets implies. Consequently, the aim of this study was to develop a refined typology with regard to the voluntariness of biodiversity offsets. To this end, four consecutive steps have been applied: 1. Deduction of an impressionistic classification of types, 2. Derivation (and reduction) of relevant attributes/criteria for voluntariness from the theory, 3. Substruction of the underlying attribute space and combinations of attributes and 4. Transformation (rectification) of the impressionistic types and analysis of

meaningful correlations. As a result, a typology with seven types has been built:

1. Regulatory offsets: required by law and enforced
  2. Conditional offsets: required by financial institutions (e.g. International Finance Corporation)
  3. Enabled offsets: fostered by governments and NGOs through pilot schemes, guidance etc.
  4. Sectoral offsets: take part in a voluntary self-commitment of a sector (e.g. mining)
  5. Corporate offsets: resulting from a voluntary self-commitment of a corporation
  6. Local offsets: single offsets, that are most likely developed at local level in a consensual process
  7. Altruistic offsets: truly voluntary offsets that are driven by the altruistic motivation to make a positive impact
- The state of the scientific knowledge and the practical evidence explored throughout this study encourage the analysis (and use of) of the various forms of voluntary biodiversity offsets, in particular with regard to the evaluation of their outcome in terms of effectiveness and efficiency. This can help to contribute to an informed debate about biodiversity offsets and how they can be delivered in practice.

2018/06/13

12:45

Room: A1 Wilhelm



UNIVERSITY OF JYVÄSKYLÄ



## The NNL approach in the EU initiative on integrating ecosystems and their services into decision-making

(Oral)

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<sup>2</sup> Helmholtz Centre for Environmental Research, Germany

Abstract of this presentation is not public



2018/06/13

11:15

Room: K301 Felix



## RS and use of new monitoring technologies

(Oral)

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Abstract of this presentation is not public



## Biodiversity assessment of vanilla plantations and surrounding areas in the SAVA region of Madagascar

(Oral)

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Conversion of land for agriculture can have catastrophic impacts on natural ecosystems and can drastically reduce biodiversity, especially in the tropics. However, different crop cultivation methods have different effects on biodiversity, with ecologically sympathetic production and management regimes often exhibiting the lowest species loss [1]. Madagascar's vanilla plantations are one example of a valuable cash-crop where large areas of forest have been converted to agroecosystems. However, the impact of vanilla production on Malagasy biodiversity is unknown. Much of the world's vanilla is produced in Madagascar's north-east SAVA region using a variety of cultivation methods, ranging from small-scale plantations grown in and around existing forests, to large intensively-farmed plantations grown on an industrial scale. We undertook a series of rapid biodiversity assessments of vanilla plantations (n=17) in the SAVA region. At each plantation, we surveyed the species richness of plants and vertebrates. Surveys were also performed in nearby natural forest fragments (n=9), to act as uncultivated controls.

We observed over 500 plant species and nearly 200 vertebrate taxa. Plant and animal species richness tended to be lower in plantations compared to natural forests, suggesting that conversion of forest to plantation was detrimental to biodiversity. However, the location and management regime of different plantations had significant impacts on resident flora and fauna. Species richness for both plants and animals was significantly higher in traditionally maintained vanilla plantations grown in or adjacent to natural forest fragments, compared to more intensively farmed, anthropogenic sites. Vanilla plantations also harboured numerous threatened animal species (n=9), suggesting that they are valuable habitats for these taxa. The most surprising result was the observation that five different species of lemurs inhabited vanilla plantations [2,3], including the newly described dwarf lemur *Cheirogaleus shethi* [2]. Lemurs were significantly more likely to be found in traditionally maintained plantations compared to intensively farmed sites [3]. While vanilla plantations may not be ecological substitutes for pristine forests, we show that they harbour significant levels of biodiversity, particularly when maintained with ecologically sympathetic management techniques. Appropriately managed and located vanilla plantations therefore act as viable habitats for many species, including primates. Given their financial worth, creating vanilla plantations may provide a more profitable and sustainable way for local people to use and potentially expand existing forests, rather than the traditional slash and burn removal of forest for other agriculture or grazing.

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## Scenario-based modelling of local land-use policy choices to achieve No Net Loss of wetland functions in the face of cumulative impacts

(Oral)

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Going beyond project by project approaches to biodiversity offsetting is challenging and local governments are struggling to find ways to achieve the no net loss (NNL) goal at the landscape level. In the Grenoble area (French Alps), land-use change was modelled, up to 2040, based on recent dynamics of urban expansion. We added offsetting of the impacts of urbanization on wetlands to the model, to investigate the consequences of various types of offsetting. In particular, we studied the effects of a recent shift towards "functional" loss-gain metrics to demonstrate ecological equivalence and NNL, rather than area-based calculations, and towards offsetting within the sub-catchments where impacts occur. Simulations were based on spatially-explicit modelling and take into account existing planning rules and recommendations to guide the location of offsets.

Two mechanisms were tested for offset implementation: (a) case-by-case compensation where each developer compensates its impacts, resulting in many restored wetlands of various sizes distributed across available land, and (b) an aggregated approach where larger sets of adjacent parcels of land are used to compensate for several projects at once, generating larger wetland units. In addition, two different methods for sizing offsets were compared: (i) an area based method whereby a coefficient is applied to the impacted area to determine offset size, and (ii) a method where losses and gains of ecological function are calculated and offsets sized so as to generate enough gains to achieve functional NNL. Wetland function was assessed using detailed information on agricultural practices (rotations) and expert opinion from agronomists and ecologists. Mechanisms and methods were combined into four biodiversity offsetting scenarios, and 5000 simulations were run for each. A sensitivity analysis of several methodological choices was carried out.

Results show that a focus on wetland area leads to net losses of wetland function from development. Current regulations for wetlands, mixing a focus on area and functions, lead to better results than the area-based approach with a net gain of ecological function. With a function based approach the NNL goal can be met on a smaller offset area. Finally, aggregated offsets also achieve NNL but need more area, given the constraints of restoring neighboring parcels. Aggregated offsets are increasingly recommended and used worldwide to ensure longer-lasting biodiversity gains from more ambitious and larger-scale restoration projects, and to enable stronger governance to be put in place, as monitoring and enforcement is easier on a single offset site. Striking the right balance between case-by-case and aggregated function-based biodiversity offsets should lead to improved outcomes for maintaining or restoring wetland functions within watersheds, so as to enable them to provide necessary ecosystem services.

2018/06/13

11:30

Room: K301 Felix



## Case Palsa mires in Arctic areas

(Oral)

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Abstract of this presentation is not public



## Lower parasite pressure – as compared to native ones – may contribute to success of invasive freshwater mussels

(Oral)

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DOI: -

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Freshwater mussels (Unionoida) are among the most imperiled animals on Earth. Invasive mussels pose a significant threat to native mussel species. Enemy Release Hypothesis (ERH) explains the success of invasive species by lack of enemies. ERH suggests that invasive species are ‘released’ from their natural enemies – such as parasites – when they leave their home range. Thus, in the new, invaded range they do not need to pay the cost of parasitism, giving them an advantage in competition with the native species that are suitable hosts for the parasites present at the new, invaded habitat. Prerequisite for ERH is that parasites are prevalent and harmful. First, we present results, based on own studies and literature, (i) on the prevalence and abundance of parasitism in freshwater mussels, and (ii) on the effects of parasites on their mussel hosts. A variety of parasite taxa is infecting freshwater mussels including ciliated protozoans, ergasilid copepods, oligochaetes, chironomids, nematodes, watermites, trematodes and fishes. For example, watermites are very common in practically all mussel species. Larval watermites encysted in the mussel tissues can occur in thousands of individuals per mussel. Sporocysts of bucephalid trematodes can decrease the growth, reproduction and survival of mussels, or completely sterilize the mussel host. Prevalences of bucephalid infections are usually less than 10 % but can be as high as 70-90 %. In general, the evidence that is available about parasitism in freshwater mussels points to a potential negative impact and frequent occurrence of parasites – a necessary condition for ERH. Therefore, if invasive mussels are released from parasitism, as suggested by ERH, parasitism may favor the invasive mussels and contribute to their success. Second, we compare the occurrence and prevalence of parasites in invasive and native freshwater mussels (from same site) from several locations throughout Europe (Estonia, Poland, Italy). The mean number of parasite taxa and the mean sum of prevalences of infection were significantly lower in the invasive mussels (*Dreissena*, *Sinanodonta*, *Corbicula*) than in native mussels (*Anatina*, *Unio*). For example, the asia clam, *Corbicula fluminea* was completely free of any parasites.

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## The effect of natural habitat and human activities on large cat's predation risk in a tropical landscape: including spatial and temporal scales in a two-dimensional approach

(Oral)

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Livestock predation by large cats represents a threat both to livestock production and to large cat conservation when retaliation occurs. Therefore, understanding the factors that influence the occurrence of attacks and their spatial distribution has become an important task for conservation managers. However, the importance of spatial and temporal scales has often been overlooked. In this study, we investigated the risk of attack on livestock by large cats while selecting the appropriate temporal and spatial scales at which these attacks occur. We collected geospatial data on attack and non-attack sites (2011-2015) in the region of Calakmul, which hosts the largest population of jaguars in Mexico, and obtained additional information relative to livestock management through 165 interviews with ranchers. We derived ecological and anthropogenic variables from two land-use maps (2000 and 2015) at four scales relevant for large cats (0,5 km, 2,5 km, 5 km and 10 km-radius). We built two sets of models, one expressing the potential effects of landscape characteristics (structural and functional), and the other expressing the potential effects of human pressure (human population, land use, and livestock production). Following an information-theoretic approach that integrates spatial correlation, we selected the appropriate temporal and spatial scales and then applied a hierarchical selection of our models. Five variables were best explained at a specific spatial scale, while the amount of forest in 2000 appeared more important than the amount of forest in 2015. The species of livestock raised was by far the main determinant of attack in the region, with sheep particularly at risk, which prompted us to integrate this variable into every models. Attack occurrence in the region was best explained by the functional characteristics of the landscape that included the fragmentation process; the effect of human pressure was of lower importance. This study, based on a robust approach using on state of the art procedures in landscape ecology, shows the importance of incorporating multiple spatial and temporal scales. It also highlights the benefit of using a two-dimensional approach to support conservation management measures at the appropriate organizational level. For instance, livestock management might be better addressed at a community level, whereas landscape fragmentation will be better tackled at a regional or state level.



## Adapting nature conservation to climate change: the importance of microclimate

(Oral)

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Over the last 15 years bioclimate models have been widely used to predict ecological responses to climate change. Results from these models suggest catastrophic consequences for life on earth, but to date, climate change has been implicated as a major cause of the extinction of just a few species. Mounting evidence from palaeoecology provides a compelling explanation for this discrepancy. Many species survived periods of rapid climate change in microrefugia: locations with suitable microclimate that would be missed entirely by coarse-scale bioclimate models. However, research in this emerging field has been hampered by a limited ability to model climate change at a sufficiently fine resolution.

Here I present models that can be applied to provide accurate fine-grained, multidecadal estimates of climate change based on the underlying physical processes that influence microclimate. I apply the models to project historic distributions of 321 plant species forward to the present day and compare the results to those obtained using coarse-scale climate data. I show that the results of bioclimate models are fundamentally linked to the grid cell resolution of the data used to drive them. Models that rely on coarse-resolution spatial associations between species distributions and climate variables predict major range shifts, whereas fine-scale models predict localised patterns of change that more closely match observed distribution shifts. The results suggest that, while the predicted proportional change in climatically suitable habitat is not strongly scale-dependent, the prediction from most existing bioclimate models: that the trailing edge of species will retract rapidly over large distances, is likely to be false. This is further supported by a comprehensive multi-taxa meta-analysis of observed range shifts. While range expansions are widely documented in the literature, evidence for range retractions is, at best, equivocal. In consequence, the redesign of protected area networks to accommodate large-scale range shifts may be less effective than focusing on protecting populations of species within their existing geographic range.

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## Potential for restoration of temperate deciduous forest by thinning of mixed forests on abandoned agricultural land

(Oral)

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The highest pressure biomes globally include the temperate deciduous forests (TDFs) of Europe (1). This biome has declined mainly due to agricultural land-use (2), and only small and isolated remnants exist today. Conservation and restoration are thus urgent priorities, and following the Nagoya protocol ratifying countries have committed to restore 15 % of degraded ecosystems within 2020.

The temperate deciduous forest biome is of outstanding importance for biodiversity, but presently covers only a small fraction of its former distribution area in Europe. Most land within the former distribution of TDF is under continuing high pressure from agriculture. However, recent and ongoing abandonment of marginal agricultural land in S Scandinavia (3) may represent a window of opportunity for restoration of TDF.

In Scandinavia, the recent, often mixed, forests often have closed canopy due to spruce succession, which may decrease biodiversity and ecosystem services associated with (semi-) open habitats, such as pollination. I will present data on the area of convertible recent forest with temperate deciduous trees in Norway and Sweden based on the National forest inventories. I will also report results from a field experiment on the economy of conservation-oriented thinning in this kind of forest. and 2) to evaluate the economic revenue and costs of partial cutting based on 26 field trials, 13 in Norway and 13 in Sweden.

The area of forest suitable for restoration according to our method implies a potential increase of TDF by about 100000 ha totally in Norway and Sweden should the whole area be restored. However, the geographical distance among sites and the possibility to combine the harvesting with other forms of forestry may be limiting factors and should be studied. Further, there are differences among the sites in terms of forest composition and structure and operating conditions, which means there is a significant variation in the cost of the thinning and the value of the wood. Our data indicate that sales of wood from the initial cutting may compensate the costs, but revenues may be limited. Subsidies to the land-owners may therefore be needed to stimulate activity.

In addition I will briefly mention potential effects on biodiversity. Based on published studies of similar forestry actions, I suggest that our restoration measures may have positive effects on biodiversity of several organism groups.

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2018/06/13

11:45

Room: K301 Felix



## Case Zonation and forest biodiversity

(Oral)

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Abstract of this presentation is not public



## Biodiversity offsets implementation in Sweden – a practitioner's view

(Oral)

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Implementation of biodiversity offsets is increasingly being applied in Sweden - primary as an instrument to mitigate the rapid loss of natural habitats due to various exploitation projects. Being one of the leading practitioners in biodiversity offsetting in Sweden Enetjärn Natur draw upon several years of practical experiences and knowledge gain in the design and development of such projects. Here we present crucial aspects that need to be taken into account when implementing biodiversity offsetting during the start-up, design, management and follow-up phases. Focus is on experiences from various biodiversity-offset projects carried out in Sweden during the last 10 years. Among the aspects considered are; judicial conformation, the need rigid evaluation/calculation models, management tools including restoration, and well-developed, research-based follow-up programs. Knowledge sharing and close contact between different stakeholders, including practitioners and researchers, form the basis for successful implementation of biodiversity offsetting - considering the complexity and the variety of conditions under which they develop.

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## Lessons learnt from industry: achieving net gain outcomes for biodiversity

(Oral)

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Development plays a major role in stopping biodiversity loss. But the ‘silo species’ protection of legislation (where certain species are protected while many are not) means that development can be legally compliant yet cause biodiversity loss. Biodiversity Net Gain (BNG) policies can help overcome this by requiring that development causes no overall loss of biodiversity and brings a benefit. However, offsetting biodiversity losses in one location with gains elsewhere is controversial because people suspect it to be an easy way for developers to buy their way out of conservation requirements. Yet the good practice principles (GPP) of offsetting provide several advantages over existing legislation for protecting biodiversity from development. This presentation describes the learning from implementing BNG approaches based on GPP. It regards major upgrades of the UK’s transport networks, which involved removing vegetation in order to construct and safely operate new infrastructure. While low-lying habitats were retained, habitats disrupting the running or safety of transport networks could not. Consequently, achieving BNG within the transport corridor was not possible and offsetting was required. The first lessons learnt were on obtaining commitment from business leaders to go beyond legislative requirements and deliver BNG, and on the institutional change necessary to embed GPP within daily operations. These issues were addressed by overcoming the challenges that biodiversity poses for business including: biodiversity cannot be measured easily unlike other sustainability factors (e.g. carbon, water) that have metrics for target-setting and measuring progress; and, the mindset that biodiversity costs money and does not generate cash in return, which is the opposite of carbon for example, where people can see how sustainability actions save money. Challenges were overcome by presenting the GPP as a cost-efficient solution to critical risks facing the business that also boosted reputation, and by using government-issued BNG metrics to develop toolkits charting BNG progress whilst ensuring that BNG decision-making was based on rich ecological data. Institutional change was best achieved by supporting, mentoring and training sustainability/environmental managers for these ‘frontline’ staff to embed GPP within the business. The second learning was from business partnerships with local wildlife groups where development supported their priorities for nature conservation, and where these groups had a say in decisions about achieving BNG. This inclusive approach enabled multi-sector collaborations to manage trade-offs between achieving BNG locally to the development whilst contributing towards national conservation priorities. But key was strengthening linkages between biodiversity measures implemented for development and conservation work undertaken by local organizations so that developers support BNG initiatives that really count.



## NEEDS FOR LEGISLATION AND AWARENESS TO COMBAT WITH INVASIVE ALIEN ORNAMENTAL PLANTS

(Oral)

**Ahmet Uludag<sup>1</sup>✉, Zubeyde Filiz Arslan<sup>2</sup>, Necmi Aksoy<sup>3</sup>, Ayse Yazlik<sup>2</sup>**

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Ornamental plants are one of the main necessities of human being who lives in big cities and as one-person families. Ornamental plant sector has been growing not only developed countries but also developing countries. These plants are known among the main pathways of biological invasions, which is one of the main drivers of biodiversity loss. Turkey with over 12000 plant taxa and being the crossroads of three biogeographical regions is considered an important source of plant biodiversity. The aim of this work is to overview current situation of alien ornamental plants (AOP) in flora in Turkey and show possible threat for future and discuss measures should be taken using literature as well as related acquis related. Among alien species in Turkey, 225 species (66%) are ornamental plants which are mainly intentionally introduced. Furthermore, 40 ornamental species that have already planted in Turkey is considered possible invasive species. There is no any dedicated act on invasive alien species. Outputs from activities related to invasive alien plants are not visible. Only two plant species are included in Agriculture Quarantine Regulation. Pest risk analyses results are not shared with general public, which are also tools for awareness creating in general public. “Code of conduct on horticulture and invasive alien plants” that was prepared in Europe with collaboration of stakeholders has not been translated into Turkish. The number of alien species is expected to increase due to changing living habits and increasing AOP imports. It is clear that biologic invasions in Turkey will be bigger problem and Turkey will have difficulty to meet CBD requirements until 2020 due to deficiencies mentioned. Being one of the main invasive alien plant pathways, AOP should be handled more carefully, acquis prepared and keep communication channels open among all stakeholders from policy makers to consumers.

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## Valuing chaos – new policies for disturbed forests

(Oral)

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A significant amount of global forests is affected by natural disturbances and subsequent post-disturbance logging to ‘salvage’ some of economic returns. Such salvage logging occurs in all types of forests, including protected areas. The present talk reviews extents and motivations for salvage logging in protected and unprotected forests globally. Motivations for salvage logging are mainly economical, followed by interests of pest control. To reduce biodiversity loss caused by salvage logging five key policy reforms are necessary: (1) salvage logging must be banned from protected areas; (2) forest planning should address altered disturbance regimes for all intact forests to ensure that significant areas remain undisturbed by logging; (3) new kinds of integrated analyses are needed to assess the potential economic benefits of salvage logging against its ecological, economic, and social costs; (4) global and regional maps of natural disturbance regimes should be created to guide better spatio-temporal planning of protected areas and undisturbed forests outside reserves; and (5) improved education and communication programs are needed to correct widely-held misconceptions about natural disturbance regimes. Also, we argue that prominent forest certification organizations such as the Forest Stewardship Council (FSC) and Programme for the Endorsement of Forest Certification (PEFC) valuing set asides of naturally disturbed forests as ecologically sustainable forest management to protect biodiversity and natural processes.

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## Assessing global tourism visitation of Important Bird Areas by using social media data

(Oral)

**Anna Hausmann<sup>1</sup>✉, Tuuli Toivonen<sup>1</sup>, Christoph Fink<sup>1</sup>, Vuokko Heikinheimo<sup>1</sup>, Henrikki Tenkanen<sup>1</sup>, Stuart H.M. Butchart<sup>2</sup>, Thomas M. Brooks<sup>3</sup>, Enrico Di Minin<sup>1</sup>**

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Tourism is among the fastest growing industries worldwide and protected areas are among the main attractors for tourists seeking nature-based experiences. Nature-based tourism provides opportunities (e.g. by generating financial incentives and socio-political support for management and conservation), but also generates threats (e.g. by increasing human pressure and disturbance) to biodiversity conservation in protected areas. Information about human use and visitation, as well as threats related to human activity, in protected areas is key for informing sustainable management. Yet, such information at a global scale remains scarce and collecting new data is expensive.

We live in the Information-age, where a wealth of digital information is becoming increasingly available thanks to the widespread use of technologies, such as smartphones. Web-sharing platforms, such as social media, are growing popular worldwide, and tourists use them to actively share their experiences (through pictures, text and videos) while visiting protected areas. Data mined from social media can provide novel approaches to explore human activities and use of protected areas worldwide, and inform conservation science and practices. In this study, we use social media data from Twitter, Instagram, and Flickr to assess global patterns of human use in 12,765 Important Bird and Biodiversity Areas (IBAs). We hypothesize that attractiveness of the IBA increases the likelihood of posting and that social media postings intensify in areas where threats to biodiversity are high. We found that European and Asian IBAs had highest social media density compared to other continents. Using generalized linear models, we found that both species richness, habitat type (IBA attractiveness), accessibility and human footprint (used as threat proxy) best explained social media postings in IBAs, although the effect of each variable varied across different continents. In addition, we identified countries where IBAs are more (14% of all IBAs, mostly in Europe and North America and Asia) or less (16% of all IBAs mostly in Africa and Australia & Oceania) exposed to visitation pressure. Results provide new understanding of the use of fine scale data from social media to assess both popularity (recreational value) and, potentially, exposure to human pressure in priority sites for the persistence of species globally.

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12:00

Room: K301 Felix



## Monitoring biodiversity change through effective global coordination

(Oral)

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Abstract of this presentation is not public

2018/06/13

12:00

Room: A2 Wivi



## Linking forest bird diversity to post-fire salvage logging in European boreal forest

(Oral)

**Grzegorz Mikusinski<sup>1</sup>✉, Grzegorz Hebda<sup>2</sup>, Michal Zmihorski<sup>3</sup>, Tommy Abrahamsson<sup>4</sup>, Sönke Eggers<sup>3</sup>, Johan Månsson<sup>5</sup>**

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Abstract of this presentation is not public



## Artificial feeding of wildlife: where do we go?

(Oral)

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Food provisioning to wildlife is an issue of increasing conservation concern due to its consequences on species and ecosystems. Humans have increased the amount of food available to wildlife and its spatio-temporal predictability; about 30–40% of all food produced in the world is wasted (1). One of these practices, quite widespread, is the artificial feeding of game animals. Here, we take the brown bear *Ursus arctos* as a model species to review the magnitude of artificial feeding in Europe and the documented effects on the ecology and behavior of the species. In most of the European countries where brown bears are hunted, artificial feeding is applied, mostly to facilitate hunting. However, official justifications include keeping bears away from human settlements, preventing damages and other conflicts, monitoring the population status and trend, increasing the habitat capacity, allowing medical treatment and facilitating photographing. In countries where bears are not hunted, although they are not officially fed, they intensively use the artificial food provided for ungulates. Over decades, the amount of food served to bears both intentionally and unintentionally keeps increasing. Moreover, the number of feeding sites is also on the rise and artificial feeding is moving from feeding in certain emergency situations to an almost year-round feeding (2). In many European countries this practice is completely unregulated or the rules are often violated. Bear feeding for photographing is in most countries out of control. Corn, beetroots, grain, carrots and even leftovers from the markets are often found in the forest to feed bears and other wildlife. Recent scientific evidence shows that this practice causes profound changes in the ecology and behavior of bears (i.e. 3). Researchers have documented changes in bear diet, alteration of movements, disruption of winter denning, increases in bear body mass, earlier sexual maturity of females and facilitation of pathogen transmission at feeding sites. The provision of artificial food to bears is conducted at country or regional level, not at the population level. So, often bears are artificially fed on one side of the border, but not on the other. The rules for feeding, when exist, are different on neighboring countries. At least ten countries in Europe feed bears for hunting, three for viewing and photographing and at least 18 countries feed bears unintentionally with food provided for ungulates. We present the results of a comprehensive survey of all European countries and discuss the potential strategies to tackle this issue.

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## Enhancing conservation of traditional rural biotopes through spatial targeting of management actions - a practical challenge

(Oral)

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Traditional rural biotopes (TRBs), which are biologically and culturally valuable habitats maintained by low-intensity grazing and mowing, are a core element of biodiversity in Europe. During the last decades, TRBs have faced severe habitat loss and fragmentation due to agricultural modernization. Despite their well-known critical state, their conservation remains inadequate, thus raising a need to promote TRB conservation via spatial land-use planning. In an earlier study (1) we analyzed a GIS database on Finnish TRBs in order to examine how the current TRB network can be complemented in terms of conservation value based on known ecological characteristics. Given different target scenarios for the amount of managed TRBs, we demonstrated where management should be directed to on national level. We concluded that in current state, biodiversity depending on TRB management is not efficiently sustained in Finland. Substantial amount of TRB habitats and populations of threatened TRB species are left unmanaged. Based on our results, we suggested that to advance TRB conservation in Finland, the cover of managed TRBs should be doubled and extended to form ecologically functional networks. However, it is well-known that although spatial prioritization techniques are highly effective at identifying where important areas for conservation are located, they are of limited use for deciding how implementation of conservation actions should be undertaken (2). To overcome this research-implementation gap, we conducted the prioritization analysis as a part of developing a national agenda for management of protected TRBs in Finland (3). In this oral presentation, we will discuss how the spatial targeting can be brought into practice, for example by developing regionally defined management targets and site-specific prioritization criteria. The criteria that link the spatial prioritization to site-level management decision-making include GIS features such as occurrences of red-listed species and habitats, but also more practical issues such as the feasibility of grazing arrangements are important to be considered. On landscape level, it seems to be beneficial for both planning and practice to target management to sites that are relatively large in their size, and well connected to existing managed sites.

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## The importance of refuges in buffering landscapes against extreme heat events

(Oral)

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Refuges provide short-term relief from adverse situations and as such are mostly relevant for mobile fauna. For example, tree hollows may provide relief from heat waves. They therefore differ from microrefugia, which facilitate the long-term persistence of biota under environmental change by providing more stable conditions. Because extreme heat events are becoming more frequent, temperature refuges are important for conservation under anthropogenic climate change. Several microhabitats can considerably buffer extreme temperatures and may hence assist the persistence of biota. Here temperature buffering provided by three important microhabitats (tree hollows of *Eucalyptus oleosa* [Myrtaceae]; cavities formed by the leaves of the grass-tree *Xanthorrhoea semiplana* [Xanthorrhoeaceae]; inside the leaf-litter) during extreme heat events in the Mediterranean climate of South Australia is quantified. Each microhabitat significantly buffered against high temperatures and low relative humidity, compared to external sensors. They reduced daily temperature variation, cooling day temperatures by 1–5°C and warming night temperatures by 0.5–3°C on average. Maximum temperatures were up to 15.1°C lower. The buffering by microhabitats increased at a rate of 0.2–0.6°C per 1°C increase in ambient temperature, meaning that maximum buffering capacity was reached during the hottest periods. For tree hollows, the capacity to buffer temperature increased with depth, suggesting that old trees with deep hollows are important in facilitating the persistence of fauna during extreme weather events. Furthermore, greater canopy cover increased the amount of microclimatic moderation provided by the microhabitats. Our study highlights the importance of microhabitats and canopy cover in buffering extreme heat events. However, this is currently not considered in species distribution modelling under anthropogenic climate change nor in the management of vegetation.



## Allocation and size of conservation measures in a production boreal forest landscape: insights from applying the Delphi technique

(Oral)

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This study aims to assess the effects of spatial allocation and size of individual conservation measures on provision of ecosystem services and preservation of biodiversity in a production forest landscape. Since it is difficult to get a complete picture of the long-term outcome using only empirical studies, we combined simulations with an expert assessment method – the Delphi technique. Using data from a forest landscape of 15000 ha in central Sweden we constructed seven scenarios. In all of them 2% of total area is allocated to each of the following measures representing untouched areas of different sizes: nature reserves (approximately 100 ha each), set asides (less than 50 ha each) and groups of retention trees. In six scenarios additional 10% of total area was allocated to one of the three categories either dispersed around the whole landscape or concentrated in a sub-landscape (the latter constitute approximately 30% of the studied landscape). In the seventh scenario rotation of production areas was extended so that net present value was comparable to that of other six scenarios. We then simulated development of each scenario for 100 years using Heureka – a Swedish forestry decision support software.

We employ the Delphi technique to investigate seven constructed scenarios for provision of several ecosystem services and maintenance of biodiversity. The technique represents a moderated group communication process in which participating experts independently of each other fill out an online questionnaire in a series of rounds. The experts are scientists who have been working in the field of either forest biodiversity or selected ecosystem services in the boreal zone of Scandinavia. They are provided with information about the studied landscape and outputs from simulations of forest development during the next 100 years in form of maps and figures. For each question experts also are asked to provide a confidence rating they have in their answer as well as record comments that could be helpful in explaining their answers to others. The latter is particularly important since there is no direct interaction between experts (each of them communicates with the moderator only). After each round the moderator sends to experts a report summarizing group results and comments from previous round together with the updated questionnaire. After they have studied the materials they are invited to reconsider their answers in the light of group summary (change in answers is up to the participant). The process continues until stability in answers is reached.

We will discuss: a) which size of unmanaged areas is considered best for different services; b) which strategy is considered more beneficial for services: dispersed or concentrated; c) degree of agreement between scientists and levels of confidence they have in their estimates; and d) factors that could explain range of obtained estimates.



2018/06/13

12:15

Room: K301 Felix



## Developing effective coastal habitats mapping utilizing high resolution satellite images

(Oral)

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Abstract of this presentation is not public



## Non-native trees alter biomass and nutrient availability in mountain streams of the Cape Floristic Region, a global biodiversity hotspot

(Oral)

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The invasion by alien trees of riparian zones may lead to significant alterations in the amount and timing of leaf litter inputs to freshwater ecosystems, consequently affecting stream ecological functioning. Invasive Australian Acacia tree species are among the most harmful of invading species in the Cape Floristic Region (CFR), a global biodiversity hotspot [1]. Blackwattle (*Acacia mearnsii*) are leguminous nitrogen fixers, making significant contributions to available biomass and nitrogen in their new habitats [2]. To-date the amount, nor the timing of additions of biomass and nutrient are known. This study assessed patterns of leaf litterfall, Biological Nitrogen Fixation and nutrient resorption (N and P) capacities of *A. mearnsii* and two native co-occurring species in two perennial streams in the CFR. Instream leaf litter decomposition and macroinvertebrate herbivory experiments were conducted. The results indicate significant riparian zone effects in terms of biomass and nutrient input. The annual leaf litterfall of *A. mearnsii* in riparian zones was nearly nine times greater compared to native vegetation, and *A. mearnsii* leaves were dropped twice a year, in mid-summer and mid-autumn, whereas natives dropped their leaves only once. *Acacia mearnsii* also retained significantly higher N concentrations in leaf litter than the native species throughout the year. The co-occurring native species were efficient at resorption of nutrients, on par with global averages. In contrast, *A. mearnsii* N resorption was low. In stream, invasive species leaf litter decomposed at a significantly faster rate than that of fynbos species, which was explained by differences in litter quality between species. This suggests that the structurally simpler and higher nutrient containing *A. mearnsii* leaf litter was preferred by macroinvertebrates. This study highlights the potential of a single alien plant species to disrupt multiple ecosystems, and provides insight to the ability of invaders to disrupt vulnerable Mediterranean-type ecosystems by creating their own environment.

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## Global implementation of biodiversity offsets - what do we know so far?

(Oral)

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‘No net loss’ (NNL) biodiversity conservation policies are increasingly widespread, and yet highly controversial – and this is particularly true of biodiversity offsets (a key component of achieving NNL). But there have precious few multinational assessments concerning the actual outcomes of implementing NNL policy globally. Such assessments are sorely needed in order to facilitate more informed debate, and confirm or refute the validity of NNL as conservation policy.

Starting with the historical emergence of NNL type policies, and their subsequent geographic and temporal spread worldwide, I will provide an overview of what is currently known about the practical implementation of biodiversity offsets. The talk will incorporate findings from (1) our attempt to build a first global dataset of biodiversity offset implementation, (2) our recently published study into problems with data transparency for offset implementation in Europe, and (3) the wider literature on NNL implementation.

Consequently, I will explore key characteristics of the aforementioned data – such as biodiversity offset activities (e.g. restoration vs. avoided loss), and key habitat targets – considering trends and implications for conservation through NNL policy. Finally, I will discuss some key open questions related to the implementation of effective biodiversity offsets, looking towards possibilities for a quantitative assessment of the outcome of NNL policies more broadly.

This proposed talk deals directly with an area of interaction between ecological science and management, relating to one of the key sustainability challenges of our time – how to dissociate biodiversity loss from economic development. Furthermore, it sets the scene for the remainder of the symposium.

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## Effects of habitat quality and fragmentation on Woodlarks (*Lullula arborea*) and their invertebrate prey in intensively managed vineyards

(Oral)

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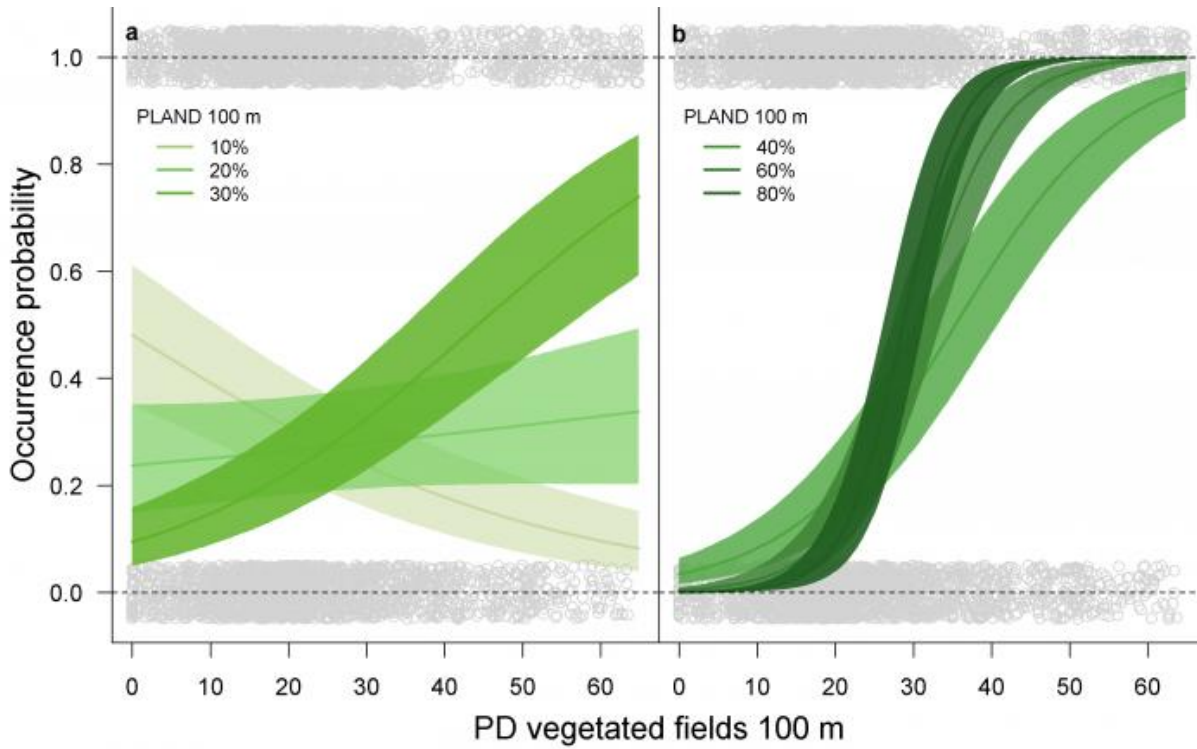
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Vineyards in Switzerland are among the most intensively managed perennial crop systems. The vast majority of all parcels are treated with herbicides and do not have any ground vegetation cover, whereas only a small proportion of vineyards is managed extensively, allowing ground vegetation to grow. These contrasting management types lead to a fragmented and almost binary system of few vegetated parcels embedded within herbicide-treated ones. The Woodlark (*Lullula arborea*) is an endangered insectivorous bird species, which has its Swiss stronghold in this intensively managed agroecosystem. In a first study we assessed Woodlarks' habitat preferences during territory settlement and linked the birds' occurrences to their invertebrate prey. Woodlarks showed a clear preference for vegetated vineyard parcels with higher abundances and richness of invertebrate prey but also increased plant richness. Given the importance of invertebrates for Woodlarks, we investigated the scale-explicit effects of fragmentation (number of vegetated patches) and habitat amount (area of vegetated patches) on invertebrate abundance, in a second study. Our findings demonstrate that (fine-scaled) habitat amount and (broad-scaled) fragmentation directly impede the movement of invertebrate prey, as in areas with less vegetated area, scattered into many single patches, abundance was strongly decreased. Further, a multi-scale habitat selection analysis based on Woodlark telemetry data (36 birds), revealed that, inter alia, habitat amount and fragmentation showed an interdependent effect on Woodlarks' habitat use. This is, in areas with low habitat amounts (<20%), fragmentation negatively affected Woodlark presence, while in areas with higher amounts of vegetated surfaces, fragmentation even positively influenced occurrence probability (Fig. 1). This indicates that, given enough available habitat, the birds prefer a certain habitat heterogeneity on a home range scale. Further, we found positive effects of steppe habitats and forests being present within their home ranges. Our results thus suggest that the installation of a network of well-connected vegetated vineyards with increased plant richness, but which do not cover 100% of the home range surface, may promote the abundance of invertebrate prey and ultimately improve the habitat matrix for insectivorous species such as the Woodlark. Also, this matrix should include semi-natural habitats such as steppes and forests, which need to be protected from further conversion and fragmentation.



**Fig. 1.** Interdependent effects of habitat amount (PLAND) and fragmentation (PD) on Woodlarks habitat selection. If habitat amount is low (< 20%, light green curve), Woodlarks prefer aggregated patches of vegetated vineyards. On the other hand, if habitat amount is high (> 30%), the birds select for areas where vegetated vineyards are distributed heterogeneously (positive effect of fragmentation).



## Attraction, avoidance or indifference: How fauna respond to edges in fire-prone landscapes

(Oral)

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We know quite a lot about how animals respond to edges in modified and fragmented landscapes, but what do they do in natural systems when edges are created by fire? Are some animals attracted to burnt edges? Or is it safer to avoid them completely?

Edges are ubiquitous, highly influential environmental features. They are ecologically important because they influence a wide range of patterns and processes that affect the distribution and movement of many species. However, we currently know very little about fire as an agent of edge creation, how fire edges change spatially and temporally, or how fauna respond to these landscape features.

This study was conducted in mixed eucalypt forests in South-Eastern Australia. Our primary goal was to quantify how fire edges influence activity patterns of forest-dwelling mammals, and how these patterns change over time. We used a chronosequence of prescribed burns (0-7 years post-fire) and long unburnt control locations (76 years post-fire) to test species response to fire edges over time. We predicted that native mammals, particularly those with behaviors strongly linked to ground level vegetation complexity would indicate activity patterns that closely followed patterns observed in the regenerating vegetation. In contrast, we predicted that the response of feral predators (cats and foxes) would be the opposite, with high activity levels on the burnt edge immediately after fire, as these species commonly prefer open and disturbed habitats.

We used linear mixed models with normal errors when habitat complexity was the response variable being investigated. When animal activity was the response variable we used generalised linear mixed models with binomial errors. We also assessed the congruence between changes in habitat complexity and animal activity across an edge over time, using Vanderploeg and Scavia's Relativised Electivity (Lechowicz 1982).

Habitat complexity was lower on the burnt side of the edge up to two years post-fire, higher in year three, and similar to the unburnt between 6-7 years after fire, indicating rapid vegetation regeneration three years post-fire. Small mammals avoided burnt edges for up to 6 years post-fire, while medium and large mammals either showed no edge effect or were attracted to regenerating burnt edges 1-2 years after fire. Predators were attracted to the burnt edge immediately after fire, with this effect decreasing 1-2 years post-burn.

Earth is intrinsically flammable, with wildfires predicted to increase in extent and severity as a result of climate change. In response to this, prescribed fire is increasingly applied as a management tool globally. Understanding how fire edges alter animal movement patterns over time is important for the conservation of species in fire-prone regions and can lead to improved management of biodiversity in flammable systems.

Reference:

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UNIVERSITY OF JYVÄSKYLÄ



## Challenges of achieving biodiversity offset outcomes through agri-environmental schemes: evidence from an empirical study in Southern France.

(Oral)

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Environmental policies increasingly refer to biodiversity offsets (BO) as a way to slow down or halt biodiversity losses caused by development projects, including infrastructure and urban development, that could not be avoided or minimized through adequate mitigation. In many cases, ecological gains for offsets are obtained through restoration activities conducted on ecologically degraded land, including agricultural land specifically acquired for this purpose by developers. This leads to competition with other land-uses and social conflicts over land availability. The purpose of this paper is to analyse the opportunity of implementing biodiversity offsets by involving farmers in producing ecological gains through contracts akin to agri-environmental schemes, we call Agri-environmental Biodiversity Offsets Schemes (ABOS). Using actual offsets designed and implemented for a new railway line under construction in Southern France, this paper examines (1) the acceptability of ABOS contracts by farmers, and (2) the effectiveness of ABOS design and actual implementation. A survey carried out with 145 farmers reveals that the main determinants of acceptability are: i) usual economic factors whereby farmers with lowest compliance levels and opportunity costs, as well as farms facing economic difficulty, are more likely to engage, and ii) social factors, such as the importance given to other farmers' decision to engage and the perception of the position of farming organisations (peer pressure). In terms of effectiveness, ABOS is shown to be effective in meeting the legal requirements of the developer, but concerns are raised about additionality and long-term duration of actions, and about non-compliance with contract requirements. We particularly highlight problems with contract enforcement – especially due to weak sanctions and monitoring – and farmers' selection that do not allow minimizing moral hazard and adverse selection which are inherently attached to agri-environmental schemes. We suggest policy improvements and research perspectives to enhance the implementation of offsets through ABOS. Overall, with current implementation arrangements, this analysis leads us to question the use of ABOS in meeting BO objectives in the long term.





## The distribution patterns, risk and potential effect of non-indigenous fish species of Hungarian waters

(Oral)

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Translocation and introduction of non-indigenous species might be considered as one of the least reversible human induced changes in nature. The background factors of a successful biological invasion are diverse; and the complete eradication of established invasive species seems practically impossible. The aim of our presentation is to (1) revise the trends and spreading mechanisms of non-indigenous species; (2) assess the potential ecological risk of new species in the catchment basin of a shallow lake (Lake Balaton, Hungary) and (3) to analyze the local and regional factors affecting the distribution patterns of gibel carp (*Carassius gibelio*), an effective invasive species of the region, based on recent case studies.

Hungary has a central position in the Danube water system and has a considerable fishery sector, therefore plays a crucial role in the spreading of non-native fish species. According to our literature review, the number of already identified non-indigenous species is more than 60, which is higher than the number of natives. The trends of new introductions seem to have increased recently, due to the uncontrolled aquarium fish releases. Recent (between 2011 and 2015) standardized nationwide surveys indicated that non-indigenous species occurred in 78.7% of 767 study sites. The most abundant species were gibel carp (*Carassius gibelio*) and topmouth gudgeon (*Pseudorasbora parva*). Their occurrence is strongly related to the presence of aquaculture facilities.

The ecological risk assessment of the Balaton-catchment was carried out by using the Fish Invasiveness Screening Kit (FISK), which proved that gibel carp and Ponto-Caspian *Gobiidae* posing the greatest threat.

Since gibel carp seems to be the most important invasive species, the relationship between abundance patterns, environmental conditions, management practices (within 11 lentic habitats), and also in long-term abundance changes (datasets from standard localities of Kis-Balaton Waterprotection System between 1986 and 2011) were analyzed. High abundances of gibel carp are strongly associated with habitat desiccation and also long-term analyses indicated that after a 'boom-bust' period, the abundance of the species might stabilize in a less disturbed system.

These results highlight the necessity of management interventions in invaded habitats as well as the development of a more effective national level (regional scale) controlling system. These may reduce the possibility of unintentional non-indigenous fish translocations between catchments.

This project was supported by the "GINOP 2.3.2 -15-2016-00004: Establishing the sustainable angling-aimed management of Lake Balaton."; the HORIZON2020 678396 TAPAS project and the "EFOP-3.6.3-VEKOP-16-2017-00008" projects. Árpád Ferincz and Ádám Staszny were supported by the Bolyai János Postdoctoral Fellowship of the Hungarian Academy of Sciences.



## Forests improve vulnerable children's diet in rural developing countries

(Oral)

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Micronutrient malnutrition affects about a third of the world's population. Children in developing countries are particularly vulnerable. Consequences include impaired cognitive and physical development and increased childhood morbidity and mortality. Recent studies suggest that forests help alleviate micronutrient malnutrition by increasing dietary diversity. However, evidence is mostly based on weakly designed local case studies of limited relevance to global policies. Furthermore, impacts of forests on diet vary among communities, and understanding this variation can help target actions to enhance impact. We compile data on children's diets in over 43,000 households across 27 developing countries to examine the impacts of forests on dietary diversity (measured with the Individual Dietary Score, a standard indicator of micronutrient adequacy). We use empirical designs that are attentive to assumptions necessary for causal interpretations and that adequately account for confounding factors that could mask or mimic the impact. We find that high exposure to forests causes children to have at least 25% greater dietary diversity compared to lack of exposure, a result comparable to the impacts of some nutrition-sensitive agricultural programs. A closer look at a subset of African countries indicates that impacts are generally higher for less developed communities, but highest with certain (not the lowest) access to markets, roads, and education. Our study establishes the causal relationship between forests and diet and thus strengthens the evidence for integrating forest conservation and management into nutrition interventions. Our results also suggest that providing households some access to capital can increase the impact of forest-related interventions on nutrition.



## Buffering of forest temperatures across the globe

(Oral)

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Climate change is affecting the phenology, distribution and performance of species across the globe. Yet, especially for species living in the shade of trees, lags in vegetation and animal responses have been reported. This effect might be attributed to tree canopies that buffer the temperature at the forest floor. However, we do not know how much understorey temperatures deviate from the macroclimate across the globe. A global analysis quantifying forest floor temperatures is lacking. Here we quantify temperature differences between forests and open areas, only retaining data from studies with a strict paired design: microclimate was quantified below trees vs macroclimate in the open. By compiling >50 independent studies from across five continents, we find that on average, forest-floor temperatures are buffered by c. 1.6 °C. Maximal temperatures are buffered much more (cooler by > 4 °C) than minimum temperatures (even warmer in the forest understorey, by c. 1 °C). We also find that the buffering capacity (decoupling) increases at warmer open-habitat temperatures. Such knowledge is key to better predict forest biodiversity and ecosystem responses to climate change.

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2018/06/13

12:30

Room: K301 Felix



## Finnish Ecosystem Observatory

(Oral)

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Abstract of this presentation is not public



## Restoring forests by bark beetle outbreaks – implications from mountain forest flagship species

(Oral)

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Although forest managers have tried to suppress natural disturbances, such as windstorms, wildfire and outbreaks of insect pests, climate change has led to increasing frequencies and intensities of natural disturbances in European mountain forests during the last decades. In addition to that, intensive human use altered European mountain forests over the last centuries, resulting not only in a loss of biodiversity and old-growth forest structures, but also in an enhanced vulnerability against disturbances. The impacts of natural disturbances on forest stands and the following succession can vary greatly and consequently species responses are difficult to predict. Using two species of conservation concern this talk illustrates the impacts of bark beetle infestations on biodiversity. We investigated the response of the foraging activity and roost selection of barbastelle bats (*Barbastella barbastellus*) in a forest disturbed by bark beetles. A combination of acoustic surveys, radio telemetry, and airborne light detection and ranging (LiDAR) was used to characterize *B. barbastellus* habitat use on different scales. In the same study area, we analysed the response of Capercaillie (*Tetrao urogallus*) and Hazel grouse (*Tetrastes bonasia*), to bark beetle outbreaks. We combined a 23-year time series of aerial photography with LiDAR data to quantify present-day forest structures as well as stand disturbance history to test the effects of natural disturbances on the probability of grouse presence as mediated by changes in forest structure. Our results increase our understanding of how to manage natural disturbances for species conservation and highlight the potential of post-disturbance biological legacies for maintaining and restoring biodiversity.

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## Common birds during winter in the face of urbanization, foraging ecology questioned thanks to an original citizen science scheme (BirdLab)

(Oral)

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Supplementary feeding of birds during the winter is a widespread phenomenon in temperate countries. While such practice can boost individuals' winter survival, not all species are likely to use bird feeders. We were particularly interested in examining if feeders on private gardens adjacent to areas impacted by agriculture could benefit farmland birds.

Since 2014, the French Museum of Natural History started an ambitious citizen science schemes named BirdLab to observe the bird communities and the intra- and inter-specific interactions on a pair of birdfeeders by asking participants to reproduce the movements (arrival, feeder switch, and leaving) of each bird on two identical birdfeeders (platform or tube), on their smartphone or tablet by drag and drop small characters representing species, for a protocol of exactly 5 minutes. Four seasons after, this with more than 25000 five minutes' samples that observe around 500000 birds of 27 easily recognisable species among the most common species that used the birdfeeders in France.

Thus, after work to verify that the expertise level of contributors does not affect the quality of data provided by this citizen science scheme, we use this big and well-standardised dataset to study winter bird diversity at feeders at the national level of France. In particular, we examine whether the proportions of artificial and agricultural territories, forests and semi-natural environments, wetlands and water areas in the buffer zone of 500 m around the feeders affect the avian diversity multifaceted indicators (as the number of visits, species richness, trophic index, and Shannon's index). As expected, the diversity of species recruited to feeders increases with the presence of natural elements in the gardens such as trees and edges but also it diminishes with urbanisation, and this even for low gradients of urbanisation. Nevertheless, our results point to a clear synergy between agricultural territories and urban areas around the gardens, with diversity increasing in urban areas adjacent to agricultural territories.

Our result supports the hypothesis that private gardens may participate in the conservation of declining farmland species, and with some precautions to limit the risks associated to the local increasing bird densities on feeders (predator attack, epidemic risk), they offer an alternative source of seeds to granivorous species, particularly in farmland intensive landscape which does not provide food for animals during the whole winter.

Furthermore, this innovative application and citizen science encourages reconnection to nature and allows highly standardized data production by novice naturalists. In addition, the data provided will make it possible to question the species interactions in the bird feeder context.



## The extinction risk for threatened species in protected areas: the case of the freshwater crayfish (*Austropotamobius pallipes*) in Italy

(Oral and Poster)

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### The extinction risk for threatened species in protected areas: the case of the freshwater crayfish (*Austropotamobius pallipes*) in Italy

When a species is endangered it's likely that there is a conflict of interests among stakeholders. This multidisciplinary study combines ethics, education, and conservation biology with the aim of promoting the conservation of the freshwater crayfish *Austropotamobius pallipes*. This crayfish is suffering a dramatic reduction throughout its distribution range, also in protected areas as in the Monte Barro Regional Park (Italy), where the introduction of an alien crayfish species (*Orconectes limosus*) in 2013 drove the local population of *A. pallipes* to extinction.

To plan an effective restoration of the crayfish population, we investigated visitors' behaviors and awareness on conservation issues, and identify the possible obstacles to the conservation of the crayfish in the area.

In 2017, 290 visitors were interviewed, and the results show that visitors go to the Park primarily "to go for a walk" (77.6%), but also "to take the dog out" (15.2%). None of them visit the Park for fishing, and only 10 participants (3.4%) went fishing outside the Park in the previous year.

About half of the respondents completely agree that the Park should invest in education to promote the conservation of the species, but only 12.8% of them completely agree on the choice of eradicating alien species.

Moreover, we discovered that a few participants (3.4%) heard of people releasing animals (including alien crayfish species) inside the Park. Poaching of native crayfish was reported by 3.8% of the respondents. Notably, 10 people admitted the improper use of outdoor equipment, which can contaminate creeks by the transmission of pathogens from other water bodies, becoming threats to the freshwater ecosystem.

Measuring people's awareness, we found that only 29.7% of participants were able to report a possible action that promotes the conservation of freshwater species, and only a quarter of the participants had heard about alien species before. There was a significant difference in knowledge of alien species depending neither on respondents' gender nor on their level of education. People who were aware of the alien species issue were significantly more often able to mention actions for freshwater species conservation (Yates corrected chi square=39.49, p<0.001).

The present study will help to target the public for educational actions and to identify possible situations of risk in freshwater crayfish conservation. The results highlighted the needs of educational activities and ethical awareness about alien species to raise concern and to explain the need to implement eradication as the regulation



requires (EU n. 1143/2014). These actions are necessary to soften future conflicts with the public about conservation strategies.

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## Turnover of beetle assemblages after a large scale wildfire in a boreal forest landscape

(Oral and Poster)

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Fire is considered the most important natural disturbance in the boreal forest [1]. Fire suppression has made large-scale forest fires rare in the managed boreal landscape and caused a significant habitat loss for species dependent on stand replacing disturbance. Before the middle of the 17th century, lightning ignitions could explain the fire interval. During the 19th century the number of ignitions increased but the total burnt area decreased due to increased human activity combined with effective fire suppression. Fire suppression impacts all parts of this landscape, even large protected areas with limited human influence. Beetles are a very rich and diverse species group in the boreal forest and has been widely used in ecological research. The impact of long term fire suppression are hard to establish but Johansson, 2011 [2] suggests that the effects of large scale forest fires on beetle assemblages can be influenced by the management history of the landscape. To better understand the species turnover of beetles after a large natural fire in a landscape less impacted by modern forestry, we monitored beetles during three years after a >300 ha wildfire in Muddus national park. Muddus is the largest national park below the mountain range in Sweden, located in the northern boreal zone. We used 10 flight intercept traps on a transect through the burnt area. The area is dominated by old growth pine (*Pinus sylvestris*) forest and reoccurring fires has been recorded since the 15th century [3]. The beetles were divided into functional groups depending on substrate and nutrient preferences, red-list category as well as their dependency on fire. Species composition, abundance and species richness changed significantly between the tree years. There was a continuous turnover of species with unique species each year. The second year after fire was the most abundant and species rich. This pattern was most prominent for the saproxylic beetles, especially cambiovores, and predators. We found several red-listed and fire dependant species including the *Cerambycidae*; *Acmaeops septentrionis*. This study show that reintroduction of fire benefit pyrophilious species even after a century of landscape level fire suppression. Prescribed burning might have the potential to be more beneficial for biodiversity conservation management if allocated to areas with low human impact and unbroken fire history.

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## Implementation of the land-sharing and land-sparing framework in agro-ecological corridors

(Oral and Poster)

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Maintaining adequate food supply while conserving biodiversity is one of the great challenges in conservation today. There is a fundamental controversy between land sparing and land sharing<sup>[1]</sup>: Land sparing favors intensive agriculture that allows maximal food production in a small area and spares land for conservation, while land sharing favors agro-environmental practices that create multifunctional agroecosystems. While land sparing has proven more advantageous in intact forests, evidence from long-history agricultural landscapes is mixed<sup>[2]</sup>. Using the sparing-sharing framework, we assessed costs and benefits of agriculture and conservation in planning an ecological corridor in the Jezreel Valley, Israel.

We compared land sharing - using environmentally-friendly practices to create a corridor (100 km<sup>2</sup>) -- with land sparing of wide, intact natural patches (50-300m). To assess these two alternatives, we surveyed biodiversity of five taxonomic groups throughout the agricultural season in six common crops, across two land-sharing practices (uncultivated field-margins and reduced-tillage), and large, spared natural patches. Then we assessed the economic costs (profit and revenue) of these alternatives. Results indicate that uncultivated field-margins are highly biodiverse, despite suffering from a high level of disturbance. Surprisingly, arthropods (ground-dwelling arthropods, butterflies and parasitic wasps) show higher or similar diversity in field-margins as compared to natural patches. This pattern is not consistent with diversity of plants and birds, which is higher in natural patches. Composition analysis shows unique communities in field-margins and higher species turnover for arthropods, emphasizing field-margins contribution at large-scales. Unlike field-margins, reduced-tillage did not affect biodiversity. Economically, field-margins are correlated with higher revenue of some crops, which could be attributed to the pest-control services they provide.

Our results indicate that in long-history agricultural landscapes, sparing is better than sharing in creating ecological corridors, but the optimal strategy is a combination of both. Thus, wide, natural patches should be the foundation of the agro-ecological corridor because they support the greatest biodiversity. In addition, field-margins make a better land-sharing strategy than reduced tillage; we found that reduced tillage did not affect biodiversity, regardless of its benefit in reducing soil erosion. The addition of field-margins further improves biodiversity, increasing habitat diversity in the landscape, and enhancing pest-control services that provide economic benefit to farmers.

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## The underestimated role of winter microclimate for Arctic tundra vegetation

(Oral and Poster)

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Assessing the impacts of climate change on biodiversity and developing climate-wise conservation planning requires in-depth understanding of the key drivers of species distributions and assemblages. This is particularly important in Arctic environments which will face the most notable climatic changes worldwide. The search for main determinants of biodiversity patterns in high-latitude ecosystems has focused on growing season conditions, but there is increasing amount of evidence suggesting that wintertime conditions can be equally or even more important factors for Arctic biodiversity than summer conditions (1, 2). Yet, large uncertainties exist regarding the role of winter climate in controlling the Arctic ecosystems, caused by the paucity of on-the-ground data on the spatio-temporal variation of tundra microclimate.

To fill this knowledge gap, we performed in-depth examination of the characteristics and relationships of microclimate - tundra vegetation at three different spatial scales in northern Fennoscandia. We used a total of over 600 microloggers to collect in-situ, year-around measurements of soil thermal conditions, and combined them with observations of snow and other key environmental factors. These data were employed to test the influence of winter microclimate on distributions, species richness and community composition of vascular plants, mosses and lichens. Our results show that winter thermal conditions vary much more strongly than summer conditions over short distances, and this variability is significantly related to the changes in species composition. Model comparisons show that winter conditions outcompete the effects of summer temperatures in driving the distributions and community properties of Arctic species, especially in vascular plants and lichens.

Our results indicate that winter is indeed a critical period for tundra vegetation. Wintertime thermal conditions driven by uneven snow distribution are thus key components of cold environments enabling a regional coexistence of large number of species. As winter climate is projected to warm more rapidly than summers (3), it becomes highly critical to increase the understanding of ecosystem responses to changes in snow conditions and winter temperatures. In conclusion, Arctic biodiversity assessments that ignore the effects of winter microclimate are prone to provide biased projections for the future of Arctic biodiversity.

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## Using Social Assessment as basis for promoting an Integrated Participatory Management Approach at Liberia's oldest Protected Area

(Oral and Poster)

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Containing 1,804 km<sup>2</sup> of lowland tropical rainforest, Sapo National Park (SNP) is Liberia's largest and oldest protected area (PA). It holds many threatened and endemic species including some of the largest populations in Liberia of the western chimpanzee *Pan troglodytes verus* (CR), the Pygmy Hippopotamus *Choeropsis liberiensis* (EN), the Jentink's Duiker *Cephalophus jentinki* (EN), and the Forest Elephant *Loxodonta cyclotis* (VU). Established in 1983 by an executive order during a military regime, with its boundaries extended in 2003, Sapo has been managed with limited consultation of and engagement with communities surrounding the park. However, in recent years, Liberia has adopted more community friendly management approaches to protected area management, with two landscapes currently co-managed with communities. Despite this trend, the management approach at Sapo National Park has remained relatively militarized. Over the last few years, relationship with local communities has further deteriorated as complaints about the nature of the 2003 extension of the Park, coupled with complaints of crop raiding and the FDA's approach to park management, have further alienated communities. To complicate the situation even further, the Forestry Development Authority, the government agency responsible for the park, has been unable to provide all of the resources needed to effectively manage the park. This led to a surge of illegal activities, particularly mining and hunting, that now threaten the ability of Sapo to protect biodiversity. We present the outcomes of a social assessment aimed at improving understanding of communities' perception of park-related impacts on their livelihood and well-being, to inform the process of enhancing the effectiveness of park management, by providing a platform through which communities can be more involved in the park management. Using the Social Assessment of Protected Areas (SAPA) methodology, we assessed the impact of Sapo National Park in 50 communities surrounding the landscape. We show results of this process to demonstrate its effectiveness in collecting information aimed at integrating communities' and management's interests and concerns, for effective PA management. The result of the assessment has informed the revision of the Park's management plan, which provides a role for communities to support the management of the park. Additionally, we demonstrate real-world value of using the information from the social assessment to peacefully resolve a volatile situation between the national park authorities and communities. Finally, we present the challenges and lessons learned in introducing community-friendly management approaches in a slow progressing but traditional protectionist setting.



## Density and habitat use of lions and spotted hyenas in Mole National Park in northern Ghana

(Oral and Poster)

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Knowledge on density trends and habitat use of wildlife species is vital for the development of conservation and management plans. By comparing density estimates for the spotted hyena (*Crocuta crocuta*) and lion (*Panthera leo*) over a ten-year period (2009-2018) in the Mole National Park (Mole) in northern Ghana, we show that hyena density and distribution has increased progressively over the study period while overall lion density and distribution has decreased dramatically. Direct count data for the study period was collated from field reports systematically collected by staff of Mole during regular wildlife monitoring patrols. Data was geo-referenced with a Global Positioning System (GPS) and later processed into distribution maps using ArcView Spatial Analyst 9.0. Estimates of lion and hyena densities were done using DISTANCE 4.1 software package. Results indicated high range overlap and density of hyenas and lions in the Brubgani-Lovi-Nyanga camp beats of Mole in the years 2009-2013, with highest densities occurring in the Lovi beat. Overall density estimate for the period was 0.62 individuals per km<sup>2</sup> for hyenas and 0.53 individuals per km<sup>2</sup> for lions. In contrast, the years 2014-2018 witnessed a gradual increase in hyena density and distribution with a consequent sharp decrease in lion density. While hyena distribution expanded southwards to the limits of the headquarters area (density of 1.32 individuals per km<sup>2</sup>), lions became restricted to just a few areas in Lovi and Nyanga with densities nearing zero. There was a significant inverse relationship between hyena density and lion density. The results suggest that Mole may be achieving only partial success in protecting lions, whereas hyena conservation seems to be considerably more effective. On the other hand, hyenas may be thriving to the disadvantage of lions. Such inference must however, be made cautiously because the fact that the densities are negatively related is not strong evidence to conclude that one is affecting the other, as many other factors including poaching activity could be involved. Our results are relevant to future conservation efforts for managing the carnivore populations in Mole, especially as reintroductions and translocations are essential tools used for the survival of several large African carnivores including the endangered lions.

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## British butterflies differ in micro-temperature and habitat preferences, and in their ability to buffer body temperature against changes in air temperature – consequences for reserve management

(Oral and Poster)

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The ecological impacts of global warming are clear, with changes in species' ranges, interactions between species, and species' declines observed and predicted to continue. A key factor exacerbating these impacts is human-induced habitat loss and fragmentation, which reduce species' ability to migrate and respond to change. Conservation action to increase reserve connectivity and size, and create habitat in more favourable climatic areas, can protect species from some impacts of warming.

Another option for climate change mitigation is within-reserve habitat management. This includes creating more varied topography and vegetation structure, and refuges of suitable microclimate within reserves that buffer species against regional warming [1], or facilitate colonisation of new sites as populations track climate change [2]. Butterfly species are able to alter their distribution and activity in response to local temperatures, demonstrating the potential of such management to assist their conservation [3].

However, to understand the potential for habitat management to facilitate species' responses to climate change, and to understand the ecological landscape butterflies are faced with, we must first establish species' thermal and habitat preferences, and their ability to tolerate, or otherwise, deviations from their thermal optima.

We searched five calcareous grassland reserves in Bedfordshire, UK, managed by the Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust, on over 40 days between April and September, recording the species and behaviour of every butterfly seen. Information on the habitat type, slope and aspect of the location in which each butterfly was observed were also recorded, as well as local air temperature. A subset of individuals were caught and their thoracic temperature taken using a fine thermocouple, along with measurements of wing length, sex and condition.

Butterfly species differed in their habitat preferences, and in the ambient temperatures found in their microsites. Moreover, species differed in their ability to buffer their body temperature against changes in air temperature. Species such as large white and large skipper showed greater thermoregulatory ability, whilst others such as dingy skipper and Duke of Burgundy appeared less able to thermoregulate.

Our results suggest that species will differ in their ability to cross microclimatic boundaries in order to colonise new sites as they become more climatically suitable, and therefore that species will be differentially affected by habitat management strategies and climate-change induced temperature shifts. Whilst some may respond quickly to relatively broad management regimes, others will require a finer-tuned management strategy. We are



conducting work to test this, and will further present preliminary results.

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2 Ausden 2014. *Environ. Manage.* 54, 685–698

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## Global risk of invasion by terrestrial vertebrates under contrasting SSP scenarios

(Oral and Poster)

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The introduction of alien species is among the main causes of biodiversity decline in the Anthropocene. We generated predictions of how climate and land-use change may modulate invasions by exotic species in the coming decades. We used the InSiGHTS modelling framework, which projects global species distributions through bioclimatic envelopes and habitat suitability models (HSMs), to predict the introduction and invasion risk of 333 allochthonous mammals and amphibians in three scenarios of global change: Representative Concentration Pathway (RCP) 2.6 - Shared Socioeconomic Pathway (SSP) 1; RCP 6.0 – SSP 3; and RCP 8.5 – SSP 5. The bioclimatic envelopes were developed using biomod2 with specific settings for alien species, mediated bioclimatic layers from 10 Coupled Model Intercomparison Project Phase 5 (CMIP5) global circulation models and alien species distributions from recent databases. The HSMs were based on the Land-Use Harmonization dataset (LUH2). We defined the invasion risk as the species InSiGHTS Index, the mean proportion of suitable habitat for introduced species in each 0.5 degree cell, inside the exotic range plus the area reachable through natural species dispersal, and the introduction risk as the InSiGHTS Index outside the native range. Global invasion risk by terrestrial vertebrates is predicted to increase in all the scenarios. Invasion hotspots were located in every continent except Antarctica and noticeably overlapped with biodiversity hotspots. The global introduction risk of mammals was positively correlated with climate change mitigation, with higher risk under RCP 2.6 – SSP 1 than in the other scenarios, and decreasing risk under RCP 8.5 – SSP 5 particularly at higher latitudes. For amphibians, global introduction risk increased at higher latitudes and decreased at lower latitudes in all the scenarios. Our prediction quantifies how mammal and amphibian invasion front will move in response to different global change scenarios, providing crucial information to prevent or mitigate their possible impact on biodiversity worldwide.



## Hunting as a source of alien species: a European review

(Oral and Poster)

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Invasive alien species (IAS) have been identified as one of the most important direct drivers of biodiversity loss, ecosystem degradation and ecosystem service changes. The threats posed by IAS have consequently been addressed through the development of many international policy instruments, guidelines and technical tools. In this context, understanding the pathways of species introductions constitutes a key issue as regards managing and preventing further invasive events. The most common motivation for the introduction of plant and animal species into new areas has by far been the establishment of new food sources. In Europe, hunting is a social and cultural activity in which millions of people are involved as both participants and beneficiaries, and it is undertaken on millions of hectares of land and wetland. Hunting activities are responsible for the translocation and restocking of millions of animals throughout Europe, including the introduction of alien species. In a context of the growing use of game translocations and of increasing concern about the impact of biological invasions, our goal is to review the role of alien species introduced primarily for hunting purposes on the European scale. We explored, among other aspects, the relative importance of game species in the context of alien species introductions and the underlying human demographic factors driving the diversity of introduced game species per country. We reviewed several lists of species that had been introduced into Europe, which we obtained from either scientific papers, books and technical reports, or official databases such as the Global Invasive Species Database (“GISD”), and Delivering Alien Invasive Species Inventories for Europe (“DAISIE”). We defined “introduced game species” as those introduced species that are deliberately sought and legally harvested from the wild, whether for sport, individual consumption, or commercial harvest. Our study showed that 24.3% of the mammals and 30.2% of the birds introduced into Europe during the last century were released primarily for hunting purposes, in total, 93 species (63 birds and 36 mammals). The most important taxa is Artiodactyls, Anseriformes and Galliformes. The species composition differed among countries, with a higher diversity of introduced game species in larger countries and in those with a higher human population density and proportion of hunters. This review stresses that hunting was a significant pathway for the introduction of invasive species into Europe in the last century. Since some of the game species introduced have had severe environmental impacts on many European regions, and introductions of non-native game species are still occurring, it is essential to improve regulations and increase public awareness regarding invasive game animals. This will help

to preserve biodiversity and improve the sustainability  
of current hunting schemes in increasingly managed European ecosystems.

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## Protecting biodiversity hotspots with the TiME educational tool

(Oral and Poster)

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Land transformation and degradation is the major driver of current species extinction, lately recognized as the sixth mass extinction. To address this threat innovative programs that combine both immediate remedies of land protection and comprehensive educational programs are sought. This is My Earth (TiME) (<http://this-is-my-earth.org>) is a new voluntary NGO that was established to address these challenges. TiME uses crowd funding to save privately owned lands in biodiversity hotspots, providing them protection. Membership fees are very affordable (as low as \$1 a year) and 100% of all fees and donations are directed to fund land purchase and protection. TiME welcomes children to become members and use its website to vote for their preferred habitat to be conserved (following vetting by an international committee of experts), and thus offering them the power to decide for the organization where in the world it will purchase lands. Using the PBL [=Problem Based Learning] pedagogical approach we developed a workshop, based on the above inherited powers of the TiME approach, that empowers children to adopt a sense of critical thinking as they become activists for wildlife protection. We began by developing a lesson plan that includes a short presentation of the problem, group discussions about potential solutions, class debates regarding the optimal lands to be saved, and a class-wide democratic vote. Following this workshop we examined the level of awareness and attitude of the children towards activism and democratic position. We report here preliminary results as a preliminary database for developing an international TiME based lesson plan.

Participants [N=80] revealed a democratic orientation regarding land reservations and expressed strong affinity for activism and further conservation activities. Responses to the Likert scale-based questions, indicate considerable support for involvement, with endorsement of five actions recommended in the questionnaire: writing letters to governmental authorities, signing petitions, participation in demonstrations, organizing demonstrations, and donations. Interestingly, donations received the highest support level, thus endorsing the TiME approach, while organizing a demonstration the lowest. It appears that the global habitat crisis presented to the students via the TiME platform triggers debate and critical thinking even beyond conservation to such topics as democracy and equity. The TiME website is emerging as an educational tool that offers a novel experience where teachers can harness curiosity and environmental engagement in the learning process about conservation issues. Educators use TiME to explain basic conservation concepts and involve classes in discussions about environmental decision-making and associated ethical dilemmas, prioritization of conservation efforts and practical ways to protect nature.



## Mesopredator spatial and temporal response to large-predators and anthropogenic activities in a Central Indian Reserve

(Oral and Poster)

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The survival and long-term persistence of mammalian carnivores is a key conservation challenge in developing countries like India. Many species of carnivores are forced to inhabit unprotected human-dominated landscapes given the miniscule proportion of land designated to protected areas. Differential human activity across a landscape grossly influences the activity patterns of both predator and prey species, depending on their degree of specialisation in feeding habits and habitat use. There lies a dearth of studies addressing the spatio-temporal dynamics of large and meso-predators in such disturbed landscapes. We conducted camera trap studies in dry deciduous forests of Tadoba-Andhari Tiger Reserve in Maharashtra, Central India hypothesizing that temporal and spatial partitioning among meso- and apex predators would be affected across landscapes with differential anthropogenic activities. Motion-detecting camera traps were systematically deployed across an area of 1700 sq.km following a systematic grid sampling with a gradient of human use. Temporal activity overlap for different species was calculated from photo-capture timings using non-parametric kernel density distribution. We found that spatial and temporal partitioning between apex-predators and meso-predators decreased with increase in difference in body sizes. Tigers and leopards showed pronounced spatial partitioning. Dhholes avoided tigers through temporal segregation, their activity peaks following plummets in the activity of the apex carnivore of this landscape. Species altered their activities temporally at sites with higher human activities. This was reflected as higher temporal overlap between the activities of predators at such locations. Results from our study provide insights on the ecology of a spectrum of carnivore species varying markedly in their body-sizes and feeding habits. Planning effective conservation strategies require a holistic understanding of the spatio-temporal dynamics between large predators, mesopredators and prey at multiple scales in the backdrop of varying anthropogenic influences. Marking of prioritisation areas could facilitate persistence of carnivores in this multi-use landscape.

1. Anthropogenic activity
2. Carnivore community
3. Niche separation
- 3.



## Biocultural diversity in the Cyclops Mountains, Papua Province, Indonesia: Threats and opportunities

(Oral and Poster)

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The dominant model of conservation since the late 19th century has been creation of protected areas and use of charismatic ‘umbrella’ species to garner donor support and funding for externally conceived conservation ‘interventions’ or ‘projects’. Such policies influence the lives of millions of people yet western-centric species prioritisation and the separation of people and nature many protected areas impose is being increasingly challenged. Although there has been a broad shift in dominant opinion on how conservation should be implemented, the full spectrum of management techniques can still be seen in contemporary conservation. Such diverse policies can be seen throughout New Guinea and are implemented within a broader context of rapid population growth and cultural change. This is altering the social, political and economic circumstances of natural resource users and causing breakdown of traditional environmental taboos and management practices, ultimately leading to a greatly diminished set of relations between people and nature.

In addition, a major problem for threatened species conservation is lack of basic baseline information. This means making even rudimentary management decisions can be problematic, causing inefficient use of limited conservation resources. One possible solution is to use local knowledge. Whilst local people may lack scientific training, they do in many cases hold alternative forms of detailed understanding about their local environment. Under certain conditions this can provide essential baseline information where conventional scientific surveys are costly or difficult to implement. Furthermore, it provides an entry point for dialogue between conservationists and local people and with careful consideration begins to shift the balance of power toward that of local communities as the knowledge holders for their local environment.

The Cyclops Mountains is a small mountain range on the north coast of New Guinea characterised by high cultural and biological diversity. In recognition of the areas unique biodiversity and critical watershed ecosystem services, it is designated an IUCN Category I(a) protected area containing a variety of endemic and restricted range species. With designation of the protected area came dispossession of rights for indigenous and local populations. This expulsion of human interaction rooted in the broader context described above, has led to a greatly diminished set of relations between people and nature, undermining the very bedrock of biocultural diversity in the area.

We will present our findings from a dataset of local knowledge collected about animals of The Cyclops Mountains. We demonstrate the extent to which local knowledge can provide novel insights into status of threatened species and question the assumptions of conservation policy in the area suggesting how a more nuanced understanding is essential if we are to promote human-environmental wellbeing.





## Assessing the dynamics of High Nature Value farmlands in space and time

(Oral and Poster)

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Despite agriculture being a dominant form of land management and a major driver of global change, the pivotal role of low-intensity farming systems for the conservation of agrobiodiversity and the wider provision of ecosystem services has been highlighted (1).

High Nature Value farmlands (HNVf) are social-ecological systems in which the maintenance of traditional, low-intensity farming systems support the occurrence of species and habitats, often with high conservation value. HNVf are especially vulnerable to socioeconomic changes, due to rural depopulation and lack of economic viability, resulting in the cessation of traditional farming practices in favour of land abandonment or intensification (1). Maintaining HNVf systems has been identified within the Common Agricultural Policy (CAP) and Environmental policies as crucial for environmental sustainability and conservation of agrobiodiversity in the EU countryside. A significant proportion of the areas protected as Natura 2000 sites are farmlands, thus maintaining HNVf and farming systems are important to assure the long-term success of the Natura 2000 network (2). Thus, understanding changes in the extent and location of HNVf before and after policy changes is essential to assess their impacts on the nature value of farmlands, particularly the ones included in Natura 2000 areas (2).

Here, using a spatially-explicit approach build on indicators expressing the intensity of farming practices, crop diversity and landscape patterns, HNVf were mapped in the agrarian region of Entre-Douro-e-Minho (Northwestern Portugal) for two-time periods - 1990 and 2010. Results were compared and analysed for changes between the two years, inside and outside Natura 2000 sites to achieve deeper insights on how the 2003 CAP reform may have impacted land use and ultimately the nature value of farmlands. Preliminary results show a general decrease in potential HNVf areas from 1990 to 2010, both inside and outside Natura 2000 sites. Further analysis are expected to highlight the impacts of recent policy changes (e.g CAP reform 2003) in land use, ultimately impacting the nature value of farmlands. Results will then be discussed in the context of HNVf conservation and monitoring.

(1) Plieninger, T. and C. Bieling (2013). "Resilience-Based Perspectives to Guiding High-Nature-Value Farmland through Socioeconomic Change." *Ecology and Society* 18(4).

(2) Lomba, A., et al. (2015). "Reconciling nature conservation and traditional farming practices: a spatially explicit framework to assess the extent of High Nature Value farmlands in the European countryside." *Ecol Evol* 5(5): 1031-1044.

This research is being developed within the FARSYD project - 'FARming SYstems as tool to support policies for effective conservation and management of high nature value farmlands' (POCI-01-0145-FEDER-016664-PTDC/AAG-EC/5007/2014).



## Natural margins of arable fields support small mammal populations

(Oral and Poster)

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Biodiversity conservation strategies in agricultural landscape often recommend keeping margins of arable fields in natural conditions. However, effect of such management method has been estimated only in limited number of taxa and quantitative analysis on the optimal width of such 'green margins' is seldom conducted. We analysed the potential effect of such management method on small mammals, which form an important part in the food chain and thus belong to keystones of the ecosystem. We measured abundance of three rodent species at ecotones between forests and three types of open agricultural biotopes (grasslands, rapeseed fields and cereal fields).

The maximum density of rodents was found at the forest/grassland ecotone. Here the highest densities of the Yellow-necked Mouse *Apodemus flavicollis* and Striped Field Mouse *A. agrarius* were detected. The positive edge-effect did not exceed ten meters. Also the highest density of forest-dwelling Bank Voles *Myodes glareolus* was recorded next to grasslands, but the abundance of this species increased towards forest interior. Rodent densities at forest/arable field ecotones were 3-5 times lower than on the edges of grassland. Summarizing, our results support maintaining narrow grasslands at margins of crop fields. Such management practice would strengthen natural communities at ecotones, but also in adjacent open land and forests.

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2018/06/13

15:00

Room: A1 Wilhelm



## Anglo American policy for biodiversity offsetting

(Oral)

**Joanna van Riet-Kuntonen**<sup>1</sup>✉

✉ none available

<sup>1</sup> Anglo American Sakatti Mining OY, Finland

Abstract of this presentation is not public



## Quantifying climate impacts and biodiversity effects of increased forest biomass harvests – an integrated assessment

(Oral)

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Increasing forest biomass harvests to combat climate change by replacing fossil fuels with bioenergy may pose a trade-off with climate regulation services of forests and biodiversity conservation. Previous forest bioenergy studies focus mainly, either on effects on carbon cycle or biodiversity impacts (1–3). These studies show that increased extraction of branches, stumps and other residual biomass from current levels decreases the carbon stock and the carbon sink capacity of forests, and has negative effects on species depended on deadwood. Nevertheless, still little is known how climate regulation services or biodiversity indicators respond to a large scale removal of harvest residues in the long term, and at the landscape level. We provide an integrated, dynamic, assessment to quantify the effects of forest residue harvesting on forest carbon balance and biodiversity in boreal forest landscapes. Through a modeling framework we simulated forest development in four real watersheds located in central Finland with three scenarios: i) with and ii) without forest residue harvesting for bioenergy, and iii) set aside to study the conservation potential of these landscapes in the future without management. We simulated changes in the forest carbon stocks and the quality and quantity of deadwood resources for 100 years, and combined this information with the information of species habitat associations based on expert judgments. This study reveals how extensive forest harvest residue extraction for bioenergy affects forest carbon balance and the availability of suitable habitats for red-listed, saproxylic species. Furthermore, the results indicate a conflict between areas of high bioenergy potential and high conservation potential. We also discuss whether current recommendations for energy wood harvesting encourage to the least harmful harvesting practices. The findings of this study can be used in developing guidelines, practices and criteria to ensure the sustainability of forest bioenergy. The work is part of the Sumforest project FutureBioEcon.

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## Using local ecological knowledge to monitor species populations and their threats

(Oral)

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Protein from forest wildlife is crucial to rural food security and livelihoods across the tropics and local extirpation of hunted species is widespread. For many wildlife species, monitoring over large spatiotemporal scales remains a serious challenge. At the root of this challenge lies tension between monitoring methods that prioritise accuracy, and those that emphasize long-term practicality. This trade-off between effectiveness and cost is a pervasive and unresolved problem in biodiversity monitoring. One possible solution has been to draw on the experience of local people in order rapidly to condense information over areas and timescales that cannot be tackled using conventional surveys. However, while there are some good examples of the integration of local participation into ecological monitoring, it remains underdeveloped.

My research aims to gain a better understanding of the role and implications of accuracy and bias when using local ecological knowledge for wildlife population monitoring, using interview-based occupancy analysis of bushmeat species and threats in a protected area (the Dja Faunal Reserve) in Cameroon as a case study.

At the ECCB, I aim to present the results of my first data chapter, which compares the results of occupancy analysis for 14 different species obtained from semi-structured interviews, daily hunter diaries and camera traps. This comparison chapter forms the basis for my subsequent work on the power of interview based occupancy models to detect change, and applying interview based occupancy analysis to monitor the distribution and relative abundance of hunting offtake.

Another part of my work which I would like to present looks at assessing expert knowledge. Experts are often asked to make judgements when time and resources are stretched [1]. The social expectation hypothesis expects highly regarded and experienced experts to give more robust advice. Applying the methods outlined by Burgman et al (2011) to groups of hunters regarded as experts in bushmeat species in my study villages, I assess the relationship between perceived expertness and their ability to make precise and accurate judgements on the distribution and relative abundance of bushmeat species in the community forest adjacent to the village.

My focus on understanding and correcting for bias and uncertainty in observational data, a data type widely used in ecology and conservation, allows for a better understanding of observational data more broadly, and how to address these issues for the overall benefit of ecology and conservation. At a smaller scale, I am developing and evaluating a method that is potentially cost effective and accurate, much needed in conservation and ecology to overcome the challenges to robust monitoring.

[1] Burgman MA, McBride M, Ashton R, Speirs-Bridge A, Flander L, et al. (2011) Expert Status and Performance. PLoS ONE 6(7): e22998. doi:10.1371/



## Using the multi-vantage point method to assess the conservation status of the tamaraw (*Bubalus mindorensis*) in the Philippines

(Oral)

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The tamaraw is endemic to the island of Mindoro in the Philippines. Previously considered widely distributed in the island, by 2007 they are now thought to remain in only three areas. The multi-vantage point method was used to count tamaraw in Mounts Iglit-Baco National Park since 2001 because it was the most expedient way to count the animals. This study covers the count until 2012. The method used 16 vantage points placed in strategic locations in the park. As of 2012, 327 animals were observed through the count, representing a 75% increase since 2001. There were 57 bulls, 103 cows, 7 unknown adults, 72 juveniles, 55 yearlings, and 33 calves. This method provides trend areas in the park, but the status of the tamaraw on the whole island has yet to be determined. The results provide a positive trend overall, but there are significant challenges to tamaraw conservation. These challenges include the encroachment of farms and cattle ranches, extensive logging and escaped fires associated with slash-and-burn farming, illegal hunting, and possible disease transmissions from cattle farms. More studies are needed to fully understand the sustainability of the tamaraw population in Mindoro.

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## Swedish monitoring data reveal negative effect of neo-nicotinoids on bumblebee abundance

(Oral)

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Neo-nicotinoids are used as insecticides in a variety of crops, e.g. as seed-coating, but have also been found lethal to pollinating insects. In 2013, the European Union introduced a moratorium on some of these compounds. At the same time, the Swedish monitoring program NILS (National Inventory of Landscapes in Sweden) had completed its first round and today a second round has been completed. Thus, it is possible to analyze the effect of the moratorium on monitoring data on bumblebees in N=419 sites in southern Sweden. The presence of neo-nicotinoids was assessed using the official records of the type of crop grown on a field (Blockdatabasen), maintained by the Swedish board of Agriculture. The change in bumblebee abundance was compared to the area of different crops in the surrounding landscape. We tested the hypothesis that abundance of bumblebees increased more in landscapes with more oilseed rape (a common crop where seeds previously were coated with neo-nicotinoids). We found no effect on diversity but significant increase in abundance for some species (*Bombus pascuorum*, *B. lucorum*) while other did not change (*B. terrestris*). There was no effect of connectivity of oilseed rape fields in the surrounding landscape, and no evidence of a threshold: it was mostly enough with one field to see an increase after the moratorium. The fact that bumblebee populations recover indicate that the negative effect is mediated directly via the crop. Our study is a nice example of how monitoring data paired with official data can be used for large scale biodiversity studies.

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## Enhancing salmon conservation releases through improved brain development and behaviour

(Oral)

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Captive breeding programmes are based on the practice of taking part of an endangered population to captive environment and releasing the captive-born offspring back to the wild. Despite the vast ecological and economical investment in restoration of endangered animal populations through captive breeding programmes - annually more than 5 billion to salmonid fishes alone - they have been unfortunately unsuccessful. The low success of captive breeding programmes is mainly due to lowered fitness of the released animals and their offspring in the wild. Degradation of many behavioural and other fitness related traits are due to (i) very fast genetic domestication and (ii) habituation to the unnatural rearing environment during ontogeny. This study is the first to examine the relative importance of the effects of genetic domestication and unnatural environment on adaptive behaviour after release to the wild and its underlying neuroanatomic mechanisms. We found that adaptive post-release behaviour in the wild is selected against in captivity and further dumbed by unnatural rearing environment. These negative effects on adaptive behaviour were directly related to decreased brain development. This is the first study showing that using wild parents and a novel naturalized rearing method promoted brain growth. Even more importantly, both in laboratory experiments and in releases to the wild, larger-brained salmon showed better foraging performance. Our findings and methods are directly applicable to increase success of salmon captive breeding programmes, as we used real production scale rearing facility and fish densities.

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## “Pollinator size and its consequences” - Predictive allometry for pollinating insects: An R package

(Oral)

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Katherine Baldock<sup>5</sup>, Andrea Holzschuh<sup>6</sup>, Juanita Rodriguez<sup>7</sup>, Laura Russo<sup>8</sup>,  
Romina Rader<sup>1</sup>**

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Allometric scaling laws have key implications for the conservation and management of pollinating insects in both managed and unmanaged ecosystems. Body size (BS) can predict influential traits such as foraging distance (FD) yet available predictive models for both body size and foraging distance are outdated, rely upon geographically restricted sampling and have limited applicability for non-bee taxa. More accurate predictions of pollinator body size and related foraging distance require models that consider biogeography, ecological traits (eg. sociality and nesting strategies), intraspecific variation and phylogenetic relatedness. Here we present the results of an international collaboration that catalogued existing predictive allometries for pollinating insects (Hymenoptera (BS: 38, FD: 6), Diptera (BS: 26, FD: 0) and Lepidoptera (BS: 21, FD: 1) and improved upon pre-existing equations for estimating body size and foraging distance in key pollinating taxa (bees and hoverflies). We measured dry weight, intertegular span and body length of bees and hoverflies from Australia (n = 900), Europe (n = 1000) and USA (n = 650) and constructed region-specific predictive equations for estimating pollinator body size. We re-examined bee and hoverfly body size:foraging distance relationships using pre-existing and new data. These models, to be released as an R package in late 2018, will be a useful resource in the conservation management of both wild and managed pollinators globally.



## Impacts of bio-economy policies on forest ecosystem services: a boreal perspective

(Oral)

**Maria Triviño De la Cal<sup>1</sup>✉, Kyle Eyvindson<sup>1</sup>, Anna Repo<sup>1</sup>, Tähti Pohjanmies<sup>1</sup>,  
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One of the most pressing challenges for governments is how to move from a fossil- to a bio-based economy to achieve a sustainable growth. Bio-economy encompasses the production of renewable biological resources and the conversion of these resources into value-added products, such as biofuels. The use of bioenergy is regarded as an important climate change mitigation strategy and its annual demand is rapidly increasing. In particular, there is immense pressure to use boreal forest resources as bioenergy for meeting the challenging new bio-economy policy goals (EC 2012). For example, Finland will need to largely intensify timber production because policy aims at increasing the levels of energy production from forest wood. On the other hand, boreal forests provide crucial ecosystem services such as climate regulation through carbon storage, timber production and provision of non-timber forest products. This intensification of forest biomass extraction is potentially in conflict with forest ecosystem services like mushrooms (due to soil damaging activities during forest management) or key resources for biodiversity like deadwood. Here, first we review what is known and unknown about the effects of increased biomass harvesting on ecosystem services and biodiversity. Second, we present a modelling framework that combines forest growth simulations and optimization tools to investigate the impacts of increased forest biomass extraction on key ecosystem services (carbon storage, collectable goods and scenic beauty) and biodiversity (deadwood resources) in Finland. The work is part of the Sumforest project FutureBioEcon.

Reference:

EC (2012) Innovating for Sustainable Growth - A Bioeconomy for Europe. European Commission. Brussels.

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## Linking pollinator abundance in field margins to crop pollination service

(Oral)

**Marjaana Toivonen<sup>1</sup>✉, Irina Herzon<sup>2</sup>, Hanne Rajanen<sup>2</sup>, Jenni Toikkanen<sup>3</sup>,  
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Crop pollination services are an often-used argument for supporting pollinators in agricultural landscapes. However, the link between pollinator occurrence in the proximity of fields and realized crop pollination service remains poorly studied. We examined how the abundance of different pollinator taxa in field margins predicts pollination services in adjacent insect-pollinated crop in boreal agricultural landscapes. Additionally, we studied how pollinators in field margins are affected by pesticide use and landscape structure.

We conducted a field experiment in 34 spring-sown turnip rape (*Brassica rapa* ssp. *oleifera*) fields and their permanent margins in Southern Finland in summer 2017. The fields situated in two landscape types, differing in the cover of arable fields within 500 m distance. We counted pollinators in the field margins from early June until end-July along 50-m-long transects, and monitored pollinator visits on turnip rape flowers three times during flowering. Through a farmer questionnaire, we collected data on farming activities in the fields.

Total pollinator abundance and species richness in field margins were poor indicators of pollination service in adjacent turnip rape fields. However, pollinator groups differed in this respect: High abundance of bumblebees and syrphid flies in field margins indicated high crop visitation rate by these taxa. Syrphid flies preferred to visit crop near field edges, while bumblebees used more field interior. Butterflies were abundant pollinators in field margins but rarely visited the adjacent crop. Honeybees, by contrast, were dominant pollinators in the crop regardless of their abundance in field margins. In total, one third of pollinator species or groups present in field margins were observed to visit turnip rape.

Pesticide use in turnip rape fields reduced pollinator abundance in field margins. The negative effect tended to be more pronounced in landscapes dominated by arable fields than in landscapes with low field cover. Pesticide use affected more bees and butterflies than syrphid flies. Syrphid flies preferred landscapes with low field cover, whereas bees benefitted from high cover of perennial grasslands in the surrounding landscape.

Our study showed that the value of field margins for crop pollination cannot be reliably assessed based on total pollinator abundance, but the assessment should focus on the few pollinator groups and species with demonstrated importance as crop pollinators. These results highlight the need for greater arguments than crop pollination for pollinator conservation in agricultural landscapes. While the effects of pollinator abundance and diversity on crop yield may be weak, the impacts of agricultural activities on pollinator conservation are obvious. Reduced pesticide use and increased land use heterogeneity would benefit pollinators in boreal agricultural landscapes.

2018/06/13

15:15

Room: A1 Wilhelm



## **Boliden Mineral: Ecological compensation at the Aitik Mine**

**(Oral)**

**Anders Forsgren<sup>1</sup>**✉

✉ none given

<sup>1</sup> Boliden Mineral AB, Sweden

Abstract of this presentation is not public



## Persistence of boreal forest epiphytes under alternative objective-driven forest management scenarios

(Oral)

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Epiphytes need to colonize new suitable host trees before their existing host trees disappear in order to persist in forest landscapes. Thus, their persistence may be threatened by accelerated dynamics of intensive forest management [1], especially if suitable host trees will be scarcely located [2].

Wood production is a key global provisioning ecosystem service. In the European Union, the bioeconomy policy guides forest management for the provision of forest products and ecosystem services to meet global, EU wide and national demands. At the same time, the EU Biodiversity Strategy sets targets for the sustainable management of forests to maintain the persistence of species. It is therefore important to identify forestry practices that can reconcile the contrasting objectives of providing high forest product yields while also preserving forest biodiversity.

We studied how alternative, objective-driven forest management scenarios affect the persistence and metapopulation dynamics of epiphytic lichens and bryophytes in boreal forests. We fitted spatially explicit colonization-extinction models for six bryophyte species of varying host tree preferences and one epiphytic lichen (*Lobaria pulmonaria*) using landscape-scale data from north-eastern Finland. We simulated their metapopulation dynamics for 100 years into the future assuming different forest management scenarios created for a 66 000 ha study landscape in northern Sweden. The forest management scenarios varied in terms of tree species composition, management and retention practices and were constructed based on alternative criteria, such as the projected wood product demand under different future scenarios of Shared Socioeconomic Pathways [3] for the European Union.

Our results show how forest variables and connectivity to potential dispersal sources explain colonization and extinction dynamics and persistence for different forest epiphytes. Thus, our results pinpoint combinations of forestry and conservation strategies that best support the long-term persistence of species while meeting the defined forestry objectives. Altogether, our results help to reconcile forestry and biodiversity conservation in boreal forests.

The work is part of the BiodivERsA project GreenFutureForest.

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## IPBES- the international perspective: Connecting global assessment processes with European and national level – lessons from the perspective of a global science-policy interface

(Oral)

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IPBES - the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services is an independent body, established in 2012 to provide policymakers and society with objective assessments regarding biodiversity, ecosystems and the benefits they provide to people, as well as the methods to protect and sustainably use these natural assets. IPBES aims to support the development of efficient policy by making available state-of-the-art, peer-reviewed, relevant scientific knowledge at an international level. Assessments performed by IPBES are a result of requests from governments and society, a scoping exercise and the work from relevant experts from all fields of science, as well as indigenous and local knowledge. Analysing this process will not only improve the work done by IPBES, but also inform the efforts that are taking place at EU and national level, aiming at similar results from different perspectives. The key aspect of IPBES functioning is the (inter)governmental commitment of its member states. This structure provides high legitimacy and a semi-direct link of the Multidisciplinary Expert Panel to IPBES Plenary, thus the governmental representatives, which can influence policies in international, regional and local level. At the same time it is also responsible for the lack of flexibility of the process, result of necessary diplomatic and political considerations, which although necessary, can lead to delays or communication dead-ends regarding the need for political action. Another aspect of discussion should be the assessment level contacted through IPBES. Knowledge regarding biodiversity and ecosystem services globally is vast, even if incomplete, and often fragmented, so the assessment of this information in an integrated manner is crucial to extract conclusions at a regional and global levels (e.g. the European and Central Asia region), thus identifying global trends and pursuing international agreements in support of conservation. When developing an assessment of that scale, it is inevitable that the information will vary in quality and quantity. In the present ECA Assessment several challenges were identified in the connection between existing assessments at national, EU level, at pan European level and at ECA scale, from uneven data and knowledge existent across the region, to accessibility of existing data, to existence of previous assessments. These challenges point to the need of a gap analysis of existing knowledge but also monitoring, assessments and mechanisms/policies to share and access data. Finally, aspects of the IPBES approach related to transdisciplinarity, nomination of experts, the engagement between scientists in intergovernmental panels, as well as the strategy and methodology through which knowledge is assessed and transformed to better be used to support policy, are crucial to inform similar approaches at EU and local level.

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## **CANCELLED: Building an open source software infrastructure for conservation - TRAPPER, a web-based application to manage camera trapping projects**

(Oral)

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Ecology and conservation biology have recently become increasingly data intensive, mainly due to technological advances and the growing inter-disciplinary character.

However, a data-intensive science needs specific information infrastructure and tools to efficiently manage, integrate, share and (re)use massive amounts of data. An open source software (OSS) is freely available, provides a source code and can be developed in a collaborative public manner. This open and community-based approach can be especially suitable for development of software infrastructure for conservation. The OSS ecosystem is rich and well developed and already existing, stable data management solutions can be easily combined into specific conservation-oriented applications. Moreover, in an information-rich and rapidly changing world, the effectiveness of conservation actions can be substantially improved when all researchers and conservation practitioners have access to the best available software tools at no extra costs. A common OSS infrastructure can help with a standardization of data management in different conservation monitoring programs, which is particularly important since the majority of data collection is still conducted by individual people who are collectively producing large amounts of data. Camera trapping is increasingly becoming an important tool in ecological research and wildlife conservation. However, the organization of large collections of multimedia files, efficient searching for subsets of data and their re-use is a challenging task. This is especially important as camera trapping generates information-rich but often under-utilized datasets (e.g. by-catch data). With proper software infrastructure at hand, data from different camera trapping projects can be harmonized and integrated and used to answer bigger, often globally oriented questions. As a case study, we present TRAPPER, a flexible and open source web application developed to manage, classify, integrate, share and re-use data in camera trapping projects. The main features of TRAPPER are: (i) it is open-source, (ii) it facilitates analysis of videos as well as images, (iii) it provides spatial filtering and web-mapping, (iv) it allows flexible implementation of specific data collection protocols, (v) it is a multi-user and role based system which facilitates collaborative work on camera trapping projects, (vi) it supports data re-use and (re)discovery. TRAPPER can therefore be widely used by ecologists and conservation practitioners working with a variety of camera trap studies, alone or in collaboration with each other.

Bubnicki, J. W., Churski, M., & Kuijper, D. P. J. (2016). TRAPPER: an open source web-based application to manage camera trapping projects. *Methods in Ecology and Evolution*, 7(10), 1209–1216.

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## How much it costs? Economics of staying near protected area of people around Pench Tiger Reserve, Madhya Pradesh, Central India

(Oral)

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DOI: 10.17011/conference/eccb2018/107984

Economics is an integral part of conservation as it plays an important role in determining people's attitude towards wildlife. Out of 1.3 billion people in India, approximately 400 million live near forested areas with 2500 tigers and 8000 leopards in their backyards. Their livelihood option is hugely dependent on exploiting the natural resources. I looked into the variations in cost:benefit ratio of people staying near protected areas in a part of the Central Indian tiger landscape to investigate whether it varies according to distance to understand how economics shapes attitudes and affect conservation. I used close-ended structured questionnaire along a gradient of distance of settlements from the core area to examine perceived loss of human property and how attitude varies. The data was cross-validated using reliable secondary data resources. Market prices for depredated livestock and crop and collected non-timber forest produces were considered to calculate the cost:benefit ratio. The results were contemplated in the light of people's attitude. 78% of the local residents said that the protected area was detrimental for them. Loss of human property remained same along the gradient of distance from the core area. Cost incurred due to human-wildlife interface was more than the benefit obtained from the forest. People who experienced more losses were more hostile towards wildlife and wanted stricter management strategies for "problem animals". Lethal control was warranted by majority of respondents for crop-raiding herbivores. Co-existence with large carnivores seemed like a plausible option for 70% of the respondents as opposed to 5% positive responses for the herbivores. Overwhelming costs of staying near protected areas with negligible incentives compel people to harbor negative attitude towards wild animals and their conservation. The co-existence between wildlife and people will be facilitated if the trade-off between losses and the benefits gained by the people are economically favorable. Sharing of benefits from ecotourism, providing alternative livelihood options can aid in fostering optimism among the locales. Central Indian landscape is a mosaic of human habitations and forested areas. The forest is not restricted to the core zone only. Buffer supports a good habitat for the animals especially ungulates. Hence the produces gained from the forest and the losses incurred to not vary to a great extent as distance from the designated core zone increases. So these kind of negative attitudes is detrimental for harmonious coexistence between man and animals. Animals residing in smaller reserves surrounded by dense human population face an even greater challenge. Active participation of local residents for long term survival of nature is essential. They are the key force to transform the conservation struggle into a success standing at this pivotal juncture.

Key words: cost:benefit ratio, attitude, co-existence



## Organic farming improves the spatiotemporal stability of pollinator species richness

(Oral)

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The spatiotemporal stability of the biodiversity of service providers such as insect pollinators is critical to guarantee high and stable levels of ecosystem services in agroecosystems. The proportion of semi-natural habitats (SNH) in the landscapes has been shown to stabilize the species richness of pollinators but the effect of farming intensity has not yet been studied. In this study, we compared the temporal and spatial stability of two groups of pollinating insects (butterflies and bumblebees) between nine conventional and ten organic farms, distributed along a gradient of landscape complexity. We surveyed pollinator communities and local flower cover during the growing season, along three years and in several habitat types per landscape (cereal fields, ley fields and semi-natural grasslands). At the plot scale we found that within-year stability of bumblebee species richness was higher in organic than in conventional ley fields, and that it was due to higher continuity of in-field flower resources. Our results also suggested that late-season flower resources in organic ley fields were critical to maintain a high within-year stability of bumblebee richness by reducing resource bottleneck during that period. The long term (among-years) stability of bumblebee richness was also higher in organic than in conventional cereal fields. The temporal stability of butterfly richness was not influenced by farming system. On the farm scale we also found that the spatial stability of butterfly and bumblebee species richness was higher in organic than in conventional farms, but that it was not explained by a greater spatial continuity of flower resources. Our study therefore suggest that organic farming can help to maintain the short-term stability of bumblebee species richness, due to practices that favor flower resources in ley fields (no mineral fertilizers, late mowing, etc.). Other practices, such as the non-use of insecticides, might be responsible for higher long-term stability of bumblebee richness in cereal fields, or landscape-scale spatial stability of both bumblebee and butterfly richness.



## Bird traits and their responses to forest structure in Central European forests

(Oral)

**Pedro J. Leitão<sup>1</sup>✉, Andreas Dahlkamp<sup>1</sup>, Paul Haverkamp<sup>2</sup>, Michael Griesser<sup>3</sup>, Astor Toraño Caicoya<sup>4</sup>, Swantje Löbel<sup>1</sup>, Tord Snäll<sup>5</sup>, Boris Schröder<sup>1</sup>**

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Forest structure, as resulting from management practices, have an effect on habitat quality and thus the occurrence of birds using and depending on these landscapes. We hypothesized that the species responses to forest structure is influenced by their ecological traits. The aim of our study is thus to examine the relationship between bird traits and their responses to forest structure in Central European forests. For this purpose, we used occurrence data from breeding bird censuses in the Canton of Zürich (Switzerland) and in Bavaria (Germany), forest inventory and climate data for the same regions, as well as a trait database for the studies species. We used single species distribution models, and multispecies predictive trait models to identify critical response traits and to quantify their relationships to species' responses to forest structure, landscape configuration and climate. Finally, and based on our results, we conclude by giving general forest management recommendations for the promotion of forest bird diversity. This work is part of the BiodivERsA project GreenFutureForest.

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2018/06/13

16:00

Room: A1 Wilhelm



## **Gaia: Business solutions to sustainability - Combating biodiversity loss and climate change through collaboration between science, technology and business models**

**(Oral)**

**Teresa Lindholm<sup>1</sup>**✉

✉ no email given

<sup>1</sup> Gaia Consulting Oy, Finland

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All solutions are needed for combating climate change and biodiversity loss. Actions shall be urgent, impactful and scalable. Gaia has a long background in collaboration with the scientific community, designing solutions to sustainability and integrating sustainability practices to companies' operations and policy. Gaia's approach is based on international best practices such as the mitigation hierarchy. Working with developing business models, legislation and practical tools for greenhouse gas, nutrient and ecological compensation Gaia helps its clients make the world cleaner and safer.

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## Oil contamination in a hyper-arid desert ecosystem in Israel: initial results from a large scale ecological monitoring program

(Oral)

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Abstract of this presentation is not public



## Connecting modern societies with wilder nature through development of nature-inclusive economies

(Oral)

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Our relationship with nature needs a paradigm shift. Nature should no longer be considered as a vulnerable domain of conservationists that have to protect it against human threats. It should, on the contrary, be seen as a strong ally for all of us. An ally that can take care of itself, but also can help in solving modern socio-economic issues like climate adaptation, water management, sustainable food production and recreation. The big question is: are we clever enough to cope with this strong force?

Rewilding Europe is developing a vision in which natural processes become vital in shaping our landscapes. Large showcases of more than 100.000 ha in different parts of the continent should prove the concept. Here we explore our hypothesis that the more we let nature take care of itself, the less need for conservation; the lower the costs will be. Here we test better practices in economic sectors that integrate natural solutions in their business models, thus becoming more sustainable and creating new incentives to reconnect people and nature.

The presentation will show the results after seven years of testing these models in a growing European network of rewilding areas. Tools that are developed to support these models will be explained like the European Rewilding Network, the European Wildlife Bank, European Safari Company and Rewilding Europe Capital. The latter being the first European loan facility to help start-ups and existing rural entrepreneurs to set up rewilding businesses that not only benefit from wilder nature, but also contribute to a more natural development of the surrounding areas.

Having a track record with ca. 20 rewilding enterprises, Rewilding Europe was in 2017 the first organization to sign a contract with the European Investment Bank to develop a much larger loan facility that offers the opportunity to close deals with forest companies, water managers and other economic sectors that could contribute to rewilding by changing towards more sustainable business models. Examples are dam-removal in combination with the restoration of sustainable fisheries in living rivers. Or natural grazing as an answer on wildfires in the Mediterranean. Carbon sequestration or biodiversity offsetting could also be driving forces for rewilding. The presentation will end with these and other possibilities that emerge with rewilding as a new conservation narrative.





## Addressing challenges of the science-policy-society interface: the EKLIPSE way

(Oral)

Juliette Young<sup>1</sup>✉, Allan Watt<sup>1</sup>, Marie Vandewalle<sup>2</sup>, Heidi Wittmer<sup>2</sup>, Hilde Eggermont<sup>2</sup>

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In February 2016, the EKLIPSE project started. This project, funded by the European Union, aims to develop an innovative, light, ethical and self-sustainable EU support mechanism for evidence-based and evidence-informed policy on biodiversity and ecosystem services, and to hand over this mechanism to the wider community once established. The mechanism will provide trustworthy evidence for policy and society upon request and will make the knowledge community more responsive by providing a platform for mutual learning and engagement with policy and society. This presentation will cover the challenges at the science-policy-society interface and ways of addressing them. In particular, we will share and discuss how different approaches are currently being developed at the EU level to support better policy decisions on our environment based on the best available knowledge.

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## A Spatial Investigation of Wolf-Human Conflict in Turkey Based on MaxEnt Model

(Oral)

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Large carnivores around the world are under increasing threat due to the human-induced factors according to the recent IUCN report. Through their high dispersal capability, large carnivores generally occupy extensive range of areas and dominate different type of habitats. On the other hand, decreasing habitat quality and available prey density compel this group of animals to inhabit semi-natural habitats and this phenomenon gives rise to human-carnivore conflict to occur. Being one of the most widespread large carnivores of the world, wolves normally prefer natural habitats and hesitate from human settlements similar to the other animals who belong to this group. However, wolves have become one of the iconic species of human-carnivore conflict in the regions where they exist. Co-existence of gray wolf and human in a region triggers the conflict via direct attacks on humans, or damage on livestock and shepherd dogs. In Turkey, despite the direct attacks on individuals are very rare, human perception of wolves is generally negative due to the economic cost of wolf-related livestock depredation. This situation is the main struggle for conservation efforts which are directed towards the gray wolves in Turkey. In this study, in order to evaluate the wolf-human conflict, which is one of the top priority issues to be resolved for sustainable management and to take protective measures for the wolf populations, the possible triggering parameters and conflict records have been examined. In this context, we have constructed a MaxEnt model using 12 parameters as predictive variables and n=309 locations of wolf attacks gathered from whole Turkey as conflict records. As a result of the study we established a risk map for Turkey and it has been revealed which factors triggered the conflict at the countrywide scale. The obtained output showed that the wolf-human conflict in Eastern Anatolia has reached high risk values and the risk of conflict depends largely on altitude, land use pattern and road network density whereas the livestock density were contributed model output at almost insignificant level surprisingly. It is envisaged that the outputs of this study will contribute to the implementations carried out on the gray wolf population within the scope of species conservation and action plans conducted to manage wolf-human conflict.



## Genetic causes and consequences of Brown trout migratory behaviour

(Oral)

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Salmonids are among the most famous and economically important migrating organisms, but unfortunately also often endangered because of multiple human activities. As many other salmonids, brown trout exhibits diverse life history types related to migration strategies. Resident brown trout stay in rivers for their entire life. In contrast, migratory trout undergo a physiological and morphological transformation called smoltification before leaving their natal rivers to enter either sea, lakes or larger river sections. While the phenotypic variation between resident and migratory ecotypes is well documented, little is known about the intraspecific genetic variation associated with these different life history strategies. For management and conservation purposes, understanding the mechanisms behind migratory behavior is a necessity. To investigate the genetic causes and consequences of the life-history dichotomy in brown trout, we used RAD-sequencing to obtain thousands of SNPs used in two distinct studies.

First, we focused on the boreal River Koutajoki watershed to understand the genetic structuring of natural populations in relation to different life histories (Lemopoulos et al. 2018). We sampled eleven sites: three main stems (one with two sections) with migratory trout and seven tributaries with assumedly resident trout. We found that the genome-wide patterns associated with life-histories. Tributary fish represented isolated unique genomic patterns that most likely had arisen because of residency, and main stem fish were more admixed and had higher heterozygosity indicating history of migrations and occasional spawning in neighboring rivers.

Second, we compared pairs of resident – migratory populations to identify potential candidate genes associated with migratory behavior. We focused on the Koutajoki watershed and complemented the study using populations from the River Oulujoki watershed. We combined different genome-scans approaches and found in total eight SNP outliers that associated with migratory behavior. We revealed, for the first time, candidate genes linked to life-history dichotomy in brown trout. Using the Atlantic salmon genome, we identified putative functions of these SNPs. Among them, we found genes involved in osmoregulation processes as well as cadherins, glutamates and zinc-fingers genes. These three gene families are involved in migratory behavior of other salmonids, indicating a potential common set of genes associated with salmonid migrations.

Our results suggest that migratory behavior in brown trout plays a major evolutionary role in shaping natural populations. They also suggest that there is significant genetic basis for the migratory tendency in brown trout. These results bear significant implications for conservation: unintended mixing of resident and migratory fish due to stockings should be avoided, and migratory stocks must be conserved independently as there are no other stocks that could replace them when lost



## Improving the contribution of citizen-science to monitoring programs requires integrated planning

(Oral)

**Alejandra Morán-Ordóñez<sup>1</sup>✉, Stefano Canessa<sup>2</sup>, Gerard Bota<sup>3</sup>, Lluís Brotons<sup>1</sup>, Sergi Herrando<sup>4</sup>, Virgilio Hermoso<sup>3</sup>**

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Monitoring biodiversity is a fundamental tool for its conservation, as it provides information that can guide and eventually improve the effectiveness of management outcomes. Citizen-science is increasingly advocated as a complement to governmental monitoring programs to overcome scarcity of resources and deliver important information for policy-making.

In this study, we used the spatial optimization tool Marxan to explore the advantages and limitations of combining government and citizen-science monitoring networks to achieve monitoring targets for bird species of conservation concern for the EU in Catalonia (NE Spain), a region where both schemes are well established. We designed and compared optimal monitoring networks under four different scenarios: (1) the No-constraints scenario simulates a monitoring network built ex novo, assuming no prior monitoring efforts and no spatial constraints to the selection of monitoring sites; (2) the Protected Areas-only, in which the monitoring would occur exclusively within protected areas where resources from the Regional Administration exist – e.g. personnel - that could be mobilized for monitoring surveys; (3) the Protected Areas-Extended recognizes existing monitoring efforts within the network of protected areas, and allows also monitoring efforts outside protected areas to achieve the monitoring targets for the bird species; (4) Protected Areas-Citizen Science recognizes both the existing resources within protected areas as well as the existing citizen-science bird monitoring programs. The four monitoring network schemes sought to cover the distribution of bird species of conservation concern for the EU in Catalonia under different pressure levels (low, medium and high) of the main threats to each species (agricultural intensification, closure of open spaces, forest immaturity, freshwater pollution and urban development) .

In our case study, current government efforts, limited to public land and protected areas, were insufficient to cover the whole spectrum of target species and threat levels, reinforcing the assumption that citizen-science data can greatly assist in achieving monitoring targets. However, simply carrying out both government and citizen-science monitoring ad hoc led to inefficiency and duplication of efforts: some species were represented in excess of monitoring targets while several combinations of species-threat levels were under-sampled.

Our study highlights the importance of accounting for species threats when designing monitoring networks, since the ability to link detected negative species trends to potential drivers would make the monitoring data more directly useful for policy decisions. Our results also suggest policy-making should concentrate on providing an adequate platform for coordination of government and citizen-science monitoring to minimize duplicated efforts, overcome the biases of each monitoring scheme and obtain the best from both.

2018/06/13

15:45

Room: A1 Wilhelm



## **Pöyry: Ecological compensation from the perspective of an environmental consultant**

**(Oral)**

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<sup>1</sup> Pöyry PLC, Finland

Abstract of this presentation is not public



## Wildlife restoration needs more effort to mitigate conservation conflicts: the case of large carnivore damages in Europe

(Oral)

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Claudio Groff<sup>7</sup>, Sauli Härkönen<sup>8</sup>, Djuro Huber<sup>9</sup>, Klemen Jerina<sup>10</sup>, Marko Jonozovic<sup>11</sup>,  
Alexandros A. Karamanlidis<sup>12</sup>, Santiago Palazón<sup>13</sup>, Robin Rigg<sup>11</sup>, Juan Seijas<sup>14</sup>,  
Jon E. Swenson<sup>15</sup>, Tõnu Talvi<sup>16</sup>, Nuria Selva<sup>1</sup>**

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After centuries of decline, numbers and ranges of large carnivores have recently increased in Europe, due to the recovery of habitats and prey populations and an increased support for conservation efforts (1). A key issue for the conservation of large carnivores is managing the conflicts arising from damage to human property, such as livestock depredation. This is a sensitive problem where wildlife species return after decades of absence and particularly sensitive when the return is made by humans; e.g., reintroductions. The mitigation of these conflicts is commonly addressed with compensation schemes, assuming that reimbursing farmers for economic losses will increase the tolerance towards the species involved (2).

Our study synthesizes information on compensation costs from 33 populations of four large carnivore species in Europe. Compensation and prevention costs tend to be higher in countries that are wealthy, lack a recent history of coexistence with large carnivores and show a low level of tolerance towards them. We estimate that almost 30 million Euros are paid annually for compensation of large carnivore damage in Europe, of which approximately two-thirds is paid in countries where the range of large carnivores has at least quadrupled in the last decades. In the case of brown bear (*Ursus arctos*), preventive cost double the amount spent on compensation (5 vs. 2.4 million Euros per year, respectively), being the majority of preventive measures subsidized in reintroduced populations and in Norway (where bear's range has ten-fold increased in the last ca. 60 years). Half of the subsidized measures classified as prevention are not invested in protecting livestock and agriculture. They rather

seem to assist in the change in husbandry practices required before implementing effective measures to prevent damage (e.g., dog fodder or veterinary assistance) or they are related in fact to damage verification (e.g., training dogs to find sheep carcasses).

We discuss that to effectively mitigate conflicts in the long term, damage management policies should focus on the quality of preventive measures rather than on the quantity; should be adaptive and flexible; and should fit for purpose. To achieve these goals we recommend to managers and policymakers to evaluate the achievements of compensation and prevention programs periodically and we call for a pan-European database of damage occurrence, management actions and associated costs.

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## An assessment of juvenile Atlantic cod *Gadus morhua* distribution and growth using diver operated stereo-video surveys

(Oral)

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While the relatively infamous Atlantic cod (*Gadus morhua*) fisheries have recovered in some areas, the cod fishery in the Firth of Clyde on the west coast of Scotland remains depleted. The role of juvenile fish survival in determining the future cohort sizes is important, yet the key habitats for juvenile marine fishes in the U.K. have received little attention. Many juvenile fish inhabit shallow coastal areas, where the monitoring of fish is not possible using fisheries dependent methods. Here, we conducted 31 stereo-video scuba transects during daylight hours from June to September 2013 within a proposed marine protected area (MPA) in the Firth of Clyde. More juvenile Atlantic cod *Gadus morhua* of fork length (LF) range 6–11 cm were observed in substrata containing mixed gravel, including maerl, than in boulder-cobble substrata with high algal cover, or sand with low density seagrass. Community composition was significantly different between substratum types. A decrease in *G. morhua* abundance was observed over the period of data collection. Over time, mean and variance in *G. morhua* LF increased, indicating multiple recruitment events. Protecting mixed gravel substrata could be a beneficial management measure to support the survival and recruitment of juvenile *G. morhua*; other substrata might be important at night given their diel migratory behaviour. Stereo-video cameras provide a useful non-destructive fisheries-independent method to monitor species abundance and length measurements.

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## Spatially explicit analysis of biodiversity loss due to different bioenergy policies in the European Union

(Oral)

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The demand for bioenergy is expected to increase rapidly in the EU, driven by policies aiming to reduce greenhouse gas emissions through bioenergy. The downside of the increased use of bioenergy is the risk to biodiversity and ecosystem services, both within the EU but also outside the EU borders through indirect effects.

Our study provides a spatially explicit analysis of biodiversity losses from land use, land-use change, and forestry under three different EU bioenergy policy scenarios in the detail of NUTS2 administrative units. The study combined methodologies for biodiversity impact assessment with a global high resolution economic land use model GLOBIOM. Potential loss of global species (PSL<sub>glo</sub>) was used as an indicator for biodiversity damage, and species loss was quantified using the countryside species area-relationships model (SARs).

The Constant demand (CONST), the Baseline (BASE), and the Emission Reduction (EMIREN) scenarios were used for depicting different future biomass demands. All scenarios had similar biomass demand until 2020 but different targets afterwards, from keeping the demand for bioenergy constant (CONST) to a strong increase of bioenergy aiming to decrease GHG emissions by 80% in 2050 (EMIREN) and with the BASE scenario falling in between the other two.

The total global biodiversity loss due to EU land use and related changes in net imports was found to reach 1% in 2050 in the BASE scenario. The biodiversity impacts were found to vary only little between the scenarios but instead increase considerably over time in all scenarios, due to increased bioenergy and food demand. The damage was found to increase by 26% from year 2000 to 2050 in the BASE scenario. The difference between scenarios increased over time and in the year 2050 impacts for the EMIREN are 2% larger than in the BASE, meanwhile in the CONST scenario, they are 1.7% lower than in the BASE. The land-use induced impacts on biodiversity were amplified in southern Europe, where the ecoregions are hosting more biodiversity than in the north. In all scenarios, the relative share of indirect impacts through EU imports is expected to increase over time. Imports accounted for 15% of total impacts in the year 2000, and increased to 24-26% in 2050, meaning that relatively more damage would be outsourced by the EU in the future.

The main drivers of the direct damage for biodiversity were the increased amount of land used for perennial energy crops and the increased use of forests for biomass supply, while the indirect damage was driven by the increase of agricultural products imports. The expansion of perennial energy crops on agricultural cropland in the EU (especially in the EMIREN scenario) was found to outsource damage elsewhere, as agricultural products would then be increasingly imported from outside EU, partly from regions rich in biodiversity and hosting vulnerable species.

This work is part of the Sumforest project Future BioEcon.



## How are we monitoring biodiversity? Indicators for evaluating and benchmarking species and habitat monitoring programmes in Europe

(Oral)

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The monitoring of species and habitats is essential to biodiversity conservation. Although guidelines for biodiversity monitoring have been published since at least 1920, we know little on current practices in existing monitoring programmes. To fill this gap, we collected metadata on 646 species and habitat monitoring programmes in Europe and characterised current practices in monitoring. We developed metadata-based indicators for sampling design, sampling effort and data analysis to evaluate current practices, to study the importance of socio-economic factors in monitoring and to provide benchmarks for the comparison of programmes.

We find that the starting year, motivation, funding source and geographic scope of monitoring influenced at least one of the indicators in both species and habitat based programmes. More specifically, sampling design scores varied by funding source and motivation in species monitoring and decreased with time (starting year) in habitat monitoring. Sampling effort decreased with time in both species and habitat monitoring and varied by funding source and motivation in species monitoring. Finally, the frequency of using hypothesis-testing statistics was lower in species monitoring than in habitat monitoring and it varied with geographic scope in both. The perception of the minimum change detectable by the programme ('precision') matched spatial sampling effort in species monitoring but was rarely estimated in habitat monitoring.

We conclude that there are many signs of promising developments in biodiversity monitoring but also that there are options for improvement in sampling design, sampling effort and data analysis. Our results thus partially confirm recent concerns over the quality of biodiversity monitoring programmes. Although monitoring programmes differ greatly in their objectives, our general indicators provide benchmarks for the comparison of programmes that can be used to identify strengths and weaknesses in individual monitoring programmes. This knowledge then can be used to improve current practices, design new monitoring programmes, identify best practices and standardise performance across monitoring programmes. For more details, please see [1] and references therein.

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## Accounting for global drivers in landscape-level assessments of biodiversity and ecosystem services

(Oral)

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Wood production is a pivotal provisioning ecosystem service of major economic importance, yet its intensive utilization is a key reason for species declines in the EU and globally. A transition from a fossil- to a bio-based economy requires increased mobilization of raw materials from forests. It is therefore essential to find ways to fulfil the increasing wood demand while conserving biodiversity.

Wood and various other ecosystem services, as well as biodiversity are produced locally in forest landscapes. However, the demand for wood products is increasingly determined by a global market, i.e. outside the landscape in question. It is at the local level where the trade-off between increased timber harvests and biodiversity conservation, as well as other land-use conflicts, needs to be resolved. This requires a multilevel perspective - local-level scenarios of forest management and conservation need to consider external drivers such as the global wood demand<sup>1</sup>.

Here, our aim was to investigate how global drivers can be accounted for in landscape-level assessments. Global wood demand was projected by the MESSAGE-GLOBIOM modeling framework<sup>2</sup> for different combinations of shared socio-economic pathways and climate scenarios. Next, the resulting national level projections of demanded wood volumes and prices for the case of Sweden were downscaled to the landscape level with a partial equilibrium model (PEM). To find market equilibria, the PEM combines the national demand for sawn timber, pulpwood and forest fuel with potential forest supply. Potential supply and associated silvicultural, harvesting and transporting costs were computed with the Heureka forest simulator<sup>3</sup> for a 100-year time period based on some 10,000 National Forest Inventory (NFI) plots covering Sweden. The NFI plots are linked with expansion factors to make them representative of the total productive forest area. Thus, the supply from the NFI plots in the landscape in question defines the landscape-level wood demand.

In a next step, the resulting landscape-level wood demand will be used in the formulation and simulation of forestry and conservation scenarios for a forest landscape in northern Sweden. We will link scenario projections in terms of forest variables, and their change over time, to (meta)population dynamics of focal species, and investigate local impacts of changes in global wood demand on various ecosystem services and biodiversity.

The work is part of the BiodivERsA project GreenFutureForest.

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## Rewilding complex ecosystems: Restore function not state

(Oral)

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Rapid global change and increasing human use of resources have led to the widespread loss and degradation of many ecosystems, and these trends are projected to maintain or even increase. Counteracting these trends requires flexible conservation approaches to maintain and restore ecosystem functioning and to enhance ecosystem resilience. We argue that rewilding, as a dynamic and low-intervention approach to conservation, can complement and support conservation efforts to protect species and habitats of conservation concern. We identify functional diversity and ecosystem complexity, natural disturbance and stochasticity, and connectivity and dispersal, as three important domains related to ecosystem processes that can be restored and maintained via rewilding. We use concepts from resilience and complexity theory to describe the ecological consequences of restoring and maintaining these process-related ecosystem aspects, and we discuss important socio-economic implications of rewilding. Finally, we provide practice-oriented guidelines for rewilding-based conservation.

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## What does the science say? The diversity of methods to synthesize knowledge

(Oral)

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Effective, unbiased and transparent methods of knowledge synthesis are a crucial element of science-policy-society interactions. A vast and rapidly expanding body of knowledge is relevant to many policy decisions. This includes scientific knowledge, technical know-how and experiential knowledge held by experts, and indigenous and local knowledge. Synthesizing knowledge within timescales relevant to policy makers is a real challenge, but many methods are now available to do so.

We have identified 21 knowledge synthesis methods that could be used to answer questions from policymakers or other stakeholders [1]. It is not an exhaustive list, but those we consider most useful for current science-policy-society interfaces in environment and natural resource management. The methods range from focus groups, which can be done in just a few days and gather local place-based knowledge, including opinions and values from small groups; to structured systematic reviews, which follow an a priori protocol, can take a year or more, require substantial scientific expertise to complete and address a narrow, well-defined scientific question.

The methods can draw on different sources of tacit or codified knowledge: scientific, indigenous and local knowledge, technical know-how, and anecdotal evidence. We have developed concise guidance on each method, providing information on how it works, what it can achieve, what type of questions can be tackled, how much it costs, and what specialist resources are required. The guidance also summarises the relative strengths and weaknesses of each method. We have collected example case studies to illustrate the use of each of the different methods to inform design or implementation of environmental policies across Europe.

Building on previous work [2,3], and in partnership with policymakers, we have devised a process for structured dialogue between knowledge-holders and knowledge requesters, to select an appropriate knowledge synthesis methods or set of methods. This talk provides an overview of the methods and describes the method selection process, using recent examples from the EKLIPSE project ([www.eclipse-mechanism.eu/](http://www.eclipse-mechanism.eu/)).



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## Loss of natural Baltic salmon populations can severely reduce metapopulation capacity for retaining genetic variation

(Oral)

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The Atlantic salmon of the Baltic Sea is a species of high ecological importance and socioeconomic value. Historically, 94 rivers entering the Baltic Sea held wild salmon populations. Hydro-electric power plant construction during the 19th and 20th centuries has obstructed the salmon's migratory pathways to upstream spawning grounds, leading to limited reproduction in the wild, and a depletion of natural - likely unique - populations. Today, wild populations remain in 30 of the rivers, of which 11 are self-sustaining. The additional rivers contain wild and released salmon in various stages of self-sustainability, although a few rivers are completely void of salmon (1). This study addresses whether the loss of separate subpopulations has reduced the overall capacity for Baltic salmon to maintain genetic variation, and if so, what the expected magnitude of such a reduction is.

Effective population size ( $N_e$ ) is a key term in conservation biology as it measures the rate of loss of genetic variation. It was initially developed for a single, isolated population. Although considerable research has been devoted to modelling  $N_e$  in subdivided populations (i.e. metapopulations), most of those efforts have used simplifying assumptions such as subpopulations of equal size and standardized models of migration. We apply a novel analytical tool (2, 3) which allows modeling of complex metapopulations with large flexibility in metapopulation structure. This permits modelling highly topical issues on the genetic dynamics of metapopulations that have previously not been possible to address, which we apply to a case study of the Baltic salmon. Our model is parameterized with empirical data from Baltic salmon populations in order to estimate the metapopulation  $N_e$  and inbreeding dynamics of Baltic salmon prior to and after the subpopulation decline.

The results show that with subpopulation sizes, migration rates, and migration models mimicking Baltic salmon population structure, metapopulation  $N_e$  is drastically reduced following the loss of separate river populations. Compared to the loss expected based on the proportion of populations lost, the observed reduction in metapopulation  $N_e$  is larger by orders of magnitude. This indicates that the capacity of the Baltic salmon to maintain genetic diversity and adapt is likely seriously compromised as a consequence of local extinctions. The future survival and adaptive potential of the Baltic salmon critically relies on management efforts retaining remaining wild populations and restoring populations in rivers that have lost their local stocks.

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## Fish scale shape analyses: in mirror of phylogenetics

(Oral)

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Several studies proved that fish scale shape is suitable for species identification, and for population level discrimination as well. There is lack of information about how the scale shape refer to the taxonomic position of a certain species. For this reason the scale shape of 10 fish species (roach *Rutilus rutilus*, chub *Squalius cephalus*, gibel carp *Carassius gibelio*, razorfish *Pelecus cultratus*, bleak *Alburnus alburnus*, carp *Cyprinus carpio*, topmouth gudgeon *Pseudorasbora parva*, perch *Perca fluviatilis*, pikeperch *Sander lucioperca*, rudd *Scardinius erythrophthalmus*), inhabiting the catchment of Lake Balaton was compared to their phylogenetic positions derived from COI sequences, available in GeneBank. At first landmark-based geometric morphometric analysis was performed on their scales' shape. The Euclidean distance matrices derived from the scale shape data and COI sequences were compared using a Mantel test. The results show that the phylogenetic relations of the studied species corresponded well with the scale shapes. Detailed patterns might be explained by other factors, like body shape and size, life history traits of the certain species. This finding might be useful in case of unidentified scale samples for rough classification, for example in case of archaeological finds, or food composition analyses of piscivore species.

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## How global bioeconomy policies and local fire management drive Mediterranean forest landscapes and their associated fire regimes

(Oral)

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Europe's bioeconomy policy seeks to diversify the energy sources for industrial purposes through the gradual replacement of fossil fuels by the sustainable use of renewable biological resources (e.g. forest products), and therefore, to contribute to the mitigation of ongoing climate change. Sustainable harvesting levels of forest biomass to meet future demands of bioenergy and wood-based products need to be carefully evaluated, in order to minimize the potential negative impacts of forest exploitation/use on forest ecosystem functioning (and services provisioning) and on their associated biodiversity values. In this study we explore the effects of three European-level bioeconomy scenarios on the coverage of Mediterranean forests, their spatial distribution, and the fire regime (fire frequency and fire size) in Catalonia, a Mediterranean fire-prone region currently dominated by an agro-forest mosaic. The 'Business-as-usual' scenario assumes that no new bioeconomy policies are implemented, the 'EU bioenergy' scenario aims to reduce greenhouse gas emissions in EU28 by increasing bioenergy production, and the 'Global bioeconomy' scenario seeks to enhance a full development of bioeconomy based on bioenergy and the use of biomaterials. We first downscaled to the study region the outputs of GLOBIOM model, a global market equilibrium model that analyzes the competition for land use between the agriculture, forestry, and bioenergy sectors. It generates national-level demands for industrial roundwood and biomass for energy production. We link the outputs of the GLOBIOM to the MEDFIRE model. The MEDFIRE is a regional spatially explicit landscape dynamic model that accounts for vegetation growth, drought-induced mortality, establishment after fire, and afforestation. It incorporates a forest management and land-use change module, and also simulates fire behaviour and fire suppression actions. The combination of the two models allow us to obtain future spatially explicit projections of the Mediterranean forests distribution and coverage on an annual basis from 2010 to 2100, under each bioeconomy scenario. Results show that fire regime is progressively altered, both fire frequency and fire size will increase, in both bioenergy based scenarios due to a positive feedback between more fuel load availability and more severe climate. However, an increase on fire incidence reshape forest structure and compromise future wood demand to meet the bioenergy policies. Scenario projections will be further used to evaluate the potential impacts of each bioeconomy scenario on the provision of ecosystem services linked to Mediterranean forests, as well as their potential effects on biodiversity values. The work presented here is part of the Sumforest project FutureBioEcon.



## How do rewilders define rewilding, and how do they think it should be done.

(Oral)

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The emergence of rewilding as a concept and as a practical approach to conservation in recent years has been accompanied by some debate amongst self-identified rewilding advocates and practitioners. Firstly, there has been a debate about what exactly constitutes rewilding, what it is aiming to achieve, what should and should not be considered appropriate, and how fundamental concepts should be defined. Secondly, there is some disagreement over the subtleties of why it should be done, which benefits and outcomes should be prioritised over others. Thirdly, there is some debate about how it should be achieved, which tools and techniques should be used, whether approaches such as payments for ecosystem services should or should not be part of the rewilders' armoury. Yet so far, there has been little empirical exploration of how rewilders define rewilding, and why and how it should be done. This paper presents the result of an extensive Q-method study of rewilding advocates and practitioners in Europe, to identify what rewilders think, and why. It demonstrates areas of convergence and divergence, and where discreet clusters of views may exist. It promises to generate a more insightful discussion about the future of rewilding.

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2018/06/13

14:30


Room: A3 Wolmar



## Multi-scale cattle selectivity by leopards in forests of northern Iran: lessons and possible solutions to human-leopard conflict mitigation

(Oral)

Igor Khorozyan<sup>1</sup>, Siavash Ghoddousi<sup>2</sup>, Mobin Soufi<sup>3</sup>, Mahmood Soofi<sup>1</sup>,  
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Abstract of this presentation is not public

2018/06/13

15:30

Room: A1 Wilhelm



## **Ramboll: Ecological compensation from the perspective of an environmental consultant**

**(Oral)**

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Abstract of this presentation is not public





## Assessing the effect of multi-species involved in conservation conflicts

(Oral)

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Conservation conflicts (i.e. when parties clash over differences in their objectives and when one party asserts, or at least is perceived to assert, its interests at the expense of another) are one of the most challenging problems facing conservation researchers and practitioners. Conflicts are detrimental for the conservation of species and costly to the economic development and wellbeing of local people. Although they are widespread around the world and involve in many cases multiple species within the same area, multi-species studies are rare, which ultimately underestimate the magnitude of conflicts. In this study, we assessed the spatiotemporal patterns of incident reports for multiple “problem species” in Northern Botswana.

In the eastern Okavango Delta Panhandle, subsistence farmers share and compete for resources with a wide range of megafauna including elephants, hippopotamus, lions, leopards, crocodiles, wild dogs and hyenas. All these species have different ecological needs (e.g. species distribution, migration, diet) as well as different conservation statuses. This is why in many cases their interaction and potential conflict with people’s livelihoods are approached and managed separately. Using incident reports collected by the Department of Wildlife and National Parks (DWNP, Botswana) since 2008 we identified trends in incident reporting for different species across the year within the study area. We found that elephants and lions were the most reported species across all villages. However, both species showed contrasting seasonal patterns, with elephant incidents being mainly prevalent during the wet season (November-May) and lions during the dry season (June-October). Our findings suggest that farmers in the Eastern Panhandle are affected by local wildlife throughout the year, which potentially could impact the perception local communities have towards wildlife. We highlight the importance of investigating the effect of multiple species involved in conflicts in terms of management, as well as their potential effect on people’s attitude towards wildlife.



## The Hungarian ecosystem services assessment – an example for a national level science-policy interface

(Oral)

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The 2nd target of the EU Biodiversity Strategy requires the member states to assess and map the most important ecosystem services (ES) and integrate these results into policy decisions. Led by the Ministry of Agriculture an EU-cofinanced project entitled „Strategic Investigations on the long-term preservation and development of natural heritage of Community Importance and on the implementation of the EU Biodiversity Strategy 2020 objective” has started in Hungary in 2016 to fulfil these goals. The project has four main elements, focusing on 1) species and sites of Community Importance, 2) mapping and assessment of ES (MAES-HU), 3) defining landscape character types and methodology development for their protection, 4) planning of green-infrastructure development. The MAES-HU aims to build up spatial databases of ecosystems and ES in Hungary, and assess them using biophysical, economic and social indicators. To ensure broad scale scientific, policy and social credibility, the project puts high emphasis on participatory planning and stakeholder involvement. Prioritization of ESs for assessment was implemented in a series of workshops according to the main ecosystem categories: forests, water bodies and marshy areas, grasslands and arable fields (in a joint workshop but with separate evaluation) and urban ecosystems. Experts from different fields (8-14 per workshop) were invited to prioritise and shortlist the ES from CICES 4.3 based on expert consensus on their perceived societal importance in Hungary. After careful evaluation of the process and its outcomes, the MAES-HU working group finally chose 13 ES to map and assess during the remaining three years of the project until the end of 2020. The methodology of the assessment is built on the guidelines of the EU MAES working group and technical reports of former national assessments of several EU member states. The evaluation of the prioritized ES will be conducted in a four step process along the four levels of the cascade model: 1) condition of ecosystems, 2) capacity (potential supply) of the ecosystems for the selected ES, 3) actual use of the selected ES, 4) contributions of ES to human wellbeing. The assessment will last for about two years and will be performed by six expert working groups, involving around 40 experts from different fields. Graphical representations (i.e. mapping) will take place at all cascade levels using a detailed ecosystem map. Economic evaluation of specific ES is also planned. In the last year of the project, planning of different future scenarios will take place based on the joint evaluation of the assessed ES. The results of the MAES-HU project will hopefully assist the sustainable management of environmental resources, the development the green-infrastructure network, improved communication between different sectors, to incorporate the results into biodiversity and sectoral policies, and to reach the UN Sustainable Development Goals.





## Rewilding: opportunities for boosting large-scale biodiversity restoration in Europe

(Oral)

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Failures of conservation policies in place to revert the current loss of biodiversity and ecosystem services urge to expand conservation approaches by seeking new opportunities for harmonizing nature restoration and social and economic needs. Rewilding has emerged as an ambitious solution to restore the integrity of ecological communities, emphasizing the need to switch from policy goals mostly focused on structural components of biodiversity such as species and habitats, towards a more comprehensive consideration of ecosystem processes and the role of species in maintaining these processes. However, contrasting perspectives on the implementation of rewilding goals, as well as misinterpretations of its ecological foundations, have obscured the debate about whether rewilding should be included or not in the conservation agenda. In this talk, I will discuss the benefits of a pragmatic approach to rewilding for boosting large-scale and long-term visions for biodiversity restoration in Europe, while taking advantage of opportunities provided by socio-economic changes and policy opportunities, such as land abandonment and the potential to contribute to the goals of Green Infrastructure. I will present rewilding as a multi-faceted concept that focuses on (1) increasing the functional ecological connectivity of habitats, (2) promoting more sustainable and biodiversity-rich food webs, and (3) allowing space for natural disturbances. Furthermore, I will make a case for the implementation of an European-scale rewilding strategy that is based on the identification and spatial assessment of the current state, the opportunities, and the risks and limitations of a rewilding approach. This advocacy has the ultimate goal of promoting the adoption of a proactive biodiversity restoration agenda at the EU level that explicitly incorporates rewilding principles.

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2018/06/13

16:00

Room:



UNIVERSITY OF JYVÄSKYLÄ



## Discussion: Science-policy-society interfacing in the European context

(Oral)

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## Movements of Individual Salmon (*Salmo salar*) in the Baltic Sea Revealed by Stable Isotopes

(Oral)

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Spatial stable isotope variability (“isoscapescapes”) offer potential for various applications in migration ecology, wherein stable isotope values of animal tissues are compared to values measured from the environment. We used otolith oxygen ( $\delta^{18}\text{O}$ ) and carbon ( $\delta^{13}\text{C}$ ) stable isotope measurements to investigate seasonal movement patterns of individual Baltic Sea salmon and the migratory connectivity of one breeding population in their non-breeding areas in the Baltic Sea. Spatial variability in  $\delta^{18}\text{O}_{\text{H}_2\text{O}}$  and  $\delta^{13}\text{C}_{\text{DIC}}$  values of the water collected around the Baltic Sea was determined to generate horizontal and vertical gridded isoscapes. Salmon individuals ascending the river to spawn were collected in early summer in four sequent years. Prior to stable isotope analysis, micro-sampling of the otolith powder was conducted using a three-dimensional micromilling system. Two selected time points from salmon otoliths, the 2nd summer in the sea and the following winter, were analysed for isotope values. The differences between summer and winter in Baltic Sea  $\delta^{18}\text{O}_{\text{H}_2\text{O}}$  values were low, whereas  $\delta^{13}\text{C}_{\text{DIC}}$  values exhibited substantial seasonal variability. Preliminary tests of probable locations of individual salmon via spatial probability surface maps revealed that present knowledge about  $\delta^{13}\text{C}$  values is insufficient for modelling purposes. Therefore only  $\delta^{18}\text{O}$  values were used to study seasonal and annual differences in locations of individual salmon in their non-breeding areas at the sea and locations in relation to the time of ascending the spawning river. Our results indicate that during their feeding migrations salmon move considerable distances within their non-breeding area and that migratory connectivity of the breeding population varies in spatial and temporal scales, the extent of which is poorly understood in salmon ecology. We conclude that better knowledge of movements within the non-breeding areas of migratory animals is important for understanding possible drivers (e.g. resource distribution) of animal migrations. Our observations also raise concerns over how to conserve and manage populations which are continuously moving substantial distances in their non-breeding area.



## Management of human-induced contemporary evolution to maintain and restore genetic diversity in brown trout

(Oral)

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Silva Uusi-Heikkilä<sup>2</sup>, Anti Vasemägi<sup>3</sup>, Pekka Hyvärinen<sup>4</sup>, Ari Huusko<sup>4</sup>,  
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Maintaining genetic diversity and integrity of animal populations is a key challenge in conservation. While ecological population declines can be reversed, loss of genetic diversity and original trait distribution is often a one-way road. Migratory brown trout is critically endangered in Finland due to extensive modification of river ecosystems and unrestricted fishing on feeding areas. In addition to being too intense in general, fishing creates challenges by being selective for a number of traits in fish. We have shown that recreational angling, for example, is selective for certain personality traits and can cause inherited behavioural changes in the offspring of brown trout. Only a few migratory brown trout stocks representing large watershed-specific areas are maintained in hatcheries and used in large-scale stockings to support intensive recreational fisheries. The hatchery-based broodstocks are under the risk of accumulating genetic changes that improve their survival in the captive environment, but decrease their survival in the wild. While natural reproduction of most migratory populations is marginal, numerous original resident brown trout populations still occur in small brooks. We have studied the potential to use wild resident populations as genetic material to increase the genetic diversity and the adaptability of hatchery broodstocks. Our results show that while interbreeding can improve predation avoidance, survival from predation and even juvenile growth, the migration tendency of hybrid fish can be compromised. In addition, both common garden experiments and population genomic data indicate that migration tendency in brown trout has a genetic underpinning. Thus, the only way to conserve the iconic, fast-growing, late maturing migratory brown trout populations is to restore their natural life-cycle and manage the fisheries at sustainable harvesting levels. The fine-scale genetic structuring, that we have revealed using both traditional microsatellite and genome-wide techniques, provides solid evidence that each brown trout population is genetically distinct and thus intrinsically valuable. Our results imply that extinct local stocks cannot be equivalently replaced with non-native fish. This creates significant societal pressures to change the existing policy and legislation of hydropower functions and compensation measures set for the companies that significantly alter natural river ecosystems and prevent the natural reproduction of most of the migratory brown trout stocks. It has become evident that even the broodstocks used to produce hatchery fish to support fisheries need regular updating with local fish, that have experienced natural selection pressures through a natural life-cycle. Selection induced by fishing still remains a challenge but the most effective solution is simple: fishing mortalities have to be decreased to sustainable levels.



2018/06/13

15:45

Room: C1 Hall



## The bee and the parasite: using genomic data from museum collections to identify parasites affecting short-haired bumblebee reintroduction efforts

(Oral)

Selina Brace<sup>1</sup>✉, Ian Barnes<sup>1</sup>, Mark JF Brown<sup>2</sup>

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Abstract of this presentation is not public



UNIVERSITY OF JYVÄSKYLÄ



## Personality of sea trout and consequences for survival quantified using detailed movement data from a telemetry study in a southern Norwegian fjord

(Oral)

Susanna Huneide Thorbjørnsen<sup>1</sup>✉, Even Moland<sup>1</sup>, David Villegas-Ríos<sup>2</sup>,  
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Animal personality may be an important part of the puzzle that is identifying the components affecting survival of an anadromous species in the marine phase. Also of interest is the interplay between individual personality and changing ecological conditions and/or management tools like marine reserves. In the present study, we have monitored more than 100 individuals of sea trout in a southern Norwegian fjord covered by a dense network of acoustic receivers. The resulting dataset provides detailed information on sea trout movement and depth use, in addition to giving information on the sea trout's use of river, fjord and outer fjord and sea habitats. In the present work, I/we will link behavioural movement traits, and herein personality, to survival in order to assess to which degree personalities can affect fate of sea trout in the marine environment. Preliminary analyses revealed that sea trout had a repeatability of behaviour related to both home range size and mean depth, indicating that these aspects of movement behaviour are consistent within the individual. I/we hypothesize that increased space use and activity will result in reduced survival. The reasons for this are likely complex and may include that more active and/or bolder individuals have a higher chance of being exposed to fishing and have a higher natural mortality. Furthermore, it is of interest how individuals with different behaviours and/or personalities respond to management tools like protection through marine reserves or marine protected areas. I/we present potential protection benefits provided by a small fjord reserve to the sea trout population, and more specifically the variation in obtained protection for different behavioural types within the population. Telemetry studies can provide valuable insights into the fate of individuals within a system, but limitations include uncertainties in determining fate of dead individuals in terms of natural or fishery induced mortality and tag excretion.

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## An optimization approach for balancing global wood demand and environmental goals on management strategies in Swedish forests

(Oral)

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The transition towards the bio-based economy in the future increases the demand for raw materials from the forests. This will increase the extraction of wood from the forests but may adversely affect its biodiversity and other ecosystem services (ESS). The growth rate of most tree species in Sweden is predicted to increase because of changing climate. It will however be counterbalanced by an increased risk of damage due to extreme weather events such as storms. Therefore, it is necessary to develop adaptive management measures that exploit the benefits of climate change while minimizing the damages on growing stock, ESS and biodiversity resulting from its risks. It is further important to consider the trends in the global development for studying the future trends of production and nature conservation in Sweden. The demand for wood varies among the global development scenarios and greenhouse gas emission pathways. The aims of this study are: (i) to identify the impacts of climate change, EU forest policies and associated wood demand on Swedish forests, (ii) how the combination of different scenarios of EU forest policies and climate affects the harvest levels, carbon sequestration and future occurrence of a set of forest-dwelling species in Sweden and (iii) to formulate optimal combinations of different management regimes for sustainably achieving the demand for different wood assortments and environmental goals in Sweden as stipulated in EU and national forest policy statements under changing climatic conditions. In this study the demand for different wood assortments in Sweden will be simulated assuming different global and EU policy scenarios using the GLOBIOM model. The three policy scenarios are baseline, bioenergy and global bioenergy. In the baseline scenario, the increase in global demand for wood stabilizes by 2020 whereas in others the increase in wood demand stabilizes only after 2050. In the global bioenergy scenario, mitigation measures are implemented globally resulting in higher wood demand in comparison to the bioenergy scenario where mitigation measures are confined only to EU. Assuming the different demand for wood assortments, we will propose adaptive management measures like delaying final felling, avoiding thinning and speeding up final felling, green tree retention, continuous cover forestry and unmanaged forest along with a current management scenario. The simulations of the Swedish forest landscape with different adaptive management regimes will be performed using the Heureka model. Optimization will be done for maximizing various objectives like net present value, carbon sequestration and biodiversity. Biodiversity will be accounted for in the form of different species distribution models. The time period of the simulations will be from 2010 to 2100. Two future climate scenarios, a business as usual scenario (RCP8.5) and an optimistic scenario (RCP4.5) are also considered in this study.



## A context-specific boundary object to strengthen collaborations across science, policy and society

(Oral)

M.D. López-Rodríguez<sup>1</sup>✉, A.J. Castro<sup>2</sup>, H. Castro<sup>3</sup>, S. Jorroto<sup>1</sup>, Javier Cabello<sup>3</sup>

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Science-policy interfaces (SPIs) are social processes that are avenues for addressing sustainability challenges through strengthening collaborations between researchers, decision makers and social actors. These transdisciplinary experiences provide a framework wherein scientific advances, policy needs and societal concerns can be coupled to increase the understating of complex problems and identify collective solutions to solve them. However, many studies have highlighted the need to develop and refine tools and operational methods to operationalize SPIs. Here, we present a SPI experience for addressing day-to-day problems in the southeastern Spanish dryland (López- Rodríguez et al., 2015). To facilitate mutual understanding and generate trust between participants we used (1) a knowledge brokering approach based on six interlinked workshops, and (2) a context-specific boundary object specifically designed to put into practice the transdisciplinary process. The boundary object is a graphical tool (triangle) for diagnosing environmental problems using three gradients based on a standardized punctuation for each one (on a 0-3 scale), namely of: (i) the scientific knowledge (i.e. the scientific evidence available about the specific problem); (ii) the regulatory capacity (i.e. the current legislative framework relevant to articulating public administration solutions); (iii) public engagement (which reflects the social relevance of the specific problems to the general public). In this gradient 0 represents that scientific knowledge, regulatory capacity or public engagement not being relevant for solving the environmental problem in the short term; whereas 3 represents high scientific evidence, regulatory capacity and that public engagement is available to address the problem. Throughout the SPI, 12 environmental problems (5 related to water management and 7 related to biodiversity loss) were identified and agreed as priorities in the region. Then, each problem was, collectively, rated differently for each dimension using the boundary object. The use of this boundary object allowed (1) aligning scientific knowledge with specific management goals and societal demands, and (2) promoting the implementation of science-based actions through collaborative work between scientists, decision makers and social actors. These insights provide a useful contextual orientation for conducting similar experiences in other social-ecological and political-administrative contexts.

Reference: López-Rodríguez, M.D., Castro, A.J., Castro, H, Jorroto, S., Cabello, J. 2015. Science-Policy interface for addressing environmental problems in arid Spain. *Environmental Science and Policy* 50: 1–14.



## Measuring progress towards rewilding

(Oral)

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Deli Saavedra<sup>2</sup>, Eloy Revilla<sup>3</sup>, Nuria Selva<sup>4</sup>, Jens-Christian Svenning<sup>5</sup>,  
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Human domination of land has transformed ecosystems, modified ecological processes and influenced biodiversity composition across most of the terrestrial biosphere. Nevertheless, this global change does not necessarily translate into a total depletion of natural values. Innovative conservation actions are emerging as a promising strategy to enhance biodiversity, ecological resilience and ecosystem service delivery, as well as to retain ecological and evolutionary potential. For instance, rewilding projects have gained increasing attention from scientists, conservationists, practitioners, decision-makers and the media. Recovering the natural dynamics of ecosystems requires increasing ecosystem complexity while decreasing human intervention, which does not prevent interactions between people and nature from occurring if these are properly integrated in these restored self-sustaining ecosystems. Despite burgeoning interest in the ideas, the practical implementation of rewilding projects remains challenging. There is a pressing need for developing specific guidelines for monitoring progress in rewilding initiatives that are informed by the best science available. In this talk, we will present a novel approach on how to measure progress towards rewilding in a given area and we will revise the evidence available for facilitating sound decision-making in order to support local rewilding and restoration projects. Drawing on evidence from ecological research, we will introduce a bi-dimensional framework that uses indicators, state variables and targets describing the humanization intensity and the natural values of a certain region to measure its position in a gradient of wilderness. Then, we will illustrate this approach with case studies, in which we draw scenarios with low human intervention and the maximum functional complexity. The approach presented here will enable the operationalization of successful rewilding initiatives.

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2018/06/13

14:45

Room: A1 Wilhelm



## **Finnish Association for Nature Conservation: The Carbon Stock Market**

**(Oral)**

**Heikki Susiluoma<sup>1</sup>**

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Carbon Stock Market is an innovation of the Finnish Association for Nature Conservation. It is a marketplace where anyone can pay for restoring drained peatland/bog and at the same time compensate for his/her carbon footprint. One hectare costs 800 € and it is about 1/5 of the footprint of the average Finnish person. 15 % of the money is spent on local nature activity and art. This restoration also increases the biodiversity and improves the water quality of lakes and rivers. Carbon Stock Market starts on the 25.5.2018 and is funded by the Kone Foundation.

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## When to rewild? Framing rewilding in the contexts of science, culture and decision making

(Oral)

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Rewilding as an approach to conservation has gained considerable ground in recent years both in terms of interest and practice. However, in an ever-expanding literature it is apparent that rewilding is a polysemic concept [1], posing a number of challenges to its utilisation for biodiversity conservation. Conversely, it is recognised that this varied nature may also offer specific opportunities [2]. Attempts to develop a singular definition of rewilding may, therefore, be neither practicable or desirable at present. Where does this leave rewilding in terms of acceptance and understanding from different stakeholder groups, including scientists, the public, and policy and decision makers? Through a comprehensive review of the literature, this research identifies underlying themes common to different definitions of rewilding. These themes are then utilised to consider the opportunities and challenges that rewilding presents to different stakeholders. From this analysis a simple set of criteria are developed as a suggested starting point to aid the identification of situations in which rewilding may be an appropriate response to specific conservation needs. In so doing, consideration is given to how these criteria may begin to conceptually frame rewilding without limiting its meaning, and so support the wider understanding of this still-developing concept and its role as an approach to biodiversity conservation.

Jorgensen, D. (2015). Rethinking rewilding. *Geoforum*, 65, 482-488. Jepson, P., & Schepers, F. (2016). Making Space for Rewilding: Creating an enabling policy environment. DOI:10.13140/RG.2.1.1783.1287.

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## Recoverable Earth: rewilding and the rise of a 21st century environmental narrative.

(Oral)

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DOI: 10.17011/conference/eccb2018/107306

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In this talk, I will posit argue that rewilding is giving form to a new environmental narrative that is different in structure and worldview to the dominant 20th century environmental narrative. An appreciation of underlying environmental narratives is important. This is because narratives are a guide to sense making in a complex and uncertain world and provide social movements, science and advocacy with legitimacy and purpose. Narratives create 'architectures' for the telling of normative stories about the state of the world and how we might act within it.

I will first outline the origins and narrative elements of the traditional environmental narrative. I will analyse its wide-reaching influence but also argue that this has is based on promoting anxiety and constructing characters of good and evil. I will go on to suggest that rewilding stories are giving form to a new narrative architecture that has similarities with accounts of mental health recovery. This emerging narrative, which I label 'Recoverable Earth' includes components relating to awakenings, action and change leading to recovery of ecological, social and personal well being. I will argue that it is a future-looking narrative of empowerment, reassessment, change and hope.

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## A Social Network Analysis of Scottish Goose Conflicts

(Oral)

**Chris Pollard<sup>1</sup>✉, Aidan Keane<sup>1</sup>, RyanRyan McAllister<sup>2</sup>, Steve Redpath<sup>1</sup>,  
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Interactions between individuals and groups drive conservation conflict. Interventions to reduce conflict based on altering interaction characteristics such as frequency, type or even existence of an interaction, require an understanding of how the variables which influence interactions are interrelated. Variables include: the group affiliation of actors involved in the conflict; the power imbalances actors perceive between themselves and others; and the influence actors have both formally and informally on decision making. Social network analysis can be used to understand the relationships between variables such as group affiliation and the likelihood of interaction between two actors. At several locations across Scotland, UK, large increases in wild goose populations have resulted in increasing goose grazing and fouling damage to arable crops and to grassland intended for livestock. Conflict between those with goose conservation priorities and those with agricultural priorities has emerged. Having recognised goose conflict as a problem, the Scottish government promoted the formation of formal local goose management groups (LGMGs) at several conflict hotspots. Each group includes local representatives from stakeholders involved in the conflicts including farmers, wildlife conservation NGOs, government, protected area managers, wildfowl hunters and land owners. We collected network data at two island locations in Scotland, The Orkney Islands, and The Uists, where increasing numbers of greylag geese (*Anser anser*) have resulted in LGMGs being formed. In order to examine how different individuals interact with both the LGMG and with other groups involved in conflict, we use exponential random graph modelling (EGRM) to determine if: i) groups perceived as having greater influence on goose management are more likely to have interactions with individuals; ii) farmers are a homogenous group, more likely to interact with the same groups as other farmers; and iii) the member groups of the LGMG are less likely to interact with individuals who are not themselves affiliated with the LGMG. Here we present how the network structure in each goose conflict offers potential interventions, both at these locations and more generally for managing conservation conflict.

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2018/06/13

14:30


Room: A1 Wilhelm



## Biodiversity and carbon offsets of the ECCB2018 congress

(Oral and Poster)

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As human beings we cause harmful ecological impacts such as habitat destruction and greenhouse gas (GHG) emissions. Biodiversity and climate offsetting (compensations) are approaches where harmful ecological and climate impacts are compensated by producing some additional benefits for nature that would not have been achieved without the offsetting. In this project we aim to offset the harmful ecological and climate impacts of the European Congress for Conservation Biology, ECCB2018, and through a case-study obtain information about the magnitude of harm caused by a large international conference, and about the benefits gained through raising funds from the delegates to be used for offsetting; restoring drained peatlands in this case.

When estimating the harmful ecological and climate impacts of any activity, the focus needs to be on the impacts that would not have taken place without the activity. In ECCB2018 case those impacts are the travelling emissions of delegates. To offset the ecological harm and emissions caused by the ECCB2018, the delegates to the conference are requested to pay an offset fee during the registration. The harmful ecological impacts are estimated from the delegates travel information requested during the registration and from the calculated climate impacts based on this information. Offsetting is recommended but voluntary and each delegate can decide the amount they are willing to pay.

All funds raised for the offsetting purposes will be allocated in full to restoration to create the offsets. Drained peatlands were restored in collaboration with Parks and Wildlife Finland, a State Enterprise managing all state owned lands in Finland. When restoring the peatland by filling in the ditches, the hydrology of the peatland recovers rapidly inducing a recovery of the vegetation and jump starting the carbon sequestration function of the peatland (Kareksela et al. 2015). Our restoration area locates nearby Salamajärvi National Park and its size is about 60 hectares. The gains of the restoration will be estimated based on climate effects of restored peatland. In addition, the habitat improvement in restored areas will be estimated by applying the framework developed for the assessment and reversing of ecosystem degradation (Kotiaho et al. 2016). By comparing the harmful impacts with the gains we are able to verify whether the offsets are adequate to completely offset the losses, whether the offset is only partial, or whether the ECCB2018 can reach a net positive impact.

1 Kareksela, S., Haapalehto, T., Juutinen, R., Matilainen, R., Tahvanainen, T. and Kotiaho, J.S. 2015. Fighting carbon loss of degraded peatlands by jump-starting ecosystem functioning with ecological restoration. - *Science of The Total Environment* 537: 268-276.

2 Kotiaho, J.S., Kuusela, S., Nieminen, E., Päivinen, J. and Moilanen, A. 2016. Framework for assessing and reversing ecosystem degradation. Reports of the Ministry of the Environment, 15en | 2016.

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## Air Bee n' Bee: a citizen science study of man-made solitary bee hotels as a conservation approach

(Oral and Poster)

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"Air Bee n' Bee" is a citizen-science study exploring the efficacy of man-made bee hotel designs in attracting solitary bee species. The species targeted by the nests are primarily *Osmia* (Mason bee) and *Megachilae* (Leafcutter bee). In the UK, these crucial pollinators are largely unmanaged compared to hive species and require study at a time with rising urbanisation. Man-made nests aggregate natural conditions by emulating the cavities used by solitary bees, with cardboard tubes or drilled holes in wood. Current attempts to offset the impact of urbanisation frequently increase floral availability, with little focus on nesting availability. Moreover, man-made nests offer a practical homegrown conservation approach, however there is a stark dearth of knowledge regarding their functionality. Specifically, participants will be required to create structures by drilling 8-9mm holes in wood blocks and inserting cardboard tubes into milk cartons; to create a selection of prospective nesting material. A direct comparison in this way attempts to further develop these tools for bee science and ensure their effectiveness in bee conservation. Using specifications suggested by MacIvor (2016)[1], this public outreach approach will integrate large scale data collection and have a cumulative impact on biodiversity (Cooper et al, 2007)[2].

Citizen science offers a novel conservation approach to preserving biodiversity and measuring populations nationwide. The combination of established networks of people with a passion for pollinators and the involvement of influential individuals in the field; will spearhead the publicity of the project. The target audience will be expanded with continual use of social media, particularly Twitter, to maintain a flow of engaging scientific material. Whilst informative, the nature of the material will be undemanding in disseminating the outcomes. Twitter allows the user to present concise elevator pitches to a wide range of people (Parsons et al, 2013) [3]. These succinct blocks can reach scholars, politicians, journalists or local community groups, simultaneously.

A platform for longitudinal study of solitary bee species will be created, with a network of citizen scientists gathering useful data. The primary objective being to generate practical conservation solutions that are easily accessible to every individual.

1. MacIvor, J.S. 2016. Cavity-nest boxes for solitary bees: a century of design and research. *Apidologie* 48:311-327

2. Cooper, C., Dickinson, J., Phillips, T. & Bonney, R. 2007. Citizen Science as a Tool for Conservation in Residential Ecosystems. *Ecology and Society* 12:11







## Trust predicts cooperation with conservation conflict interventions in a framed public-goods game

(Oral and Poster)

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Conservation conflicts are widespread, wicked problems, with damaging environmental and social consequences. Many different types of interventions have been designed and implemented to manage conservation conflicts. However, little attention has been paid as to whether who carries out these interventions is important. In this presentation, I describe how we used a novel experimental framed public goods game to test how stakeholder support for conservation conflict interventions varies with different intervening groups. I then show how we explored whether this variance was explained by differences in trust, since trust in conservation organisations has been identified as important in shaping stakeholder support for conservation. We conducted our experiment with villagers in a Community Wildlife Management Area (WMA) in northern Tanzania. In an adaptation of the classic public goods game, we framed as a public good the protection of village crops from elephants. Between treatments we changed the groups framed as responsible for carrying out the intervention. We found that cooperation with the conflict intervention was significantly higher when the intervening group is framed as local Maasai moran compared to a WMA group. We found this variation in cooperation to be best explained by differences in levels of trust in the intervening group. From this we can make two suggestions. Firstly, it matters which group carries out a conservation conflict intervention. For this reasons conservation conflict managers should think carefully about which actors are best suited to deliver interventions. Secondly, highly trusted actors are more likely to receive greater support. Conservation conflict managers should therefore consider a number of strategies to increase stakeholder trust.

Redpath, S.M., Young, J., Evely, A., Adams, W.M., Sutherland, W.J., Whitehouse, A., Amar, A., Lambert, R.A., Linnell, J.D., Watt, A. and Gutierrez, R.J., 2013. Understanding and managing conservation conflicts. *Trends in ecology & evolution*, 28(2), pp.100-109.

Stern, M. and Baird, T., 2015. Trust ecology and the resilience of natural resource management institutions. *Ecology and Society*, 20(2).

Travers, H., Clements, T., Keane, A. and Milner-Gulland, E.J., 2011. Incentives for cooperation: The effects of institutional controls on common pool resource extraction in Cambodia. *Ecological Economics*, 71, pp.151-161.



## How to really help bees: key pollen host plants may alter growth, development and fitness, thereby influencing populations, of a generalist solitary bee

(Oral and Poster)

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Floral resource limitation connected with land degradation and habitat loss was identified as potential threat that cause pollinator decline and food resource quality may be the main limiting factor for bee populations. To better understand the nutritional constraints of growing and developing organisms, their colonies and populations, ecological stoichiometry was developed with reference to the elements that, if environmentally scarce, prevent the building of biologically important organic molecules. The least understood aspect of bee nutritional needs concerns stoichiometric balancing and the need for adequate amounts and ratios of nutritional elements in consumed food. I used the framework of ecological stoichiometry to study differences in the demand and supply of nutritional elements and stoichiometric balancing of an important pollinator's diet: the mason bee *Osmia bicornis* L. *O. bicornis* larva is supplied with pollen by its mother. I used a field study to investigate concentrations and stoichiometric ratios of C, N, S, P, K, Na, Ca, Mg, Fe, Zn, Mn, and Cu in the bee production (body and cocoon) of both sexes and their pollen supply, i.e., the only food eaten during larval development. Females had a higher demand for and were supplied with pollen richer in P, Cu and Zn than males. Female fitness may be in particular related to a high P proportion and a low C:P ratio in their diet. Additionally, males had a higher demand for Na and a lower demand for K than females, but these elements were similarly concentrated in the pollen supply for both sexes. Comparison of nutritional demand and supply of the bee suggests that adult females while collecting pollen supply for their progeny, may favor key species that allow for a dietary stoichiometric balance. Moreover, they may provide their daughters and sons with a different mix of pollen that better fulfills sex-specific nutritional demands. Bee production, growth and development may be limited by the availability of P, Na, Mn, Mg, K, Fe Ca, Zn and Cu, i.e., elements that show high taxonomical concentration variabilities in pollen. Therefore, it is likely that the presence of key plant species in the flora, which produce nutritionally balanced pollen for bees, influence bee development and shape bee populations.

Changes in bee habitat floral composition shape the available nutritional supply in the environment. In this context, the key plant species must be present in the flora to produce pollen that is nutritionally balanced for bees. Using literature data on the elemental composition of taxonomically different pollen, I suggested pollen species that either promotes or limits bee production, thereby influencing the bee populations. In conclusion, the quality of food sources for bees, not solely the quantity, should be considered in intervention strategies aimed at improving the nutritional base for bees and planting random plant species that offer pollen in large quantities is not a good practice.



## Scale-dependent mitigation of pollination – winners and losers

(Oral and Poster)

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Ongoing agricultural intensification and landscape simplification pose a threat to wild pollinators and the pollination service they provide to both crops and wild plants. As a result, there is currently a strong focus on how to benefit pollinator populations in agricultural landscapes, by e.g. preserving semi-natural habitats or providing supplemental flower resources in the form of flower strips. However, not all pollinators are the same, neither in terms of how they react to landscape change and mitigation measures, nor in what services they provide. Using recent research in our group, we demonstrate the implication for pollinators and pollination. We demonstrate how both nesting habitat availability and spatio-temporal availability of food resources act as spatial ecological filter for bees, explaining variation in community composition along a landscape complexity gradient. In field-studies we show that the spatial scale at which pollinators react to mitigation measures is dependent on their functional type. However, as demonstrated by experiments manipulating densities of honey bees, the presence of some pollinator species may be impacted by the density of other species. Hence, to understand pollinator community composition, we need to focus not only on how land-use change affect individual pollinator species, but how it modifies scale-dependent interaction between species. Using a novel modelling approach based on foraging theory, we demonstrate that the coexistence of multiple pollinator species may be critically dependent on the spatial structure of landscapes. Thus, landscape simplification may be detrimental to some species, because of the interaction with species that are better able to utilize spatio-temporally variable resources. This may explain our results that a wild flower species pollinated by generalist pollinators benefit from oilseed rape at landscape scales, while a wild flower species relying on more specialized pollinators does not. We discuss our results in relation to where and when pollinator mitigation measures should be implemented to preserve pollination as a service.

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UNIVERSITY OF JYVÄSKYLÄ



## Working with pastoral communities to conserve threatened wild mammals

(Oral and Poster)

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In India, most of the conservation sites have local community and the policy makers as the major stake holders. However, they have been rarely involved in conservation. The alpine and subalpine meadows of Hirpora Wildlife Sanctuary are overstocked with about 300 livestock/sq km, which seems to be more than the carrying capacity. The pastures have started exhibiting a degraded look because of overgrazing and wild ungulates such as markhor *Capra falconeri* and musk deer *Moschus chrysogaster* have started decimating. At the same time, we have the herders who are mainly dependent on the livestock for their survival. And the large carnivores such as Tibetan wolf and Himalayan Brown bear attack the livestock resulting in the loss for herders and retaliatory killings of these carnivores. Therefore it is important to understand the social and ecological issues and consult with the herders - the major stake holders to save the alpine pastures, rare wild ungulates and also provide relevant incentives and alternatives to the herders. The present study is a step towards it.

We studied the changing traditional livestock grazing practices and the increase in grazing pressure as a result. We also looked at the problem of livestock depredation by the large carnivores like wolf and brown bear and its impact on the attitudes of livestock herders and the conservation of these carnivores. We engaged with the herders to encourage them to leave the non-traditional practices and discussed about the relevant incentives to help them. We interviewed the livestock herders to record the livestock numbers, change in traditional practices to understand the grazing pressure on the pastures. We also recorded the number of livestock killed by the carnivores and the attitude of herders towards these carnivores. We conducted Focused Group Discussions and Participatory Rural Appraisals with the livestock herders to discuss the changing grazing practices, its negative impacts, and its conservation implications along with the incentives for the herders. We found that the changing herding practices have doubled the livestock numbers. Livestock herders, who were traditionally grazing their own livestock, bring livestock of landlords now along with them to earn cash. Some of the traditional herders even sublet their pastures to non-traditional herders for the season to earn money. About 2% of livestock is being killed by carnivores and herders hate Tibetan wolf more than the brown bear because Tibetan wolf is too smart to deceive herders to attack the livestock. Herders agreed to leave the non-traditional practices and continue with the traditional livestock grazing practices to conserve these pastures, herbivores and improve the quality of livestock. They outlined the incentives such as solar lights, cooking gases and the school bags and books and school fees for their children to give them proper education. Herders also pledged not to go for retaliatory killings of carnivores.



## Understanding rural development and ecosystem conservation from a socioecological landscape approach: combining resilience research, soundscape monitoring and livelihoods assessment in Colombian Andes

(Oral and Poster)

Martin Bermudez-Urdaneta<sup>1</sup>✉, Camila Parra-Guevara<sup>1</sup>✉

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For conservation biology is essential to assess ecosystems sustainability encompassing nature-society dynamics, ecological effectiveness, social equity and economic opportunities. Assessments are needed across a wide array of managerial conservation arrangements and specific production contexts. We have researched Tota Lake and surrounding páramo ecosystems as unique case of Andean productive landscapes intertwined with vital terrestrial and aquatic ecosystems. We combine socioecological systems, landscape ecology and political economy to study resilience of rural landscapes, departing from Satoyama Initiative (UNU-IAS et al., 2014) proposed toolkit, and enhancing it ecologically by incorporating soundscape ecology to study biophony, geophony and anthrophony and describe acoustic complexity in holistic fashion (Pijanowski & al, 2011), and economically by including rural livelihoods assessments to link local production decisions and conservation strategies (Scoones, 2009). Our research perspective tackles sustainable development complexity in 4 aspects: 1) scale, by studying local case; 2) multidimensionality, by proposing an overarching approach landscape and soundscape ecology; 3) multi-stakeholder involvement, by co-researching with local inhabitants, organizations, and policy-makers; and 4) relevant results, by offering soundscape descriptions and livelihood assessments in comprehensive yet understandable fashion. We characterize socioecological production landscapes, recorded soundscapes along altitude gradient between paramos and lake borders, and accounted for livelihoods located amidst rural landscape. We gathered data from participatory workshops, 20 interviews, 300 surveys, and 1116 soundscape recordings collected in 4 different sites with continuous monitoring. Given 5 dimensions of Satoyama Initiative to research socioecological production landscapes, our preliminary research findings are: 1) landscape diversity and ecosystem protection with extreme transformation in low and middle sectors of Tota basin, eroded ecological connectivity between paramos and wetland, since soundscapes exhibit increasing biophonic simplification; 2) biodiversity including agricultural components with high-vulnerability of traditional tuberous crops, diet simplification, and low biodiversity along soundscapes recorded; 3) knowledge and innovation presenting gradual decrease of traditional knowledge to use local flora, and increasing gap between generations on their awareness of visual and acoustic richness of surrounding biodiversity; 4) governance and social equity hampered by miscommunication between national authorities and local producers, uneven dependence of downstream creeks; 5) livelihoods and wellbeing with hopeful local enterprises for slow and fragile diversification, aiming for better agricultural practices and for food security with small-scale family greenhouse



## A nation-wide census for future conservation actions

(Oral and Poster)

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<sup>4</sup> Society for Birds and Nature Protection Institute of Ecology and Geography, Laboratory of Natural and Anthropogenic Ecosystems, Kishinev, Academiei Street, 1, MD-2008 Moldova State University, Faculty of Biology and Soil Science, 65a M. Kogalniceanu St., bl. 3, Kishinau, MD-2009, Moldova

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Citizen science is a type of research which could be crucial for wildlife monitoring in the developing countries due to low funding opportunities and trained specialists. In the Republic of Moldova, this concept is not fully understood and currently under-developed. The citizen science will bring new data in ornithological research, which is still in its early stages, due to the few ornithologists involved in scientific research. Thus, there is poor data and knowledge regarding occurrence and distribution of wild bird species across the country, which makes difficult to implement conservation strategies in order to conserve our bird fauna.

White stork (*Ciconia ciconia*) is a common bird species which breeds near human settlements and is easily identifiable. This aspect makes the species to be a very good target for citizen science monitoring. The number of White stork nests in Republic of Moldova was estimated to be around 574 in 1984 and continued to decrease since then. During 1990-2010 the official numbers pointed to 180 nests, while the breeding stork population was considered to be around 400-600 breeding pairs.

During June – August 2017 the Society for the Birds and Nature Protection (SPPN) carried out a national census when 283 nests were recorded. The nests were registered on a digital map with the help of citizen volunteers. The concept and the procedure were a novelty for Republic of Moldova, as the observations were uploaded using an online survey which provided additional information about the nests (type of support, condition, number of offspring). The impact among citizens was high: 90 volunteers participated in the census across the country. Most of the nests were installed on concrete pillars (57.24%), followed by wooden pillars (17.67%), 15.19% were found on trees, while 9.19% were installed on other types of support (towers, monuments and barns). Only one nest was found on a house. Comparative with the previous monitoring program, from 1984, the White stork population from Republic of Moldova changed the breeding behavior, using the electric poles in a much higher percent. These changes in species ecology should be included in the species conservation strategy for the next years.

Out of the total number of 283 nests, 83% were occupied in the 2017 breeding season, with a breeding success of 1.51 offspring per nest during the study period.

The 2017 White stork nest census in Republic Moldova proved to be an efficient tool for field data collection. Moreover, the information improved significantly the knowledge regarding the breeding status of White stork and raised awareness about the ecology of this species. For the Republic of Moldova scientific community, which is young and still developing, the census represents the first step for future conservation projects and a successful start of citizen science methods.





## Environmental science-policy organisations in the era of post-truth

(Oral and Poster)

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Better utilization of science in policy has been seen as a way to enable solving environmental problems. Several science-policy interface organisations have been established to compile and assess existing knowledge, as well as facilitate dialogue between science and policy (Tinch et al. 2016). Simultaneously, statements ignoring science in policy and emergence of alternative facts has led to claims that we currently live in a post-truth era (Lockie, 2017). However, it can be questioned whether the use of knowledge in policy has ever been apolitical. So far, there is only a little research on the impact of environmental science-policy interface organisations (also as SPI or boundary organization). The impact has been studied, however, e.g. through relevance, credibility, legitimacy and iterativity. The interface actors may have different perceptions on what the impact means. In addition, the various organisations can have similar objectives, their functions and activities are partly overlapping and therefore their relationships are not clear. In this research project I study: 1) How various actors perceive the meaning of the impact of environmental science-policy platforms and organisations? 2) How various organisations act in relation to each other and their objectives? 3) How organisations work as a combination in the alleged post truth-era? The post doc research project will start 2018 and last 26 months. First work package focuses on actors. In first article, I will study Finnish participants of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (10 persons) and supplementary views from members of the Finnish national IPBES panel (5) using thematic interviews. In second article, I will study knowledge produces perceptions by interviewing Red List evaluators (10). Red List is an example of international knowledge production and assessment organization. In this article, I focus on peatland evaluation because peatland conservation policy has showed examples of political use of knowledge. In the second work package, I will conduct a systematic literature review that produces a typology of impact of various Finnish environmental science-policy panels from Web of Science and SCOPUS. It covers interrelationships of various panels and stakeholders, as well as panels' objectives and achievement of those objectives. The article will be supplemented with the materials produced by panels and actor involvement. Actors will be asked to comment the typology. Finally, I bring together all data from different work packages to answer third research question.

Lockie, S. 2017. Post-truth politics and the social sciences. *Environmental Sociology*, 3(1), 1-5.

Tinch, R., Balian, E., Carss, D., de Blas, D. E., Geamana, N. A., Heink, U., ... Young, J. C. 2016. Science-policy interfaces for biodiversity: dynamic learning environments for successful impact. *Biodiversity and Conservation*. (online)





## Panel discussion: The role and challenges of biodiversity offsetting in achieving the ecosystem degradation neutrality goal

(Oral)

**Janne Kotiaho**<sup>1</sup>✉, **Sirpa Pietikäinen**<sup>2</sup>, **Satu Hassi**<sup>3</sup>, **Suvi Borgström**<sup>4</sup>, **Juha Niemelä**<sup>5</sup>,  
**Atte Moilanen**<sup>6</sup>✉, **Joseph Bull**<sup>7</sup>✉

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<sup>7</sup> Lecturer of Conservation Science, University of Kent, United Kingdom

DOI: -

Video Presentation:

**Sirpa Pietikäinen**, Member of the European Parliament

Panelists:

**Janne Kotiaho**, Professor, Coordinating Lead Author of Global Land Degradation and Restoration Assessment, IPBES

**Satu Hassi**, Member of the Finnish Parliament, Chairperson of Environment Committee

**Suvi Borgström**, Senior Officer, Ministry of Environment

**Juha Niemelä**, Director-General, Ministry of Agriculture and Forestry

**Atte Moilanen**, Research Director, University of Helsinki

**Joe Bull**, Lecturer of Conservation Science

In this panel discussion we will explore the role of ecological compensations or biodiversity offsetting in helping us to achieve the land degradation neutrality goal as aspired in the sustainable development goals. We will discuss whether it would be desirable to demand biodiversity offsetting from all activity degrading environments or not and about the challenges there may be in devising policy to support or demand compensations. The discussion aims to identify major challenges of implementation and find solutions to overcome the challenges.



## Monitoring satellite remote sensing essential biodiversity variables to guide management in the Spanish National Park Network

(Oral)

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Based on the use of Satellite Remote Sensing - Essential Biodiversity Variables (SRS-EBVs), we developed a monitoring system (REMOTE) to guide management in the Spanish National Park Network. REMOTE is based on the analysis of time-series of satellite images of spectral vegetation indices (Product MOD13Q1), using free and open-source software. The system derives maps and plots with reference conditions, temporal anomalies, and long-term trends of three aspects of the seasonal dynamics of vegetation greenness: annual productivity, seasonality, and phenology. The information is produced at three different levels: network, national park, and ecosystem. REMOTE is used by the Network managers to inform on changes in ecosystem functioning, biodiversity status, and intermediate ecosystem services, that track the effects of both environmental changes and management actions. REMOTE is the result of the dialogue between scientists and managers, and represents a way to compile and process satellite-derived information with ecological meaning to society and policy.

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## Shrub species exhibit differing long-term responses to a change in the species of ungulate browsing

(Oral)

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Hyper-arid rangeland vegetation is typically dominated by large woody species which are often overlooked in herbivory studies. Knowledge of long-term large shrub population responses to change in browsing system in the Arabian Peninsula has been anecdotal. Population and size of 1559 individuals from four shrub species were opportunistically assessed over an 11-year period under two browsing regimes, one in which domestic livestock (camels) were replaced by semi-wild ungulates (oryx and gazelles) before, and the other during, the study period. Each shrub species exhibited a different response to the change in herbivory. Populations of *Calotropis procera* decreased dramatically. Populations of both *Calligonum comosum* and *Lycium shawii* increased through sexual reproduction, but the spatial distribution of recruits indicated different modes of seed dispersal. Average lifespans were estimated at 22 and 20 years respectively. The strategy of *Leptadenia pyrotechnica* was similar to tree species of this habitat, prioritizing vegetative regrowth, and average lifespan was estimated at 95 years. Hyper-arid large shrub populations may take many decades to adjust to a major change of browsing regime if they have adopted a vegetative method of persistence, though the size of surviving individuals may adjust relatively quickly.

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## Pre-study regarding potential SOC stocks in central European old-growth beech forests: a comparative analysis

(Oral)

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Soils have long been identified as the most important terrestrial carbon sinks – and thus, as one of the preliminary sources of atmospheric CO<sub>2</sub>. About 80% of the terrestrial carbon actively involved in the global carbon cycle are bound in soils, whereas only 20% are bound in vegetation. According to the Thünen Institute, approximately 2.5 billion tons of carbon are stored in German forests; more than half of it can be found belowground. Here, the accumulation and mineralization of soil organic matter (SOC) form a dynamic equilibrium. Although the understanding of organic carbon turnover is ever increasing, little is known about maximum carbon storage capacities in forest soils, respectively about accumulation rates. This is partly because natural forests in Central Europe are very rare due to historic land use, and at the same time there has been no systematic approach to investigate the forest soils' potential to store SOC. Additionally, forest soils are spatially very heterogenous, making it exceedingly difficult to systematically investigate SOC stocks. For instance, organic carbon storage and turnover depend on a variety of natural factors, such as climate, parent material and terrain – but, equally important, forest management practices. Studies have shown that there is a negative correlation between the intensity of forest management and SOC stocks. Harvesting trees and biomass can significantly deplete carbon stocks in the long term. However, for a better understanding of the global carbon cycle and more informed land-use management decisions, this pre-study aims to answer following questions: What are the maximum SOC stocks that can be accumulated in Central European natural forests and which time spans are needed to reach these? How do different forest management practices effect the storage of SOC? To help answer these questions, we decided to investigate SOC stocks on seven sites in mesophilic beech forests along a chronological and management gradient. Other influencing parameters, such as climate, potential natural vegetation and soil types were kept as constant as possible. Hence, the only variable impact factors are the age of the forest site and the management type. The gradients range from a regularly managed forest site over an ecologically managed forest site to a protected zone of a biosphere reserve which has seen no forest management for almost 500 years. We hypothesize that the longer forest sites can grow under natural, unmanaged circumstances, the more SOC is accumulated, while eventually approaching a maximum. The soil samples are currently being analyzed in the laboratory. The final results are due by the end of February 2018. The results of this pre-study identify reference values of SOC in very old unmanaged forest sites and support the discussion around the impact of different management practices, which is important for the discussion of natural climate solutions with respect to climate change.



## Remote Sensing for biodiversity studies of very high spatial resolution

(Oral)

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Remote Sensing (RS) is currently one of most important tool for Earth Observation. Many biodiversity and conservation studies depend on RS imagery and techniques as main source of environmental data. However, data are often limited to the available satellite imagery. In the case of local studies, satellite imagery frequently lacks adequate spatial or temporal resolution. Drones can provide valuable data with very high spatial resolution. However, when study areas are very small, even drones are not a good solution. Here, we present a study case where we modelled the distribution of several individuals of lizards using a simple camera attached to a stick and a matrix of temperature/humidity data-loggers to obtain several environmental layers with very high resolution. Fieldwork was performed near Porto (Portugal) during May-June 2016 in a mesocosm of 20×20 m. We captured 25 adults (15 males and 10 females) of the Iberian lizard *Podarcis bocagei* and marked each individual with a unique combination of three non-toxic colour dyes. A researcher walked randomly through the mesocosm looking for lizards, several times per day throughout the whole period of daily activity. Lizards' positions were recorded with a Trimble GPS receptor (~10 cm error). We built an orthophoto map with a spatial resolution of 2 cm from a set of 1152 photos captured by a Canon compact camera fastened to a stick. Photos were processed with Agisoft Photoscan 1.2.0. We created a digital elevation model with a pixel resolution of 2 cm using 3016 accurate altitude points obtained with a RTK (Real Time Kinematic)-GPS and a triangulated irregular network. We classified the orthophoto with a supervised maximum likelihood algorithm in ArcGIS, using four different classes (refuges, vegetation, bare soil and organic soil). We recreated Bioclim variables by combining data from 27 temperature and 23 for humidity/temperature Maxim's iButton dataloggers. For each individual we also calculated the distance to males and to females, excluding the focal lizard. From the set of 22 variables, we selected 11 variables with a correlation lower than 0.6. We calculated realised niche models for each individual and for all individuals together with the correlative method for presence-only data Maxent. All models obtained an AUC higher than 0.8. The most important variables were related to distances to males or to females and to climate (isothermality, minimum temperature and humidity), organic soil and vegetation. Our very high spatial resolution models provided information about the differential space use by each individual lizard. Correlative models can identify the most suitable areas inside the home range, similarly to core areas estimated from kernel algorithms. Overall, RS tools provided high quality data on both animal presence and its environmental context which allowed better interpretation of the spatial patterns in this species outperforming other methods.



## Half a century of multiple anthropogenic stressors has altered northern forest understory plant communities

(Oral)

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The boreal forests constitute the largest forest biome in the northern hemisphere. These forests are under increasing anthropogenic impact from intensified forest management, eutrophication and climate change, which may change their ecosystem functions and the services they provide. Swedish forests cover a long climatic gradient, receive highly variable rates of nitrogen deposition, and have a long history of forest use. Extensive systematic long-term data on vegetation from the National Forest Inventories (NFI) make Sweden an ideal area to study how species composition and function of other, more pristine boreal forests, might change under increased anthropogenic impact. We used NFI-data to quantify changes in vegetation types between two periods, 1953-1962 and 2003-2012.

Our results provide evidence of large-scale changes of the understory vegetation over the last half century. A majority of the vegetation types changed significantly in areal extent, with a general increase in types characterized by high nutrient acquisition and shade adaptation, e.g. high specific leaf area, and a decrease in types characterized by high nutrient conservatism and light demand, e.g. low specific leaf area. The mean cover of ericaceous dwarf-shrubs decreased dramatically. All these effects were most pronounced in areas with the highest anthropogenic impact, suggesting a link to drivers such as nitrogen deposition and land-use changes. Possible associated changes in ecosystem functions and services include effects on higher trophic levels and higher decomposition rates of plant litter in the expanding vegetation types, which can influence nutrient dynamics, with subsequent effects on ecosystem productivity and C sequestration.

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## A long-term impact of forest disturbance on spruce seedling regeneration on coarse woody debris

(Oral)

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Storm disturbance have huge impacts on subalpine forest ecosystems. However, long-term effects of such disturbance on regeneration of subalpine forests are poorly understood. *Picea jezoensis* var. *hondoensis* has limited and discontinuous distributions in subalpine central Japan. Thus, evaluating long-term effects of forest disturbance and their mechanisms have great conservation significance. *Picea* needs coarse woody debris (CWD) such as logs and stumps for their seedling colonization, and thus their establishment is greatly affected by CWD condition which largely depending on decay activity of decomposer fungal community. Recent studies in Europe found that frequency of occurrence of brown rot fungi, a certain functional group of fungi which decay wood holocellulose without decaying lignin, tends to be increase after forest dieback<sup>1</sup>, and that CWD decayed by brown rot fungi negatively affects spruce seedling density<sup>2</sup>. Because the decay process of CWD is known to be several decades long, we hypothesized that the effect of forest disturbance on fungal community and wood decay of CWD, and its negative effect on spruce seedling establishment would be long lasting. To test this hypothesis, we compared fungal communities within CWD and spruce seedling density among forest sites of the three different categories (control old-growth forest, damaged forest with the logs left, and damaged forest with the logs removed) in an old-growth subalpine coniferous forest in Mt. Yastugatake, central Japan. This forest had got a wide-range disturbance by a typhoon in 1959. We surveyed totally 95 logs in 9 sites (5, 2, and 2 sites for the forest categories held in above, respectively). Fungal communities within CWDs were documented using Illumina sequencing. Seedling and epiphytic bryophyte communities were recorded and were analyzed with CWD properties such as wood decay type (white rot, brown rot, and soft rot), pH, moisture, and bryophyte coverage. Illumina sequencing did not show obvious difference in fungal communities among the forest categories. Also, frequencies of the occurrence of wood decay type were not significantly different among the categories. None of these variables had significant association with spruce seedling density. However, experience of the disturbance certainly reduced current spruce seedling density. These results suggested that the forest disturbance do have a long lasting effect on spruces seedling regeneration on CWD, but the effect might not be attributable to their impacts on CWD fungal community and wood decay.

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<sup>2</sup>Bače R, Svoboda M, Pouska V, Janda P, Červenka, J (2012) Natural regeneration in Central-European subalpine spruce forests: Which logs are suitable for seedling recruitment? *Forest Ecology and Management* 266:254-262.





## Do traits explain colonization-extinction rates of wood-decaying fungi?

(Oral)

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In Fennoscandia, intensive forest use has led to substantial decreases in the amount and diversity of dead wood, which constitutes critical habitat for saproxylic species such as wood-decaying fungi. The transient nature of the dead wood habitat implies that metapopulation persistence of wood-decaying fungi depends on the continual colonization of newly created habitat. Dead wood dynamics in turn are strongly influenced by forest management practices. Very little is known about the dispersal ecology of most species and there are competing hypotheses about functional trait effects on dispersal and colonization rates as well as on species sensitivities to forest management.

We test for the effects of traits on colonization and extinction rates using hierarchical modelling of 79 species of wood-decaying polyporoid fungi. We use data from an extensive survey in Finland of 258 forest stands of differing stand type that were surveyed twice at an interval of on average 13 years. Functional relationships between fungal morphology and rates of dispersal, establishment and development of fruiting bodies are an area of active research. We therefore broadly test for effects of spore traits (spore size, spore shape, and spore cell wall thickness; hypothesized to affect dispersal and germination probability) and traits describing the hyphae and fruiting body (hyphal system type, fruit body type, size and lifespan; hypothesized to relate to growth rate, competitive ability and longevity) on colonization and extinction rates.

Results will be informative regarding traits and mechanisms that mediate colonization-extinction dynamics as well as sensitivities to forest management of wood-decaying fungi. A better understanding of the ecology of this important functional group is imperative to improve conservation measures aimed at halting these species' decline.

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## The need of evidence-based management: the case of the the Lesser White-Fronted Goose in Northern Norway

(Oral)

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In the face of global change, conservation actions are implemented worldwide to reduce the risk of extinction of declining populations. Population dynamics can be, however, the result of complex biotic and abiotic interactions. Therefore, it is often unsure to what extent management contributes to the recovery of a population if a proper scientific assessment is lacking. If conservation is the goal, it is crucial to quantify the impact of management actions. The Fennoscandian population of the Lesser White-Fronted Goose *Anser erythropus* (henceforth LWFG) experienced a dramatic decline in the last decades, to the point that conservation actions were deemed necessary. Among several conservation initiatives, culling of invasive red fox has become relevant, as red fox is perceived to be the main factor affecting reproductive success through predation on chicks and eggs. The LWFG population trend has reversed from negative to positive since the onset of the fox control program, suggesting an overall positive effect of management. However, in Arctic ecosystems, factors such as cyclic small rodent populations and fluctuations in ungulate carrion availability can determine strong variation in annual predation pressure and in turn affect geese recruitment and survival. Using 19 years of data, we investigated to what extent red fox culling contributed to the recovery of the population. Specifically, we evaluated whether fox removal had the expected positive effect on LWFG reproductive success, while taking into account those factors outlined above that may confound the effect of the management action. We predicted LWFG breeding success to fluctuate synchronously with the rodent cycle due to an apparent facilitation mechanism. We also expect that increased availability of reindeer carcasses sustain foxes during the harsh arctic winter and enhance their survival, especially in years with deep snow that makes small rodents less accessible. Thus, we predicted lower reproductive success in years with high carcass abundance, due to an apparent competition mechanism. Moreover, we used these relationships to assess the relative impact of fox culling program. We found a strong positive effect of rodent density on geese breeding success, as well as a negative effect of the yearly amount of reindeer carcasses. However, there was no evidence in the data for any positive effect of fox culling. These results are relevant for the conservation of the LWFG population. Overall, this study emphasizes the importance of scientifically evaluating the effectiveness of management actions by taking into account all the potential confounding factors.



## Engaging science-policy-society dialogue on European scale: the example of EKLIPSE Science Cafes

(Oral)

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To achieve biodiversity conservation targets comprehensively, and to support transparent, democratic and legitimate EU biodiversity policy, there is a growing need and momentum to engage society as a whole to develop biodiversity and ecosystem service policies. For example, citizen science efforts made in environmental sciences have generally been innovative and efficient at harnessing the knowledge and know-how of citizens in observations and data gathering. In addition, different means to encourage public participation in policy development have been presented and implemented both in real life and online, including a variety of especially asynchronous online mechanisms for both spreading information and awareness and promoting public deliberation on EU policy matters. Despite these developments, the involvement and role of the wider public in deliberating on policy matters regarding biodiversity and ecosystem services in the EU level has been rather inconsistent to date. Therefore, more systematic, meaningful and inclusive interplays between science, policy and society need to be developed. Towards this aim, we evaluate the potential of online science cafés to narrow the gap between science, policy and society, strengthen the interface of them, and encourage active and effective public participation in biodiversity policy on the EU scale. Developing social engagement via online science cafés is a manifold process; technical usability, participant's previous knowledge, past discussions and the framing of the topic and the implicit and explicit objectives and outcomes all relate to the meaningfulness and quality of the discussion and the commitment of the participants.

Keywords: societal engagement, online participation, science café, EU biodiversity and ecosystem services, policy development, science-policy-society interface, transnational discussion

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UNIVERSITY OF JYVÄSKYLÄ



## Ethical challenges at the science-policy interface: building an ethical infrastructure for the EU support mechanism

(Oral)

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EKLIPSE is an unusual EU project, which is developing a sustainable mechanism that supports better decisions on our environment, based on the best available knowledge.

Developing such EU support mechanism at the interface between knowledge holders and decision makers will face many challenges, just as any science-policy interface does. When various actors from different spheres (policy, academia, business, lobbyism, media etc.) are called upon to interact within a process as complex as a science-policy-society mechanism—implying that their different sets of values, needs, objectives, vested interests and understandings will be confronted—the integrity and credibility of such interface is at high risk of being compromised if not managed sufficiently and adequately. Determining an ethical course of action will therefore be essential to prevent damages to the perceived legitimacy and credibility of an EU support mechanism.

In the scope of our project, we will review all the measures EKLIPSE is implementing in the ethical infrastructure of the future EU mechanism. The main objective of the talk is to address how a science-policy interface and the scientific community as a whole would benefit from implementing ethical measures and instruments to help prevent sensitive issues and undesired consequences undermining credibility and legitimacy.

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## DOPA Explorer 2.0: A web based tool assessing all large protected areas in support to conservation policies

(Oral)

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The Digital Observatory for Protected Areas (DOPA) has been developed to support the European Union's efforts in strengthening our capacity to mobilize and use biodiversity data, information and forecasts so that they are readily accessible to policymakers, managers, experts and other users. Conceived as a set of web based services [1,2], DOPA provides a broad set of free and open source tools to assess, monitor and even forecast the state of and pressure on protected areas at local, regional and global scale.

Recognized by the UN Convention on Biological Diversity (CBD) as a reference information system, DOPA Explorer is a web based interface of the DOPA providing simple means to rank protected areas at the country and ecoregion levels. It further provides users with the information at the site level species, important ecosystems and the pressures they are exposed to because of human activities. First launched in 2015, and recently updated in 2018, the DOPA Explorer 2.0 currently documents all protected areas in the world at least as large as 50 km<sup>2</sup>, around 23 000 of them covering in total more than 95% of the global protected surface. Distinguishing between terrestrial, marine and mixed protected areas, DOPA Explorer can help end users, for example, to identify those exposed to highest pressure and at the same time hosting unique threatened biodiversity. The DOPA provides a broad range of consistent and comparable indicators, based on global reference datasets, on protected area coverage, connectivity, species, ecosystems, ecosystem services and pressures at multiple (country, ecoregion and protected area) scales. These indicators are derived from more than 400 metrics and include new indicators on the connectivity of protected area systems as well as new indicators derived from Copernicus services that highlight changes in the land cover, surface water and built-up areas in protected areas.

These indicators are particularly relevant for Aichi Biodiversity Target 11 (Protected Areas) of the Convention on Biological Diversity, and the UN Sustainable Development Goals 14 (Life below Water) and 15 (Life on Land), and can be used to support spatial planning, conservation and international reporting.

It is the purpose of this presentation to introduce the audience with this new DOPA Explorer 2.0 tool as released in February 2018.

The above work has been made with the kind collaboration of the UN Environment World Conservation Monitoring Centre (UNEP-WCMC), the International Union for Conservation of Nature (IUCN) and BirdLife International.

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## Industrial-scale evidence collation and application

(Oral)

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If we are to respond to the ensuing conservation crisis with effective solutions then we need the means to collate and assess evidence on an industrial scale. Undertaking practices already known to be ineffective is a waste of nature, money and effort. I will then describe how a process tackling multiple reviews simultaneously, using a process we call Subject-wide evidence synthesis, has enabled the completion so far of 1735 reviews (1) of effectiveness with a further thousand underway; an estimated further 900 reviews are needed to complete reviews of the interventions for all habitats and taxa. I will review the strengths and weaknesses of this approach and then estimate the effort needed to review all aspects of sustainability, including all ecosystem services. I will describe how considering the over ten thousand possible actions to deal with all the society's problems can be used to identify overlaps in options for responding to the major global challenges, including the different Sustainable Development Goals, the Aichi targets and the Nexus of food, water and energy. I will consider why evidence is not used and classify the different reasons for not using evidence, including evidence complacency (2). One solution is to make evidence easier to use. One serious problem that is that evidence is collected from a range of locations and species but is applied by practitioners for specific locations and species. I will describe how it is possible to create customised reviews for specific conditions by interpreting the relevance of studies for individuals and then suggest how approach this could be rolled out for use by practitioners and policymakers.

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## Wood ant nest mounds as biodiversity hotspots: Case studies with oribatid mites

(Oral)

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The red wood ant (*Formica*) nest mounds form in forest landscape diversity hotspots by hosting large amount of invertebrate ant associates. The most numerous associate group, the soil-dwelling oribatid mites, have however remained rather unstudied due to their minute size and lack of taxonomic experts. Few studies conducted in Finland have recently lighted up the oribatid's diversity in ant mounds.

First, our study based on 10,600 specimens and 74 identified species, showed that the wood ant *F. polyctena* nest mounds were inhabited by an equally abundant and diverse oribatid fauna as the surrounding soil. Moreover, the results revealed that predominantly different species inhabited these two habitats. Second, a more extensive study based on 18,600 specimens and 94 identified species, showed that the oribatids occurred predominantly on the surface layer of mounds and that their distribution was positively related to mounds' surface moisture content. In an ecological framework such observations illustrate the variability in species assemblages within forest landscape, and could be taken into account in regional conservation practices, forest management and land use planning.

Forest management practices, such as clear felling, affect the physical properties of mounds which may be harmful not only for ants, but also for their rich associate fauna. Indeed, our next study revealed that the surface layer of *F. aquilonia* mounds was significantly drier in clear fells than in forest, and mounds were cooler in clear fells indicating that humidity has a function in mound thermoregulation. The impacts of forest clear felling and the carry-over effects of the detected drying of mounds on oribatids were investigated next. The study of 16,500 specimens and 67 species revealed that while the clear felling had no impact on abundance or community composition of oribatids, the species richness was significantly lower in clear fells and was positively related to mounds' surface moisture content. These results indicate that the oribatid fauna of this distinctive habitat may be considered as a useful bioindicator group in the studies of environmental changes. As the red wood ants build large, dense and long-lived nest mounds in boreal forest, their nests are important factors in maintaining oribatid biodiversity. Many of the red wood ant species have a status as vulnerable or near threatened species in Europe and conservation of these species is of high significance.

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## Conservation of Dioecious tree Genus *Litsea* in Central Western Ghats, India.

(Oral)

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The tree genus *Litsea* consists of about 400 species which is largest genus in the family Lauraceae differentiated by its dioecious nature, distributed in tropical and subtropical Asia. In India about 45 species are distributed in evergreen and semi evergreen forests. Most of the species are endemic, distributed across the Western Ghats of India. In this study, complete stretches of Central Western Ghats have been randomly sampled for identification of *Litsea* and particularly eight different study sites were sampled to know the diversity and distribution. The results of the study indicate that rare and endemic species of the genus distributed infrequently in Western Ghats. A total of 12 species are occurred in central Western Ghats are of Karnataka. At the same time this *Litsea* having male and female trees are separate individuals. Present study also reported that ratio of male trees was lower when compare with female trees in the Central Western Ghats. In all the study sites we observed the ratio of males to female in case of *L. floribunda* trees. A total of 403 (293 females, 110 males) trees were found during flowering season. The ratio of males to female is 1:2.6 in all the study sites, 1:1.5 in Kemmannugundi, habitat, 1:3.6 in Mullayyanagiri, 1:2.8 in Kodachadri, 1:3.3 in Madikeri area. Male trees bear individually more flowers when compared with female trees. Economically some species of *Litsea* are important as a source of medicine, timber and nutritious fruits. Numerous species are having biologically active compounds like alkaloids, flavonoids, steroids and essential oils, these compounds are used to cure diarrhoea, rheumatism and an aid to longevity in the study area. Due to these reasons now a days population of *Litsea* dwindling because of unscientific harvesting and over exploitation. For all the above reasons which warrant the regeneration of these *Litsea* trees, particularly male trees needs proper management and conservation strategies to conserve the rare and endemic species.

Key words: Trees, Conservation, Dioecious



## An overview of international legal and institutional frameworks for promoting community action in conservation

(Oral)

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In much of the conservation discourse, the interests of humans and biodiversity are still presented as conflicting, in a relationship where satisfying the needs of one would come to the detriment of the other. This trade-off ideology has been at the basis of the, for instance, fences and fines approaches to conservation, and in the most extreme cases has led to the creation of protected areas by evicting indigenous peoples and local communities, irrespectively of their actual impacts on the local environment. Emerging approaches informed by the notions of community-based conservation and biocultural diversity have advanced alternative (yet age-old) ways of understanding the relationship between people and nature, highlighting the positive role that indigenous peoples and local communities can play in the conservation of biodiversity. Community contributions to conservation are receiving growing recognition also in international legal, institutional and political frameworks. In this presentation, we review the main international instruments providing recognition of community action for conservation – such as the Convention on Biological Diversity and its Nagoya Protocol, the International Treaty on Plant Genetic Resources for Food and Agriculture, and the Draft Declaration on the Rights of Peasants and other People Working in Rural Areas, as well as the IUCN Protected Areas Programme, the Aichi Biodiversity Targets, and Other Effective Area-based Conservation Measures. These instruments, increasingly, though still limitedly, provide at least some recognition and promotion of the fundamental role that Indigenous and Community Conserved Areas (ICCAs) play for both the conservation of biodiversity as well as local livelihoods. As economic and corporate pressures increase, legal recognition is especially important for the efforts of local communities and indigenous peoples in conserving their lands and livelihoods. Understanding the existing instruments, how to use them, and how they can be improved is thus key to furthering such efforts and supporting them into the future.

1) biocultural conservation; 2) Indigenous Peoples and Communities Conserved Areas (ICCAs); 3) international legal and institutional review



## The Urban Biodiversity Hub: A Webtool and Interactive Database to Connect Scientists and Practitioners

(Oral)

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Urban biodiversity has been demonstrated to increase resilience and improve ecological and human health and well-being; however, many local governments currently lack the capacity to develop and manage urban biodiversity strategies. The Urban Biodiversity Hub (UBHub) is a new web tool that increases the capacity of cities to make decisions for urban biodiversity planning and management. One of the main goals of UBHub is to support local governments through providing resources, connections, and ultimately by funneling funding to those who most need it. In the long term, we seek to promote biodiversity mainstreaming, the integration of associated tools, and awareness of biodiversity planning.

UBHub will be previewing our online platform comprising (1) a searchable map of urban biodiversity activities around the world covering over 900 activities and frameworks; (2) myHub, a tracking tool for cities to measure their progress towards urban biodiversity protection; and (3) an experts forum connecting cities, practitioners, and researchers. The platform is designed to increase the capacity of cities to plan for and manage biodiversity, and to foster the development and refinement of biodiversity indicators.

UBHub was founded in 2016 at the 13th Conference of the Parties of the Convention on Biological Diversity by like-minded individuals who saw the need for a one-stop shop for all things on urban biodiversity. It has since grown into an international all-volunteer powerhouse that has produced the largest known urban biodiversity database and is developing the first customizable tool for biodiversity indicator development for local governments. Our partners include international NGOs and academic groups as well as leading cities.

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## Protect Your Roots : Working to Restore and Conserve Native Forests in Ireland Using a Grass Root Approach linking Natural and Cultural Heritage

(Oral)

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Protect Your Roots : Working to Restore and Conserve Native Forests in Ireland Using a Grass root Approach Linking Natural and Cultural Heritage.

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Abstract

The Woodland League is a not for profit NGO, dedicated to restoring the relationship between people and their Native Woodlands. We are actively engaged with three community native woodlands - one large scale and two small scale -native forest restoration projects. We conduct educational walks and talks with tree planting in native woodlands, schools, and communities.

Today less than 0.002% of Ireland's land area consists of ancient native woodland. (Ref: Cross J.R. 2012, Ireland's Woodland Heritage. Department of Arts Heritage and Gaeltacht.)

Our micro plan is a grassroots led initiative to inspire the creation of new community native woodlands using the locally grown trees, allowing local communities to take direct action on Climate Change.

We have developed a basic introduction education manual, The Woodland League, "Know Your Native Trees" which has been digitised to form an E-learning platform for schools. It is also complimented by the Woodland League, "Forest in a Box", a copy nature, tree seed incubator system for schools to actively promote and encourage an understanding of the value of native woodlands with the aim of creating new community native woodlands. Thanks to these instruments, local children are investing in their own sustainable future in partnership with their communities.

The Woodland League, "Forest in a Box" project, provides an answer to the message of the new film, "Call of the Forest, the Forgotten Wisdom of Trees" by Diana Beresford Kroeger, a consultant scientist of The Woodland League. The message of the film is a call to action for native woodland restoration on a global scale, "By the People for the People". The Bretha Comaithchesa, ( Ref :Fergus Kelly, Early Irish Farming, School of Celtic studies, Dublin Institute for Advanced Studies, 1997)which are the old Gaelic Brehon Laws- of Neighbourhood-concerned with community forest rights, are highlighted in the film.

The Great Forest of Aughty is our macro plan, and is a native woodland restoration project. It aims to bring farmers, local communities, schools, private landowners, local authorities and public land managers together to restore, conserve, and expand the remaining shreds of ancient Irish woodland within the footprint of what was once a mighty oak forest, covering 100 square miles and is replicable. The western Atlantic temperate climate makes conditions near perfect for the growth of broadleaf trees.

The project aims to link the existing ancient forest pockets and other native/semi natural woodlands via

ecological corridors, using rivers and streams to create linear riparian forests. This will enhance the ecological integrity of the existing woodlands for their future viability.

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## Does Deforestation Increase Malaria Prevalence? Evidence from Satellite Data and Health Surveys

(Oral)

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DOI: 10.17011/conference/eccb2018/107325

Deforestation has been found to increase malaria risk in some settings, while a growing number of studies have found that deforestation increases malaria prevalence in humans, suggesting that in some cases forest conservation might belong in a portfolio of anti-malarial interventions. However, previous studies of deforestation and malaria prevalence were based on a small number of countries and observations, commonly using cross-sectional analyses of less-than-ideal forest data at the aggregate jurisdictional level. In this paper we combine fourteen years of high-resolution satellite data on forest loss with individual-level data from Demographic and Health Surveys on malaria in more than 60,000 rural children in 17 countries in Africa, and fever in more than 470,000 rural children in 41 countries in Latin America, Africa, and Asia. Adhering to methods that we pre-specified in a pre-analysis plan, we tested ex-ante hypothesis based on previous literature. Using a cross-sectional regression we reject the ex-ante hypotheses that deforestation increases malaria prevalence and that intermediate levels of forest cover have highest malaria prevalence. We further reject ex ante hypotheses related to disaggregations: that the effect of deforestation on malaria is greater in Latin America and Africa than Asia, greater at earlier stages of a forest transition, greater for smaller cuts, and diminishes in effect over time. In panel regressions performed on a sub-sample of data from locations where repeated measurements were available, we also found no support for our ex ante hypotheses. And less than one-quarter of cross-sectional regressions performed on data from individual countries and years showed results consistent with our ex ante hypothesis. Because we did not find a significant effect we did not carry out initial plans to test for mediating factors, nor did we undertake a planned cost-effectiveness analysis. Our findings differ from the majority of previous empirical studies, which found that deforestation increases malaria prevalence in other contexts. We speculate that this difference may be due to an "African exception to drivers of deforestation" (Fisher, 2010) in which deforestation in Africa is largely driven by the slow expansion of subsistence or smallholder agriculture for domestic use by long-time residents in stable socio-economic settings rather than rapid clearing for market-driven agricultural exports by new frontier migrants as in Latin America and Asia. Our results imply that at least in Africa forest conservation does not appear to be an effective anti-malarial intervention. Anti-malarial efforts in Africa should focus on other proven interventions such as bed nets, indoor spraying, and housing improvements. Forest conservation efforts should focus on securing other benefits of forests, including carbon storage, biodiversity habitat, clean water provision, and other goods and services.





## Scientific basis for developing key environmental criteria of FSC forest certification standard

(Oral)

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Developing certification criteria requires solid scientific knowledge. An extensive review of scientific literature was carried out by the author for WWF Finland. The aim of the study is to improve eight key environmental criteria of the Finnish FSC –standard in the revision process.

Altogether 200 scientific articles and reports were reviewed and their main findings presented in a report that is published by WWF Finland in March 2018. The review was mainly based on Finnish and Swedish research articles and reports supported by some Norwegian and Estonian articles. The articles were selected by the author according to their usefulness for developing measurable criteria and indicators for the FSC –standard.

Based on the results of the review conclusions and suggestions were made for developing current criteria more efficient for protecting biological diversity, soils and waters. The knowledge, conclusions and suggestions are used in the revision negotiations between environmental organizations and forest industries.

Key findings are:

Forest buffer zones 20-30 meters wide are ecologically efficient for protecting aquatic habitats, as well as riparian forest habitats in most cases. Also around protected spruce mires 20-30 meter wide are well justified for buffering microclimatical changes.

Saving naturally dead trees in all forest operations is the most cost-effective way to increase the volume and diversity of dead wood in managed forests. Spared dead trees should be primarily over 20 cm thick. In the areas with high conservation values the target for the volume of dead wood should be over 20 m<sup>3</sup>/ha. This kind of areas should cover 10-30 % of forest landscapes.

Minimum of 5-10 % of the stand volume should be left in final fellings as retention trees. retention trees should be at least 20 cm thick at breast height. Higher levels of retention ought to be used in areas of high conservation values.

Several key biotope types were suggested to be added in the FSC criteria as they were currently lacking.

It is ecologically well justified to retain 30 % of the volume of slash and stumps in energy wood harvesting.

In forest fertilization 20-30 m wide buffer zones should be left along watercourses, and 50 m when the fertilizers are spread from air.

The most significant water quality impacts of soil preparation are caused by maintenance ditching and ditch-mounding on peatlands and fine textured mineral soils. On high risk areas continuous cover forest management should be used.

On controlled burning areas 10-20% of the stand volume should be left as retention trees to provide a longer continuity of fire scarred and dead trees.

Keto-Tokoi, P. 2018. Science-based recommendations for developing environmental criteria of the Finnish FSC forest certification standard. Report of WWF Finland. Unpublished report in Finnish.



## Snag fall rates in Fennoscandian forests

(Oral)

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Snags (standing dead trees) are an integral component of natural boreal forests, serving multiple functions, including habitat for a variety of dead wood-dependent organisms, and as a dynamic carbon storage. As a result of intensive and long-term use of forests in Finland, Norway and Sweden, the amount of snags has drastically decreased from the levels encountered in the natural forests. Consequently, increasing the amount of snags is one important aim when restoring habitat diversity in managed forests. However, current information on the dynamics of snags and most importantly how long do they remain standing is fragmentary. Earlier research that has suffered from limited by data availability, has revealed a wide range in standing times of snags. This range has been variably linked to different factors, including climatic and edaphic conditions of the site, the tree species or its size, but comprehensive, large scale efforts on assessing dynamics of snags have not been conducted so far. Understanding snag dynamics and the factors that drive this variability would be essential for predicting snag dynamics and more efficiently incorporating them into forest management.

In this study, we will compile a large dataset of snag survival and fall in Fennoscandia, combining Finnish, Norwegian and Swedish national forest inventory (NFI) measurements on permanent sample plots since the mid-1990s, when systematic dead wood measurements began in these inventories. Using this dataset, our aim is to analyze the rates of snag fall, and their variability as a function of the characteristics of the snag, the site it grew on, and the climate.

For this, we will harmonize the datasets from the inventories of the three different countries, to create a single dataset for modeling snag dynamics. In the Norwegian NFI, individual snags are tracked through time as part of the measurement protocol, but for the Finnish and the Swedish NFIs we will first develop a piece-matching algorithm to link trees measured at one time with trees measured at the next inventory. We will then use mixed effects models to analyze snag fall rates, and the factors influencing their variability. Here, we report the first results of these analyses.



## Building evaluation capacity in small/medium-sized conservation projects

(Oral)

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DOI: 10.17011/conference/eccb2018/107856

Small/medium-sized projects make up a key component of the work of many conservation organisations. Given the challenges facing global biodiversity it is essential that we are able to evaluate and learn from the outcomes and impacts of such projects. Furthermore, many of those working in conservation receive their first experience of practical conservation work through managing and implementing projects of this scale, therefore instilling good evaluation practises at this level can also act as a valuable capacity-building experience which further enhances the potential impact of such projects.

PRISM is a toolkit developed by a collaboration of organisations in the Cambridge Conservation Initiative, with additional input from academics, practitioners and donors from across the conservation sector. The toolkit aims to support small/medium-sized conservation projects to evaluate the outcomes and impacts of their work, specifically to help projects:

- Understand the theory behind evaluation relevant to small/medium-sized conservation projects
- Plan project evaluation in a way that maximises useful information while remaining feasible to carry out
- Use practical, easy to use methods to collect and analyse evaluation data that can be adapted for specific conservation scenarios
- Interpret, communicate and apply evaluation results to improve current practise

The toolkit addresses the need to build evaluation capacity in such projects, reconciling the challenges they face with the need to go beyond only measuring what has been done and to look at what difference the project has made, what lessons have been learnt and what should be done next.

Ferraro PJ, Pattanayak SK (2006) Money for Nothing? A Call for Empirical Evaluation of Biodiversity Conservation Investments. *PLoS Biol* 4(44)

Dickson, I. M., Butchart, S. H. M., Dauncey, V., Hughes, J., Jefferson, R., Merriman, J. C., Munroe, R., Pearce-Higgins, J. P., Stephenson, P. J., Sutherland, W. J., Thomas, D. H. L., & Trevelyan, R., (2017) PRISM – Toolkit for evaluating the outcomes and impacts of small/medium-sized conservation projects. Cambridge Conservation Initiative. Version 1. Available from [www.conservationevaluation.org](http://www.conservationevaluation.org)



## Manipulating below ground diversity for above ground diversity: application of fungi for vegetation restoration

(Oral)

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The loss and fragmentation of habitats is one of the main drivers of deteriorating ecosystem functioning and services. This has induced a growing need for conservation and increasingly more – restoration. A central part of land-ecosystems is soil biota with arbuscular mycorrhizal (AM) fungi being a key constituent. As ubiquitous plant symbionts, AM fungi have a global impact on carbon sequestration and nutrient cycling, soil formation, erosion and leaching processes, therefore influencing all spheres of earth. In soils where disturbance has led to the loss of soil cover or a drastic change in plant community composition, the absence of suitable AM fungal symbionts can lead to slow post-restoration plant community recovery, with negative implications on ecosystem functioning for decades. Because of this, the manipulation of soil AM fungal composition for restoring plant communities is a highly promising perspective.

To test the applicability of this idea, we have set up field inoculation experiments in three ecosystem restoration scenarios in Estonia: restoration of alvar grassland vegetation following clearing; restoration of wooded meadow vegetation following clearing; restoration of vegetation in depleted oil shale quarries. Native soils and plant seeds were collected from target ecosystems in good condition and trap cultures were set up to obtain bulk fungal inoculums. These inoculums were applied with native plant seeds in 18 restoration sites across Estonia. The experiment is monitored for effects and temporal changes in above and below-ground diversity, giving valuable insights into the practical implication of AM fungi for ecosystem restoration. An overview of the hypotheses, methodology and practical boundaries of this experiment will be given in tandem with results from year one of the experiment.

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2018/06/13

17:00

Room: K305 Alvar



## Why we will accept your paper in Biological Conservation?

(Oral)

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As the Editor in Chief of Biological Conservation, one of the leading journals of the field, I will outline the major directions of the journal and provide future authors with a tool box to help them with their submission. What is the scope of the journal? Is biological conservation the right target for my paper? What are the key messages to keep in mind when preparing my manuscript for this journal? Is there any specific type of findings that should be promoted or avoided to maximize the probability of having my paper accepted? I thought about these questions both as an author and as an editor and I want to share and discuss this experience of the publication process in conservation.

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## Forest Fire Monitoring-An Integrated Approach to Sustain Forest Biodiversity.

(Oral)

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Lack of appropriate forest spatial information has been a major challenge in Nepal. In the hilly and mountain regions of Nepal, forest fire is very common. Once there is a forest fire, there is loss of biodiversity including wildlife and their breeding points. The problem is the lack of forest fire warning and management system. The forests of Nepal encompass a variety of endangered species, flora and fauna. The most important of them are Royal Bengal Tiger, Red Panda, Rhinoceros, *Codiceps Sinensis* (Yarshagumba), *Dactylorhiza hatagirea*, *Rheum Emodi* and so on. These valuable species have recognized Nepal all over the world. When there is a forest fire, these species come under direct threats of destruction both by fire or human attack, thus causing an irreparable loss to forest biodiversity.

Basically in response to management and conservation, areas of high biodiversity sensitivity are taken as high alert and people residing near the forests are given forest related training and information. A real time mobile application showing the forest degradation and loss due to fire and other catastrophic events are provided through satellite maps and data to the nearby residents in order to get immediate warning of forest fires. Forest fire maps, community based data, biodiversity data, forest fire triggering factors are the most important results I have obtained.


Forest Fire maps, biodiversity sensitive maps and spatial data would be of great use to WWF, Forest Department and NGO-INGO. Our maps have helped a lot to WWF, Department of Forest, NGO, INGOs in taking conservation measures and awareness program. My work has raised community awareness and an integrated approach for conserving forest and forest species, promoted forestation and above all developed the concept of community forest, that is, community responsibility to conserve forest. So, forest fires can be monitored and controlled if there is an integrated approach through local, communal and government effort.



## High Atlas cultural landscapes: Elucidating the links between cultural and biological diversity for conservation

(Oral)

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Rapid and profound social and environmental changes are threatening both biological diversity and traditional livelihoods in the High Atlas Mountains, Morocco. Due to the intimate links between human and non-human populations, approaches that put local communities and their ecological knowledge at the centre of conservation strategies are necessary to halt this loss. This paper presents results from the Global Diversity Foundation's auto-ethnographic, ethnographic and ethnobotanical research on traditional ecological knowledge of cultural practices for conservation in two High Atlas rural communities. These are practices that have an impact on maintaining local biodiversity patterns as well as culture-specific traditions and livelihoods, and are contextualised in the local layered social fabric. We elucidate the links between the agro-pastoral and water management systems, customs that utilise biodiversity and local institutions and ceremonies. Alongside Morocco's best known ICCAs, pastoral agdals, other customary management strategies that regulate access to resources are presented. The definition of ICCA is discussed to include a gradient of territories and practices in the southern Mediterranean context. Drawing from these results as well as the GDF's multi-cultural, multi-disciplinary experience in the "High Atlas Cultural Landscapes" project, we provide recommendations to implement successful, integrative biocultural conservation strategies.

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## When mining the habitat of a rare carnivorous landsnail leads to a wealth of knowledge gain for the whole genus

(Oral)

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Powelliphanta is a genus of large land snails endemic to New Zealand. The twelve recognised species and numerous sub-species in that genus are known for their bright and colourful shells as well as their carnivorous habits. Although they are found in a variety of habitat types, several species and sub-species are in danger of extinction. In 2006, a new species (*Powelliphanta augusta*) was discovered on the footprint of New Zealand's largest opencast coalmine. Most of this snail natural habitat had been lost already and an ambitious conservation programme was established to save the species.

Before conservation work began on *P. augusta*, little was known about the behaviour, the diet, the population structure, the life cycle, of most species in the genus. Only two peer-reviewed publications on *Powelliphanta* can be found on web of knowledge prior to 2007. Since then, 13 additional papers have been published, attracting 113 citations. The conservation programme around *P. augusta* also breathed new life in research on native earthworms, upon which the snails prey. The direct knowledge gained and the research emulation generated by the conservation programme of *P. augusta* had far-reaching repercussions on the ecology and conservation of New Zealand fauna and constitutes a long-term scientific compensation for the mining activities.

For example, the method routinely used by the NZ Department of Conservation for estimating abundance of *Powelliphanta* had never been proven to be accurate. In fact, we show that on average, only 30% of snails are observed during a standard monitoring event, while the proportion of snails overlooked at each monitoring plot ranges from 10% to over 50%. We propose an alternative mark-recapture technique, which was developed to monitor the critically endangered snail *P. augusta* (1). Our proposed monitoring method is reliable and a practical alternative to the standard method for monitoring *Powelliphanta* snails. Another example lies in the detailed description of the diet of *P. augusta* and the development of a molecular diet analysis method later applied to another species in the genus (2). Knowledge on the diet of these species supported their successful rearing in captivity with the aim of releasing new populations in protected predator controlled areas.

In this talk we will present our findings and summarise the knowledge gained on the ecology, development, captive rearing and translocation of *Powelliphanta* snails, which directly arose from *P. augusta* conservation programme.

(1) Hamilton M (2015) Monitoring *Powelliphanta* land snails: an assessment of the current technique and the development of a new mark-recapture technique (Doctoral dissertation, Lincoln University).

(2) Boyer S, Wratten SD, Holyoake A, Abdelkrim J, Cruickshank RH (2013) Using next-generation sequencing to analyse the diet of a highly endangered land snail (*Powelliphanta augusta*) feeding on endemic earthworms. PLoS One, 8(9), e75962

2018/06/13

17:30

Room: K305 Alvar



## Publishing in high-quality ecology journals

(Oral)

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Submitting to international journals is an important part of a scientist's career. I will give an overview of how the British Ecological Society works to help the research community and will discuss the process of publishing in international journals, including selecting the right journal for your work, what happens during the review process and how to respond to decision letters and reviews.

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## Rethinking Ecology, a new journal fostering new thinking in ecological research

(Oral)

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Rethinking Ecology is a new open access, peer-reviewed journal that aims at fostering both forward-thinking and the publication of novel ideas in all aspects of ecology, evolution and environmental science. Rethinking Ecology is an opportunity to publish novel ideas and hypotheses prior to fully testing them. Our aim is to encourage scientists to share and discuss their novel ideas with their peers without fear of losing the credit they deserve. The publishing of these ideas at an early stage has the potential to draw attention from the scientific community, help create research networks with other interested parties, support grant proposals, and help refine the idea before testing it experimentally. The aim of Rethinking Ecology is therefore to be an incubator for novel ideas, and a catalyst for new thinking. This role is particularly important in conservation science where urgent innovation is required to stem biodiversity loss.

During its first year of existence, Rethinking Ecology has published papers contributing to advancing ecological research by recommending new definitions, proposing new avenues of research, exploring new tools for conservation, fostering discussions on previously published research, and proposing better ways to fund scientific research.

This presentation will outline and discuss the core values of the journal which have been hot topics in 2017, in particular the tackling of biases associated with single blinded reviews (1), the gender bias (2), the issues with peer-review funding panels, or the co-authorship black box (3).

1. Tomkins, A., Zhang, M., & Heavlin, W. D. (2017). Reviewer bias in single-versus double-blind peer review. *Proceedings of the National Academy of Sciences*, 114(48), 12708-12713.
2. Bradshaw, C. J., & Courchamp, F. (2017). Gender-biased perceptions of important ecology articles. *bioRxiv*, 219824.
3. Boyer, S., Ikeda, T., Lefort, M.-C., Malumbres-Olarte, J., & Schmidt, J. M. (2017). Percentage-based Author Contribution Index: a universal measure of author contribution to scientific articles. *Research Integrity and Peer Review*, 2(1), 18.



## The mechanistic basis of changes in community assembly in relation to anthropogenic disturbance and productivity

(Oral)

Merja Elo<sup>1</sup>✉, Santtu Kareksela<sup>2</sup>, Tuomas Haapalehto<sup>2</sup>, Hilja Vuori<sup>1</sup>, Kaisu Aapala<sup>3</sup>,  
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In the human-dominated world the natural drivers of species diversity, such as productivity and habitat heterogeneity, have been accompanied by anthropogenic disturbance resulting in increased extinction rates at global scale. However, decrease in species richness does not necessarily result in local decreases in species richness. Moreover, species richness provides limited information on processes that cause changes within and between communities, and the mechanistic basis of these changes remains elusive. As all patterns in community ecology can be understood as a result of four processes (speciation, selection, drift, and dispersal), the effect of disturbance should depend on how disturbance disrupt these processes. We studied the effects of disturbance and productivity on species richness, community composition, and beta diversity (i.e. spatial variation in community composition) in the vegetation of 120 boreal peatlands. Using null model approach we determined whether community assembly processes differ between pristine and disturbed sites. Sites represented three peatland ecosystem types, each with two levels of productivity. Half of the sites were pristine and half were drained for forestry, which causes a major ecosystem level disturbance. Our results showed that high productivity sites encompassed higher species richness and different communities than low productivity sites. By contrast, we did not observe any difference in beta diversity between high and low productivity sites. Between pristine and drained sites neither species richness and nor beta diversity differed. Instead, peatland communities in drained were dissimilar to pristine sites, thus showing changes not attributed to drift but to selection, most likely based on altered hydrology, pH, and nutrient gradients. Moreover, the changes due to drainage were toward forest communities which could lead to landscape level homogenization. Effective ways to combine knowledge of the landscape level changes among disturbed areas and the understanding of the mechanisms affecting communities locally are important for reaching the ambitious global targets of restoring the degraded ecosystems.


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## Simulating the gene flow pattern in *Cabralea canjerana* fragments in Atlantic Forest, for genetic conservation

(Oral)

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Gene flow assumes special importance in the conservation of genetic resources by allowing the connectivity of geographically isolated populations and, thus, subject to the reduction of genetic variability. Its effectiveness is a function of the model and the rate, thus justifying studies for planning genetic conservation. Simulation programs allow us to infer past events from current data or predict future phenomena under real genetic scenarios. Adverse phenomena can be predicted and measures can be taken to bypass them. In the present work we used simulations with the EASYPOP program (Balloux, 2001), using data from microsatellite markers obtained from eight fragments of the forest tree species *Cabralea canjerana*, growing in the Atlantic Forest, in Brazil, aiming to study the model and the rate of gene flow that best explain its genetic structure. Five models and nine migration rates were tested, and the model that presented the closest values to those obtained with microsatellite markers by Melo (2012) was selected. The selection criteria was the observed heterozygosity, expected heterozygosity, and Wright statistics  $F_{ST}$  and  $F_{IT}$  obtained in the simulations. The selected gene flow model was the isolation by distance, with a rate of 0.1. High levels of genetic differentiation were observed among the fragments due to their reproductive isolation, suggesting the need to build ecological corridors to connect distant fragments and, thereby, allow the homogenization of their allelic frequencies through gene flow. In this study we suggest the use of computer simulations based on molecular markers data in the conservation context to predict future phenomena, thereby enabling identification of priority populations for conservation.

Key references: 1. Computer simulations; 2. Forest conservation; 3. Molecular markers.

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## Getting published in journals via Peerage of Science

(Oral)

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The median delay from your manuscript being ready, to being assigned a DOI at a journal, is about nine months. This would be understandable, if that time was spent on rigorous, thorough and careful peer review - but we all know it is not. Mostly the time is spent waiting, sliding down the journal prestige ladder one rejection after another.

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2018/06/13

18:30

Room: K307 Elsi



## Discussion II: Science-policy-society interfacing in the European context

(Oral)

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2018/06/13

17:45

Room: A2 Wivi



## Regeneration dynamics of foundation species *Quercus*: effects of changing land-use and ungulate browsing in Sweden

(Oral)

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Abstract of this presentation is not public



## How the assessment of ecosystem services at sites can act at the science-policy-society interface: the example of the TESSA toolkit.

(Oral)

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Management decisions and the development of appropriate conservation policy require scientifically rigorous and accessible information. Biodiversity conservation has been and continues to be a complex issue; more recently the field of ecosystem services has become more prominent. This provides both risks and opportunities for nature conservation. Risks, because the provision of ecosystem services may be prioritised over, and conflict with, nature conservation. Opportunities, because ecosystem services may support arguments for conserving the natural environments that provide them.

Decision- and policy-makers require robust evidence regarding the provision of ecosystem services at sites where alternative management decisions may be considered, and there is a demand for tools that can produce that evidence. Many of these are GIS-based, operate at the regional or landscape scale, and require considerable expertise to apply. TESSA (Toolkit for Ecosystem Service Site-based Assessment) has been developed by a collaboration of academics and practitioners from several organisations, including partners of the Cambridge Conservation Initiative (Peh et al. 2013). It is designed to be used at the site-scale by non-experts, focuses on the net differences in ecosystem service provision, and explicitly incorporates communication of the results. In this way, it operates at the science-policy-society interface, providing a framework for researchers to gather information and disseminate it to decision-makers, and the general public.

TESSA is widely used throughout the world (for example, it is approved for use in the EU's LIFE program), and supports local decision-making across varied contexts. Its application has been published in a dozen peer-reviewed journal articles. In December 2017, a new version was released, which introduced three new modules: coastal protection, pollination, and cultural services. The cultural services module in particular expands on TESSA's existing commitment to connect science, society and the natural world with policy-makers and stakeholders. I will present examples of uses of TESSA in societal decision-making, and discuss its future potential.

Peh, K.S.-H., Balmford, A., Bradbury, R.B., Brown, C., Butchart, S.H.M., Hughes, F.M.R., Stattersfield, A., Thomas, D.H.L., Walpole, M., Bayliss, J., Gowing, D., Jones, J.P.G., Lewis, S.L., Mulligan, M., Pandeya, B., Stratford, C., Thompson, J.R., Turner, K., Vira, B., Willcock, S. & Birch, J.C. (2013) TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance. *Ecosystem Services*, 5, 51-57.



## The Society for Conservation Biology's Commitment to Facilitate the Creation, Dissemination, and Application of Conservation Science

(Oral)

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The Society for Conservation Biology (SCB) currently published two globally recognized peer-reviewed journals, Conservation Biology and Conservation Letters. Publications included in Conservation Biology address issues germane to the conservation of any of Earth's ecosystems or geographic regions and that apply diverse approaches to analyses and problem solving. The conservation relevance of articles published in Conservation Biology transcends the particular ecosystem, species, and situation described. Conservation Letters publishes empirical and theoretical research with immediate implications for the conservation of biological diversity worldwide. The journal's concise papers are renowned for their originality, timeliness, and influence on policy debates and management solutions. Both of these journals maintain high impact factors, h5 indices, and CiteScores and have proven to be must-read sources of cutting-edge, policy-relevant conservation research from the natural and social sciences. Due to the successes of these journals, SCB is now excited to announce the launch of a brand new peer-reviewed journal! Conservation Science and Practice will publish papers that address the policy, planning, and practice of conserving biological diversity including those that expand conservation knowledge ranging from practical experience to advances in theory. Conservation Science and Practice will place special emphasis on studies that connect findings to conservation outcomes and address strategies that work as well as those that don't. Studies with implications for biodiversity conservation applications that rely on established methods on specific case studies will be welcome, including those that do not transcend species, ecosystem, or situation.

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## The value and costs of information for conservation decisions – a comparison of inventory strategies using imperfect and perfect information

(Oral)

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Conservation decisions should be made considering the information available. The quality of information can vary, depending on how the data is collected. High quality (expensive) information could be obtained from detailed field inventories, or lower quality (inexpensive / free) information could be obtained from remotely sensed information or previously acquired information. From a Bayesian statistics perspective, the value of collecting better information can be evaluated. The remotely sensed or previously acquired information could serve as prior information while the detailed field inventories could be the posterior information. For a simple one stand decision, the value of information can be examined through a Bayesian decision framework [1, 2]. This provides the expected benefits of obtaining additional information that can be evaluated in comparison with the expected costs of obtaining the information. When multiple stands are considered for conservation simultaneously, concisely describing the value of information become difficult, as the value of information is linked to the decision maker's preferences and the potential impact the additional information has on decision. In this presentation, we describe how to evaluate the value of information for multiple criteria on a single stand. We then present how this concept can be applied to a simple forest conservation problem with four stands. For each stand, a decision can be made to inventory the site (with a specific cost) or not. If an inventory is conducted the decision to conserve the site (with a specific cost) or not can be made with perfect information, otherwise the decision will be made with imperfect information.

The results are demonstrated through a variety of visualization techniques including the empirical achievement function which describes the probabilistic outcomes of each decision alternative [3]. By comparing the general decisions we highlight the potential value of information from different conservation and inventory strategies. With this simple case, the benefits of collecting more information occurs when the desired conservation value is near the mean of the conservation value range.

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[2] Raiffa, H. and Schlaifer, R. (1961). *Applied Statistical Decision Theory*. Harvard University, Boston.

[3] López-Ibáñez, M., Paquete L., Stützle, T. (2010). Exploratory Analysis of Stochastic Local Search Algorithms in Biobjective Optimization. In: Bartz-Beielstein, T., Chiarandini, M., Paquete, L., Preuss, M. Eds. *Experimental Methods for the Analysis of Optimization Algorithms*, pages 209–222. Springer, Berlin.



## Abandonment or ambition: Sustaining nature and society through pastoralism in 21st century Abruzzo, Italy

(Oral)

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The abandonment of rural and peripheral areas has been a dominant trend in Southern Europe since the rapid modernization of the 1960s. At the social level, this trend is leading to the disintegration of local communities and loss of traditional cultural heritage. At the ecological level, it is driving land use changes that threaten elements of biodiversity and ecosystem functioning, which depend on human management. A human activity that is tightly intertwined with biodiversity patterns and processes is open-range animal husbandry. Here, we present a successful experience in sustaining this practice, with the relative social and ecological benefits, within the area of the National Park of Abruzzo, Lazio and Molise, Italy. Quality products, direct distribution networks, educational opportunities and low-impact tourism have been key elements for attaining economic sustainability of the activity under current market conditions. In contrast, the main hindrances have included: poor support from local institutions, disregard of traditional activities in Park management and governance, and broader socio-economic trends. Increasing recognition of ICCAs and other effective conservation measures (OECMs) in conservation policy may partly help overcome some of these limitations.

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## Global assessment of 'border protected areas': ecosystem conservation along international borders

(Oral)

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Transboundary conservation approaches have a great potential for conserving functional ecosystems, solving conflicts and strengthening bilateral and multilateral diplomatic relations. The UNEP-WCMC Transboundary Protected Area Inventories between 2005 - 2007 show an increase of transboundary protected areas which is the baseline of our study, whereas we also include other sites with management components, such as UNESCO Biosphere Reserves. Our global assessment includes both transboundary protected areas and those adjacent to international borders. Based on the overlap with a 10 km buffer on both sides of all international borders we distinguish between a. officially established *transboundary protected areas*, b. *pre-transboundary protected areas* - sites within the border buffer and spatial proximity from both sides or even joint boundaries along an international border, but without a joint management agreement, and c. *border protected areas* just on one side of the border. We use a hexagonal grid to map the existence/non-existence of protected areas within the buffer and the level of transboundary conservation along the international borders. It is possible to reveal potential areas for establishing or fostering transboundary network as well as substantial gaps. Additionally, we classify and quantify all 'border protected areas' according to some criteria such as biomes, Intact Forest Landscapes, continents and time of establishment and also study their spatial intersection with anthropogenic features such as roadless areas and built-up areas. This allows for identifying potential thematic networks and using synergies in future transboundary efforts.

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## Mapping Cerrado woody plant traits with spaceborne hyperspectral data

(Oral)

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**José R. Pinto**<sup>4</sup>, **Leandro Maracahipes**<sup>5</sup>, **Mercedes Bustamante**<sup>4</sup>, **Patrick Hostert**<sup>6</sup>,  
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The Cerrado (Brazilian savannah), is the most diverse of all of the world's savannahs. While holding a high diversity and endemism of species, this biome is mostly unprotected and understudied. Also, recent studies have given focus on the importance of species traits, and on the need to incorporate them into biodiversity monitoring and conservation. In this paper, we used woody plant inventory data, plant trait data, and spaceborne hyperspectral (Hyperion) data to map woody plant traits in two study sites in the Cerrado. To this aim, we applied a Sparse Generalized Dissimilarity Modelling (SGDM) approach for modelling the species turnover on each site. Matrix calculations were applied to assign the sampled species to the derived turnover axes, and their specific traits. Furthermore, a knn-imputation applied to these axes allowed us to map the spatial patterns of the woody plant traits over our study sites.





## ForAdapt: Supporting collaborative decision making for managing wildlife and ecosystem services in transboundary protected areas of Europe

(Oral)

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Integrating conservation and natural resource management (CNRM) across international borders has been recognized as necessary to maintain biodiversity and ecosystem services in the face of broad-scale pressures including growing resource demands, invasive species, natural hazards, and climate change. Implementing transboundary CNRM strategies raises three prominent challenges: (1) engaging decision makers and stakeholders from local to regional scales and across borders; (2) linking local-scale management decisions to measurable objectives at landscape to regional scales; and (3) learning and adapting to the complexity of decision making under multiple objectives and scales. To address these challenges, we used a collaborative decision-analytic approach to support cross-border CNRM in multiple European transboundary protected areas (PAs) through the EU-funded ForAdapt project. The approach includes elements of structured decision making and has been applied in non-transboundary contexts and comprised iterative steps of identifying ultimate objectives, external factors (at least partly beyond control of the PA managers), resource allocation options, predictive model linking actions to the objectives, and the optimal allocation option. We applied and evaluated the approach for the first time in two transboundary conservation contexts. For the Triglav National Park (SL) and Prealpi Giulie Nature Park (IT) we identified a recommended 10-year transboundary resource allocation strategy for satisfying stakeholders concerned about brown bear and associated ecosystem services in the Julian Alps Ecoregion. We used participatory methods to develop a Bayesian decision network that accounted for competing stakeholder objectives and future uncertainties regarding perceived competence of the park managers and agreement among Alpine countries regarding bear management. The ultimate objectives were to maintain bear population carrying capacity and sustainable agriculture while minimizing stakeholder conflicts. The recommended allocation led to a concrete transboundary strategy for park managers to collaboratively engage stakeholders, data gatherers, and regional decision-makers in this transboundary pilot region for enhancing ecological connectivity under the Alpine Convention. The second case study focuses on Bavarian Forest National Park (DE) and Šumava National Park (CZ), which provides a recommended strategy for communication between and beyond parks regarding many of their CNRM activities. Together, these case studies demonstrate the efficiency of a collaborative decision-analytic approach for overcoming challenges of transboundary management and conservation for wildlife, biodiversity, and ecosystem services. Based on our own experience and independent feedback from stakeholders, we believe the approach will be useful in other transboundary CNRM contexts where there are already established working relationships between PA managers.



## Evaluating and improving representation of ecoregions and habitat types in the Natura 2000 network of protected areas

(Oral and Poster)

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In order to stop biodiversity loss, the Convention on Biological Diversity was adopted in 1992. The current Strategic Plan for Biodiversity contains 20 so-called Aichi targets that each signatory nation is expected to reach until 2020. Despite these efforts, global biodiversity loss will likely continue beyond 2020 [1].

Aichi target 11 explicitly refers to protected areas (PA) as a means to conserve biodiversity and calls for at least 17 per cent of terrestrial areas to be conserved through PA. In the European Union (EU), the adaptations of the Birds and the Habitats directives led to the EU-wide PA network Natura 2000 which currently covers 18 per cent of the terrestrial territory. With this, the EU formally reached the areal component of Aichi target 11, but biodiversity is still declining. To promote the successful implementation of international conservation targets, interdisciplinary research on ecological and socio-economic key factors for the establishment and evaluation of PA systems is needed.

PA network performance has seldom been assessed across the whole of Europe, yet there have been assessments for certain taxonomic groups and specific regions. According to Aichi target 11, PA networks need to be ecologically representative in order to protect biodiversity effectively. Our study therefore aims at evaluating representation of European biodiversity within the whole Natura 2000 network extent. As distribution data for many European species is not available or incomplete, we evaluate network performance on the ecosystem-level, at two different levels of detail, namely ecoregions and habitat types. First, we conducted a gap analysis, evaluating if the Natura 2000 network is representing ecoregions and habitat types adequately. While Aichi target 11 calls for 10 per cent of each ecoregion to be preserved, no targets exist on the habitat type level. We therefore assigned a target to each habitat type based on its threat status as evaluated by the European Red List of habitat types. We discovered that six ecoregions and 101 habitat types do not meet their representation target. To address these shortfalls, we simulated cost-efficient expansion of the network that strategically targets underrepresented ecoregions and habitat types.

By signing the Convention on Biological Diversity, nations pledged 25 years ago to stop biodiversity loss, but this goal is not reached yet and will likely not be reached until 2020. Evaluating and improving existing protected area networks based on systematic conservation planning principles [2] should be one vital component in future conservation planning efforts, ensuring that protected area networks are continuously improved to conserve biodiversity more effectively.

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## Beliefs, facts, and practices: Towards evidence-based decision-making in the forestry sector in Finland

(Oral and Poster)

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Polarisation of views has long been seen in the discourse around sustainability of forestry in Finland [1]. Different actors have different perspectives, and these perspectives are often supported by referencing a subset of research findings. However, if only research that supports a certain viewpoint is used, the overall picture of what is known remains incomplete, and decision-making is based on opinions and traditions. Hence, there is a need for knowledge synthesis that minimizes biases and uses all available evidence to shed light on the effects and effectiveness of different management interventions.

The Evidence-Based Forestry in Finland (EBFF) initiative was started by Metsäteho Oy in October 2017. It aims to create a basis for evidence-based decision-making through research collaboration with universities and research institutions in Finland and beyond. In the EBFF initiative the best available scientific evidence is collated and synthesised for the use of Finnish forestry stakeholders to support decision-making in questions related to sustainability of the forestry sector. To minimize bias and to ensure highest possible standards, systematic reviews and maps will be used to conduct the evidence syntheses.

The evidence synthesis process is very stakeholder oriented from setting the research question and working together on defining the research protocol to active dissemination of the results. In the EBFF initiative initial research topics arose from discussions with the Finnish forest industry about their evidence needs related to sustainability. The topics include, for example, societal impacts of ecosystem services and wood sales, effectiveness of water protection regulations, and impacts of forest management on biodiversity and ecosystem services.

In this presentation I will introduce the EBFF initiative and systematic reviews as a method for evidence synthesis. I will discuss how the use of systematic reviews can strengthen the role of science in decision-making, and enhance stakeholder collaboration drawing on my experience from the early stages of the EBFF initiative and from the evidence-based environmental management initiatives in other countries. I will frame the talk by using four quality principles of impact-oriented research [2]: relevance, credibility, legitimacy, and effectiveness. The EBFF initiative can help to decrease tensions around forestry related sustainability issues by building bridges between different stakeholders. It will also contribute to solving social and environmental problems by providing decision makers with robust evidence and information on knowledge gaps. With this presentation I also want to encourage more people to partake systematic reviews to fully realize their potential in decision-making relevant to environmental management.



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  2. Belcher, B.M. et al. (2016), *Research Evaluation* 25:1-17
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## Diversity of Bamboos in north-eastern region of India with a note on their flowering occurrences from the area

(Oral and Poster)

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Bamboos (Poaceae), the ‘Green Gold’ of India are a wonderful gift of nature to mankind. These tree grasses contribute a significant component of tropical moist deciduous – evergreen forests and temperate – alpine forests of the country. Within India, the north-eastern region, comprising of eight states viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, is known as the most Bamboo rich zone. Remarkably, among ca 150 species occurring in India, the north-eastern region accounts for more than 60% of the total bamboo-wealth of the country out of which ca 40 taxa are endemic to the area. Dominant genera found are Bambusa, Dendrocalamus, Schizostachyum, Arundinaria, etc. which are represented in the region by more than 10 species each. On the other hand, genera like Ampelocalamus, Chimonobambusa, Stapletonia, etc. are represented in the region by single species each. It has been observed in the present study that arborescent genera like Bambusa, Dendrocalamus and Schizostachyum are common in low elevation tropical forests of the region whereas, reed bamboos like Arundinaria, Chimonobambusa, Yushania, etc. occurs in high elevation temperate and alpine forests. Flowering in bamboos is an interesting as well as curious phenomenon due to its semelparous and monocarpic nature. Flowering cycle recurs in bamboos at long intervals varying from 6 – 70 years or even upto 120 years. Usually the flowering bamboo clump dies after blooming. But, it was noticed in the present study that vigorous clumps are able to overcome the probability of death after flowering and only weaken considerably. In *Bambusa cacharensis*, it was noticed that diameter of the vegetative clump measures 23 – 26 cm whereas the same of bloomed clump measures 10 – 12 cm only (Devi & Bhattacharyya, 2013). Two types of flowering have been observed in the bamboos in North-eastern India viz. Gregarious and Sporadic. In this present study, flowering in several species viz. *Bambusa cacharensis*, *B.tulda*, *Dendrocalamus longispathus*, *Melocalamus compactiflorus*, *Schizostachyum pergracile*, etc. has been observed from different states of the region in recent times since 2011. Gregarious flowering in bamboos are considered as a dreadful event in several parts of north-eastern India as it results in population explosion of rodents which ultimately leads to devastating famine. This present study on bamboos of north-eastern India attempts to document the bamboo species of the region based on morpho-taxonomic analysis. As reproductive characters are rarely found, vegetative characters like culm sheath, auricle, etc. have also been taken into consideration for identification of the taxa.

Key words: Bamboo, Flowering, North-eastern India

Reference:

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## Distribution of biodiversity in managed landscapes – can remotely sensed data be used to find biodiversity hot-spots?

(Oral and Poster)

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Management of boreal forests for timber production has caused changes in forest structures and disturbance regimes, which have influenced distribution patterns and abundance for a wide range of organisms. The aim of this study was to evaluate how bird and beetle species composition is influenced by stand age and management history in a heavily managed boreal forest landscape and whether it is possible to find biodiversity hot spots in these landscapes using remotely sensed data. Taxa included was flying and epigeic beetles, and birds. We first compared the assemblages among stands of three ages: 1) young (8-25 years) and 2) middle-aged (40-58 years) stands regrown after clear-cutting, and 3) mature stands (80-130 years) that had been selectively cut historically but never clear felled. We sampled beetles in 42 stands and birds in 47 stands during one summer. Both bird and beetle assemblages in young stands differed from those in middle-aged and mature stands. Young stands generally harbored fewer species and lower abundances compared with middle aged and mature stands. Lack of differences in assemblage composition, species richness and abundance of beetles between middle aged and mature stands suggests that beetle assemblages recolonize following clear-felling. However, our collections included large numbers of unique and usually rare beetle species in mature stands, including several species associated with old growth characteristics, indicating that old forest is important for conservation. The lower abundance of beetles in young stands indicates that an increasing proportion of young stands on managed landscapes will reduce the overall abundances of species, with potentially negative impacts on recolonization [1]. When testing the potential of airborne laser scanning (ALS) and forest estimates derived from satellite images for predicting the stand-scale abundance and species richness of birds and beetles in the same landscape we found that the abundance and species richness of both birds and beetles was best described by the maximum vegetation height within 50 m (and thus correlated to stand age). For birds the vegetation cover between 0.5 and 3 m was important, highlighting the importance of layered stands for birds. These results show that forest estimates derived from satellite images and ALS data provide complementary information for explaining forest biodiversity patterns and may provide an efficient tool for conservation planning in managed boreal landscapes [2].

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## Making sense of the wild: Integrated participatory mapping for understanding community relationships to dynamic mountain landscapes

(Oral and Poster)

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Existing research has demonstrated that capturing stakeholder attitudes to landscape may be most accurately performed in the field, in spite of the challenges this brings (Evans and Jones 2011). The use of innovative walking methods is emerging as a key tool for understanding experiences of and relationships with landscape and place. In conservation biology, these and other mobile methods have used underlying spatial data to develop a landscape typology, then spatially tagged and captured stakeholder attitudes in relation to that typology in-situ (Scott et al. 2009). This poster presentation describes our forthcoming research in Abisko, Sweden, which seeks to blend bio-acoustic methods with participatory mapping in order to comprehensively capture stakeholders' perceptions of, knowledge about and attitudes towards dynamic Arctic environments. The use of this multi-sensory, participatory mapping methodology, which amalgamates experiential human data with empirical ecological survey data, can advance understanding of the complex interactions between society, environment and place in modern conservation approaches (Zia et al. 2015). This interdisciplinary and collaborative research project aims to engage research subjects in active, sensory roles for the co-creation of mutually beneficial knowledge. By complementing existing geophysical/ ecological surveys with insights into local community land-values using ethnographic methods, we build capacity for understanding the impact of environmental change on local communities within the Arctic, whilst developing a new methodology for broader use in the future co-production of sustainable land-management policies internationally. Furthermore, involving people in co-created conservation tools such as wildness maps may be one way of addressing the multiple conflicts currently surrounding wild land and wild species.

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## Vulnerability assessment of oligo-mesotrophic habitats of Lake Svityaz to recreational load using satellite imagery

(Oral and Poster)

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Lake Svityaz is the largest and deepest lake of natural origin in Ukraine. It forms a unique complex of aquatic habitats, considered of high value for conservation within the Shatsk National Nature Park as well as the entire West Polesie Transboundary Biosphere Reserve. Meanwhile, due to its tourist attractiveness, the lake suffers from significant anthropogenic impact. Constantly increasing recreational load leads to decline in resistance and resilience of the lake ecosystem.

The main purpose of our research was to detect and analyze transformations of vulnerable freshwater oligo-mesotrophic habitats of Lake Svityaz and examine effectiveness of using multi-temporal satellite images to estimate impact of recreation on the lake's littoral.

Using Landsat satellite imagery series (June-August) over the 30-year period (1985-2015) and seasonal series of Sentinel-2 imagery for 2016-2017 a set of habitat maps was obtained. Previously developed two level algorithm for plant habitats recognition utilizing multispectral satellite and seasonal data was applied [1, 2]. Analysis of the acquired thematic maps is shown that the main types of oligo-mesotrophic habitats are well recognized on the satellite images owing to the high transparency of the lake water. Main spatial and temporal patterns of macrophyte aquatic vegetation transformations of C.1.1-C.1.2 oligo-mesotrophic boreal habitats affected by organized and uncontrolled recreation are identified. It is revealed that direct mechanical impact caused by recreants leads to integrity destruction of aquatic plant communities, loss of Chara and alluvial-dependent macrophyte species and to structure simplification of species communities. It also results in degradation of macrophyte thickets and loss of endangered and vulnerable freshwater habitats formed to a depth of 1.5 m. Permissible recreational load for the lake's littoral is estimated. Assessment results may provide conservation managers, municipal officials and researchers with substantial information on the lake's threatened habitat vulnerability to recreational load.

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## Scientific background of ex-situ conservation and reintroduction of endemic plant species *Minuartia smejkalii*

(Oral and Poster)

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Ex-situ conservation and species reintroduction is a standard approach in many conservation actions. These actions should ensure that the new populations will be genetically diverse and will not suffer from loss of fitness due to inbreeding or outbreeding depression. Despite this, many projects establish new populations without previous scientific research.

We present the results of a genetic analysis and hybridization experiment aimed to provide background information for ex-situ conservation and reintroduction of *Minuartia smejkali*, a critically endangered endemic species included in Habitats directive 92/43/EEC. *M. smejkalii* is restricted to serpentine rocks and occurs only on two isolated regions with 8 populations in total.

Because of the rapid decrease of population size, the project LIFE for *Minuartia* (LIFE15 NAT/CZ/000818) focuses on revitalization of its habitats, enhancement of population size, establishment of ex-situ conservation and reintroduction of the species on localities where it went extinct. We performed genetic analysis and a hybridization experiment to understand the between population differentiation and thus to select appropriate population or their mixture to establish new populations. Genetic variability was analysed by nextRad sequencing using 20 individuals per population. Hybridization experiment was done by hand pollination of plants with pollen from the same plant, same population or other population. The developed capsules were collected and number of ripe seeds evaluated.

The results showed that populations from the two regions are genetically differentiated and therefore the ex-situ conservations should be established separately for each regions. Similarly it is necessary to keep regionality of plants used for reintroduction. On the other hand, populations within each region are not genetically different and their hybrids produced ripe seeds. Moreover, self-pollination reduced seed set. In the smallest population, plants pollinated by pollen from other population within the same region produced the highest amount of seeds. This suggests that for the establishment of new populations it is suitable to combine individuals from different populations within each region to avoid inbreeding depression. It is even the preferred strategy for the enhancement of population size of the smallest population in the nature. Prior to the realization of these actions in the nature we still need to test the germination rate of the seeds and fitness of hybrids.

To conclude, the data collected were crucial for proper design of species reintroduction and ex-situ conservation. They suggest that we should not combine individuals from the two regions. They also suggest that different populations within each region should be combined for establishment of new populations, and for the enhancement of the smallest natural population. This demonstrates that detailed scientific data on the species should be a key part of any conservation action.



## Ecosystem engineer hiding under the shade: Mutualistic association between Num-num (*Carissa bispinosa*) and Snouted harvester termites (*Trinervitermes trinervoides*) in a semi-arid savanna

(Oral and Poster)

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In many ecosystems one individual, or species may alter the environmental conditions in such a way that a stressful habitat becomes more hospitable for other individuals. Mutualism is a relationship between two organisms of either the same species or different species that enhance their survival or growth. Much of the diversity in the world is due to the mutualistic relationships that organisms form with one another. However, very few of these mutual associations have been documented in the semi-arid savanna region of Africa. Our study used seasonal transect surveys to determine the levels and benefits of association between *Carissa bispinosa*, a fast-growing medium sized ever green thorny shrub, and *Trinervitermes trinervoides*, a nocturnal termite species, at a semi-arid savanna setting in Nylsvley Nature Reserve, South Africa. The aim was to understand whether the relationship between *C. bispinosa* and the *T. trinervoides* termitaria: (1) benefits both species (mutualistic in nature); or (2) if it was only beneficial to one entity; and (3) determine to what extent the relationship benefits the species involved. We hypothesised that the termite mounds provide favourable conditions for vegetation and as a result, num-num shrubs are better established on termite mounds. In return, the shade, thorns and “cagey” shrubs of num-num trees provide termite mounds with a thermoregulation buffer and protection from predation. Our findings show that plants growing on mounds were significantly taller with a wider canopy compared to stand alone plants. Plants in association with mounds also remained greener in the dry season and bear more fruits in winter compared to standalone trees. On the other hand, termite mounds under plants were less prone to be damaged by aardvark and pangolin compared to mounds in the open. Termite mounds in shade had a significantly wider diameter than exposed mounds. Termite mounds under num-num plants maintained a better constant and higher mean internal temperature during winter compared to exposed mounds. The magnitude of this difference increased with mound volume and amount of plant cover. We therefore conclude that the association between *Carissa bispinosa* (plant) and *Trinervitermes trinervoides* termite mounds is mutualistic in nature and may play a significant role to ensure persistence of both species in these semi-arid environments. There are several animal-plant associations that have been documented in other parts of the world, but none are reported for southern Africa. Scientists are increasingly studying termite behaviour and the role they play as ecosystem engineers. In this study emphasis was placed on the newly observed survival mechanism that termites employ to escape extreme temperatures and predation.



## Assessing the long-term effect of Natura 2000 network on common breeding bird communities

(Oral and Poster)

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The Natura 2000 network (N2000) is currently the largest coordinated network of protected areas in the world, and focuses on the conservation of most valuable and threatened species and habitats in Europe. Although there has been several assessments of N2000, few studies have looked at the long-term effect of this protection network on biodiversity, and even fewer on common species. A recent study by Pellissier et al. 2013, highlighted that common bird species have actually benefited from the designation of N2000 directed toward other target species, but has not been able to provide strong evidence regarding the temporal efficiency of the network. As such, questions remain as to whether this reflects a lack of efficiency of N2000 or that temporal responses could not be not detected because of potential time lags. Here, using data from the French Breeding Bird Survey, we investigated the effect of the protection network on the temporal trends of non-threatened avian biodiversity in France, over the period 2002-2016. For this purpose, we tested for differences in temporal changes in abundance and in community structure between sites inside or outside the N2000. We considered abundance of i) the overall bird populations, ii) of habitat specialists (farmland, woodland, and generalist) and iii) of species of concern (listed in the Annex I of the Bird Directive). Changes in community structure were measured through two functional indices: the Community Specialisation Index and the Community Trophic Index. We found consistent results with previous findings pointing out at a significant decline of common bird populations over time. However, our results show that this decline is weaker within N2000 areas than outside N2000, especially for farmland specialists. This emphasises that common bird species - not directly targeted by the European Birds and Habitats Directives - may have benefited from the protection or management measures of the N2000. From our knowledge, this is the first study highlighting significant long-term effects of Natura 2000 on common bird populations. Despite these encouraging outputs, we did not find any long-term benefit of the protection network for the bird species targeted for the designation of Natura 2000 areas. We note, however, that our results did not show any significant trend in abundance for these specific populations, meaning that these may have remain stable over the past decade or so. Also, we did not find any significant long-term protection or management effect of N2000 on bird communities. These lack of findings may reflect either a limited capacity of N2000 to deliver large benefits or the need for longer time series to detect protection or management effects at a community level. Overall our study support the fact that Breeding Bird Survey is a useful tool to assess a protection network, and we encourage further studies to re-evaluate the impacts of the network in the coming future.



## Metrics and tools for evaluating conservation target achievement in protected area networks

(Oral and Poster)

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The Convention on Biological Diversity's Aichi Target 11 calls for 17% of terrestrial and 10% of marine areas to be in "effective and equitably managed, ecologically representative and well connected" protected areas by 2020. This is one of many global and national conservation policies that require progress reporting towards achieving conservation targets. Transparent and repeatable metrics that can be applied broadly are an important step towards meeting these commitments. Currently the most widely used approach for evaluating progress towards these goals is reporting total protected area coverage due to its relatively unambiguous and easily quantifiable nature. However, this alone is not a sufficient indicator for conservation achievement because it ignores the other key components of conservation target, such as how well a network represents important biodiversity features (e.g. ecological regions or species). While reporting the number or percentage of ecoregions that meet a protected area coverage target has been a first attempt towards this end, such measures ignore biodiversity features that do not reach a target but still provide some degree of protection.

Building on the work by Sutcliffe et al. [1], we present two complementary metrics measuring ecological representation for protected area networks. The 'mean protection gap' (MPG) and the 'mean target achievement' (MTA) determine the degree of conservation target shortfall or achievement in a single metric and thus show a more differentiated picture of the state and progress in protected area coverage beyond reporting total protection level or amount of features that reach a target alone. To facilitate use of these metrics by researchers and conservation practitioners we have developed an R package to calculate and plot both metrics.

We use Australia's proposed Commonwealth Marine Reserve network as a case study to demonstrate the application of these metrics. Our case study showcases that the network would be praised by reporting total area protected alone, as it surpasses the 10% target of Aichi 11 four-fold with 43% of the marine area protected. However, the MPG and MTA metrics highlight shortfalls in the protection of several bioregions that would remain undetected if only the overall level of protection were considered. Additionally, MPG and MTA account for considerable, yet underperforming protection levels that are missed in other standard reporting measures, but contribute to overall biodiversity goals. We recommend these metrics be used to evaluate progress towards building representative protected area networks in line with Aichi target 11's goals.

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UNIVERSITY OF JYVÄSKYLÄ



## Protected areas enhance expanding populations and mitigate declines on range edges under climate change

(Oral and Poster)

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Warming climate is changing geographical distributions of species. However, keeping pace with the climate may be complicated. The climate is indeed changing faster than species are capable of following it. Other environmental changes can hamper the ability of species to move if they face difficulties following climatic preferences in a fragmented landscape. This may lead to increased extinction risk especially for species inhabiting high latitudes and altitudes. These species are expected to be particularly exposed to the consequences of climate change due to the lack of space into which they can retreat. Evidence is mounting that this may indeed be the case, since boreal and montane species in northern Europe have shifted their abundances faster than southern species, and exhibit decreasing populations. Protected areas are the cornerstones of our conservation strategies. Yet their role in mitigating climate change impacts has been debated since species distributions are dynamic while a network of protected areas remains static. There is however evidence that protected areas are important for conserving rare species and for the overall maintenance of biodiversity under climate change. Most findings concerning species distribution changes under climate change are based on occurrence data, despite recent evidence showing the increased reliability in generating outcomes for conservation prioritization when abundance data are used. Many studies have concentrated on modelling and predicting the future and therefore more attention is required on studying changes which have already happened for increasing empirical knowledge on climate change impacts on species, and for validating and improving projections of future impacts. To assess the effects of protected areas against climate change driven distribution shifts we compared changes in abundances inside and outside protected areas on the range edges of 100 Finnish land bird species on a time span of five decades. On the trailing range edge of northern species abundances declined less inside than outside protected areas and abundances were in general higher inside protected areas. In turn the abundances of southern species on their leading range edge increased more inside than outside protected areas for species with high reliance on protected areas. The results show that protected areas mitigate the retraction of northern species, although are not fully able to prevent it. Results also indicate that protected areas help southern species of conservation concern to expand their distribution farther North. Our results represent an encouraging message for biodiversity conservation. We show that PAs play an important role in mitigating impacts of climate change on biodiversity, providing strongholds for species persistence in the short term. Thereby PAs allow some time for wider protection efforts to start yielding positive effects but also time for counteracting the constitutive reasons of climate change.





## Thinking the ecological solidarity through trace metal and metalloid pollution transfer from terrestrial area to marine ecosystems in a protected territory: case study of the Calanques National Park

(Oral)

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The south coastal area of Marseille (France), included in the Calanques National Park since 2012, is characterized by a rare and remarkable biodiversity, although the terrestrial and marine ecosystems have been impacted by past industrial activities (1). Indeed, 8 industrial sites and 12 factories were in activity in the Calanques until the beginning of the 20th century. The subsequent contamination of the territory is not limited to brownfields and slag deposits, but covers a wide range of the area in the form of a diffuse pollution of soils and living organisms (2), and has impacted the entire coastal area by a significant contamination input in marine sediments. Nowadays metallic pollution is still transferring to the sea from contaminated soils and slag deposit materials due to unreclaimed brownfields and diffuse soil pollution in their vicinity. The terrestrial areas thus represent a challenge not only for the stabilization of soil pollution but also in terms of prevention of transfers to the marine environment. In this context, we propose to consider the concept of 'land-sea ecological solidarity' with the aim of improving the environmental quality of these two compartments by limiting pollutant transfer, and preserving or better, restoring their biodiversity.

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## An Evaluation of the Impact of Payments for Ecosystem Services using a Randomized Control Trial

(Oral)

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Payments for Ecosystem Services (PES) aim to incentivize land users to manage their land in ways which benefit society. However, as with many complex socio-ecological interventions, robust evaluation of PES is challenging and rare. Using a Randomized Control Trial (RCT) we evaluate whether a conservation program in the Bolivian Andes, which incentivizes landowners to avoid deforestation and exclude cattle from riparian forests, delivers improvements in microbial water quality (as measured by *Escherichia coli* contamination), and reduces deforestation. Baseline data was collected in 2010 in 129 communities which were then randomly allocated to a treatment or control group. The evaluation ran until 2016. Presence of cattle feces adversely affected microbial water quality, showing the effectiveness of excluding cattle, but the intervention itself did not have a demonstrable effect at the landscape scale. Using Global Forest Change data, we show that the intervention (especially at higher levels of uptake) does appear to reduce deforestation (once past deforestation and other geographical predictors are taken into account). Program effectiveness is fundamentally an empirical question so well-designed field studies are needed. We highlight some of the challenges encountered in using this pioneering RCT to robustly evaluate a large-scale conservation interventions but conclude that such randomized approaches have an important role to play in contributing to the evidence base available to decision-makers.

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## Tree monocultures in biodiversity hotspots: impact of pine plantations on the mammal assemblages of the Atlantic Forest and the Southern Cone Mesopotamian Savanna ecoregions of South America

(Oral)

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Large scale plantations of exotic trees (mostly Pinus and Eucalyptus) are replacing vast areas of native environments in South America, with still poorly known consequences on local communities. This is particularly worrisome in endangered ecoregions of high biodiversity that contain endemic and endangered species. This study was aimed at assessing the effects of pine plantations on the mammal assemblages of NE Argentina, in areas where plantations are rapidly increasing. We evaluated the effects of the native forest replacement by non-native pine (Pinus sp.) plantations on the composition of the assemblages of terrestrial mammals in two forest productive landscapes. In the first study area, of approximately 5,000 km<sup>2</sup> and located in the endangered Atlantic Forest of N Misiones province, we deployed 184 camera-trap stations in three different "treatments": 53 in continuous forest, 69 in forest fragments and 62 in tree plantations. In the second, of approximately 20,000 km<sup>2</sup> and located in the vulnerable Southern Cone Mesopotamian Savanna ecoregion of NE Corrientes province and S Misiones, we deployed 234 camera-trap stations: 35 in grasslands without cattle, 54 in grasslands with cattle, 35 in forests without cattle, 19 in forests with cattle, 54 in pine plantations without cattle and 37 in plantations with cattle. We used NMDS and PERMANOVA to assess the effect of the treatment, the structural complexity of the vegetation, the presence of cattle (in Corrientes) and several landscape variables (cost-distance to the continuous forest in Misiones, the percentage of different environments within different radiuses, and the cost of human access as a proxy for hunting pressure) on species composition. We recorded 34 species (4735 records) in Misiones and the same number of species (4460 records) in Corrientes. Mean recording rate (a proxy of relative abundance or activity) and richness were much lower in pine plantations than in natural environments in both landscapes (e.g., mean mammal richness per station in Misiones was (X±SD) 7.54±2.65 species in continuous forest, 5.97±2.46 in fragments and 3.39±1.90 in plantations). In both landscapes mammal composition was affected by treatment, the proportion of native environments in the landscape, and human access. In Misiones, the distance to the continuous forest also had a strong effect on the compositions of the assemblage. Different management practices (e.g. pruning and thinning), the presence-absence of cattle and landscape features can partially mitigate the negative effect of tree plantations on mammal assemblages. Large areas of native environments that function as population sources and forest fragments immersed in the matrix of plantations (in Misiones) are necessary to preserve the original native mammal assemblage at the landscape level. Promoting connectivity of the native environments and improving hunting controls will also mitigate negative impacts.



## Trade-offs and synergies between biodiversity and ecosystem services in restored, reforested, abandoned, and energy-producing peatlands

(Oral)

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There is a need to optimize the use of peatlands to simultaneously reach the biodiversity, environmental goals and the economic needs. Besides raw material timber and peat, peatlands provide a variety of valuable services, such as biodiversity, C sequestration and hydrological control. High pressure is targeted to these ecosystems by e.g. forest, bioenergy and peat industries. In Finland, a country with the highest percentage cover of peatlands in the world (30% of total land area, almost 10 mill. ha), about 60% of peatland area has been drained for forestry. This had led to the degradation of biodiversity, environmental loading to watercourses, and emission of greenhouse gases (GHG). We used empirical country-wide spatial data 1) to estimate and predict the impact of seven peatland uses on the biodiversity, GHG balances and environmental loading to watercourses, and 2) to numerically optimize cost efficient land uses so that benefits from biodiversity and ecosystem services are safeguarded. We show that there is no simple answer to the optimization of peatland uses due to the numerous trade-offs between biodiversity, ecosystem services and monetary value. The outcome depends on the level of environmental constraints, set monetary targets and the time frame of evaluation. Selection between multitude of options requires continuous contact between research, administration, planning, and other relevant stakeholders. We will demonstrate a multicriteria decision support tool that visualises the trade-offs and was piloted in a real planning case concerning peatland use.

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## Crops in a Changing World: Hidden Forest-Agriculture Teleconnections

(Oral)

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Advances in climate change modeling have uncovered eco-climate teleconnections where changes in weather or the environment in one location affect distant regions. Recent studies demonstrate that loss of forest cover in one region (sending regions or locations) can alter temperature, precipitation and gross primary production (GPP) in far regions (receiving regions or locations). Here we show how these eco-climate teleconnections in turn, bring changes to agricultural yields and revenue in distant locations. In effect, forests provide telecoupled ecosystem services that sustain food production in receiving locations. However, these telecouplings are seldom acknowledged and remain unquantified. Thus, there is a critical need for research to quantify how forest loss in one location may further impact agricultural production in other areas. We conducted Community Earth System Model (CESM) model experiments in which we simulate forest die-off in different NEON regions in the United States. We modeled multiple scenarios of forest loss in sending regions to project a range of hypothesized climate impacts in receiving agricultural regions. Furthermore, we quantified the teleconnection by transforming changes of climate into changes in agricultural production and monetarizing the change of agricultural production in different NEON regions. Through a network analysis, we were able to differentiate NEON regions that have a predominantly role of sending (e.g., Pacific Southwest) from those that were primarily receiving telecoupled ecosystem services (e.g., Southeast). Our study contributes to the growing body of literature documenting telecoupled systems and provides novel information that will aid policy makers in the US to acknowledge linkages between forest conservation and agricultural production, and develop management strategies accordingly.

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## Protected area effectiveness and management indicators do not correlate: what are we doing wrong?

(Oral)

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Protected areas are one of the key tools for conserving biodiversity and recent studies have highlighted the impact they can have in avoiding habitat conversion, finding that protected areas in general are effective, yet that this varies with governance regimes (Schleicher et al. 2017) and over time (Eklund et al. 2016). However, the relationship to management actions on the ground is far less studied (Coad et al. 2015) and we currently do not know which management actions are crucial for success. To investigate this in a challenging socio-ecological environment, we studied the effectiveness of the protected area network of Madagascar; a country with high deforestation rates and an unstable political environment. We computed the effectiveness of individual protected areas in avoiding deforestation, accounting for confounding factors (elevation, slope, distance to urban centers and infrastructure, and distance to forest edge). We then investigated whether Protected Area Management Effectiveness (PAME) scores, and their different facets, explained the variation observed. We found that the majority of the analyzed protected areas in Madagascar do reduce deforestation, but the levels of deforestation they manage to avoid are small. Protected areas with higher management scores did not perform better in terms of avoiding deforestation. Yet, instead of suggesting that management is ineffective or that PAME is not a good indicator of management effectiveness, we present a novel framework that uses a combination of deforestation measures and can clarify why no correlations have been found, in this study and elsewhere.

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Eklund, J. et al. 2016. Contrasting spatial and temporal trends of protected area effectiveness in mitigating deforestation in Madagascar. *Biological Conservation* 203: 290-297.


Schleicher, J. et al. 2017. Conservation performance of different conservation governance regimes in the Peruvian Amazon. *Scientific Reports* 7: 11318.



## What are the most popular animals in the world? Using Wikipedia to quantitatively compare interest across 60,000 vertebrates

(Oral)

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Species vary widely in their popularity, and these variations in human interest impact conservation. The popularity of a species, for example, may influence the conservation funding that species receives and affect the long-term success of its protection efforts. As a result, understanding what drives interest in species and how it varies across cultural contexts is relevant to conservation. Here we use a ‘big data’ approach to quantitatively compare interest in ca. 60,000 vertebrate species across nearly 300 language editions of Wikipedia—a large, online encyclopedia. We assess how the popularity of a species in Wikipedia, measured in terms of its pageviews, correlates with biological attributes including distribution, body size, diet, and IUCN threat status. We find that overall interest is highly skewed with a small number of species receiving a large proportion of all pageviews. The strongest correlate with high pageviews is body size, with larger species tending to receive more views, though there are important exceptions. IUCN status also corresponds with increased popularity, with more endangered species receiving more views, demonstrating that conservation Red Listing can be effective at increasing popular attention. While a subset of species are consistently popular across language editions there are significant differences in the most popular species between languages. Overlaps, or lack thereof, in the distribution of a species and language explains much of this variation with species that are ‘local’ tending to be more popular within a given language. We argue that Wikipedia provides a useful tool for systematically comparing interest in species at large scales and propose that this approach can be applied to multiple other questions in conservation research.

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## The role of Management Effectiveness assessments in understanding the performance of protected areas

(Oral)

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Setting aside land for the protection of nature is a key global strategy for halting the current loss of biodiversity. However, the extent to which PAs are safeguarding biodiversity is debated, and there is an increasing understanding that setting aside land for protection is not enough to safeguard biodiversity. Importantly, we also need to understand if and how existing protected areas are maintaining biodiversity and reducing threats as well as understand what management systems, and interventions make protected areas most effective. Protected Area Management Effectiveness (PAME) tools is one of the most widely used methods for assessing the adequacy of management actions and resources and have been applied across thousands of protected areas globally, championed by organizations like the Global Environmental Facility and WWF. This talk will present results using PAME tools to evaluate the performance of protected areas in maintaining species populations and reducing human threats and discuss the strength and weaknesses of simple, quick, and easy-to-apply management assessment tools for assessing the impact of conservation interventions.

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2018/06/14


10:30


Room: K305 Alvar



## How and why biodiversity offsetting became a policy of international relevance? An Investigation of offset policies in France and Australia

(Oral)

Florence Damiens<sup>1</sup>, Libby Porter<sup>1</sup>, Sarah Bekessy<sup>1</sup>, Ascelin Gordon<sup>1</sup>

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Abstract of this presentation is not public



## Introduction to the concept of ecological solidarity and its challenges

(Oral)

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This long introduction will be done by two speakers (Maylis Desrousseau and Alexandra Langlais). The ecological solidarity is an environmental concept coming from both the ecological sciences and the human sciences. Its definition is recent, however, it is inspired of the concept and juridical principle “solidarity” in France. The latter benefit of a large audience among research, public policies and civil societies. Thus, by drawing a strong link between the environment and humans, the ecological solidarity appears as a lever to achieve the Planetary well-being.

In the view of the planetary well-being, we will explore three dimensions of the concept of ecological solidarity: The first one will question our representation of the world and we will demonstrate that ecological solidarity is between an ecocentric and an anthropocentric worldview. However, its implementation in public policies would probably be a progress compare to the concept of “sustainable development”: as it ties people together and to their environment, it raises the issue of equal access to natural resources.

The second dimension of the concept that will be exposed in the symposium is its spatial and geographical scale: ecological solidarity is not obvious at first sight, especially for issues such as the degradation of soils, and it needs to be clearly defined. In this context, the solidarity marine and terrestrial areas will be exposed as an example. Moreover, are all the humans tied up by an ecological solidarity or is it more likely to define regions and/or categories of population regarding their dependencies to their environment.

The third dimension of the concept that needs to be discussed is its formulation. Literally, it demands further research on how it can be implemented and at what spatial scale: what legal translation would be the most efficient and relevant between international conventions and local regulations? How could it be accorded with other principles such as National sovereignty and Private property for example?

In this symposium, we expect to discuss these different possibilities, by involving scientist with different backgrounds, from social and environmental sciences.

Key references: John D. Thompson, Raphaël Mathevet, Olivia Delanoe, Chantal Gil-Fourrier, Marie Bonnin, Marc Cheylan, Ecological solidarity as a conceptual tool for rethinking ecological and social interdependence in conservation policy for protected areas and their surrounding landscape, *C. R. Biologies* 334 (2011) 412–419



## Multi-criteria Decision Analysis on Peatland Ecosystem Services

(Oral)

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Given the limitations of monetary valuation of ecosystem services, there is a growing interest in mixed or multiple criteria assessment methods such as participatory Multi-Criteria Decision Analysis (MCDA), which has variably been seen as an alternative or complementary approach to monetary valuation of ecosystem services (Kenter et al. 2015). According to Vatn (2009), MCDA is particularly suited for integrated valuation of ecosystem services because it can combine information about the performance of the alternatives with respect to evaluation criteria with subjective judgments about the relative importance of the criteria in a particular decision-making context.

In this paper we look at the potential of MCDA to capture multiple dimensions of value provided by peatland ecosystems in Finland. Peatlands offer various, and mutually exclusive, ecosystem services: Peat is a domestic source of energy but its extraction destroys peatland ecosystems and their capacity to provide services such as water purification and carbon sequestration. A participatory MCDA process using interactive decision analysis interviews (Marttunen and Hämäläinen 2008) was organised with ten key stakeholder representatives in 2016-17 to evaluate the capacity of alternative peatland scenarios to produce ecosystem services, and to determine the relative importance of the services in this context.

The results were presented in a disaggregating fashion, illustrating the different perspectives to the debate. Important part of the analysis was also reporting the arguments and value statements behind the criteria weights. Somewhat surprisingly, all stakeholders gave relatively little value to cultural ecosystem services. The most important conflicts were between provisioning services (peat) and regulating services (carbon sequestration and biodiversity). It also turned out that the ecosystem services framework did not capture all aspects of the debate, including employment and land ownership rights. To conclude, the MCDA process was well-suited for a joint problem structuring and fact finding with the key stakeholders but unlike a parallel citizens' jury process, it did not facilitate learning and reflection among the stakeholder representatives. The most important output of the process was that it required the participants to make explicit value judgments and hence facilitated transparent policy dialogue on the future of peat extraction in Finland.

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2. Vatn, A. 2009. An institutional analysis of methods for environmental appraisal. *Ecological Economics*, 68, 2207–2215.
3. Marttunen, M. & Hämäläinen, R.P. 1995. Decision analysis interviews in environmental impact assessment. *European Journal of Operational Research* 87: 551-563




UNIVERSITY OF JYVÄSKYLÄ



## Maximising ecosystem service delivery in modern forestry

(Oral)

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Around a third of global forest cover is managed for timber production (1), yet modern forestry faces a plethora of challenges. Climate change, disease and increasing recreational pressures are among the threats and issues requiring radical changes in the management of many commercial forests. To ensure a viable future for these forests, it is essential to balance the economic needs of forestry with the maintenance of resilient and functioning ecosystems. Additionally, when managed carefully, woodland and forest environments have the potential to deliver a great variety of other ecosystem services, such as non-timber forest products, water regulation, soil quality, recreation and heritage, alongside nature conservation and the maintenance of biodiversity (2). Decision makers need information on how land management affects different ecosystem services, in order to implement evidence-based management that maximises efficient delivery of ecosystem services in addition to biodiversity benefits.

Different forest management options invariably lead to trade-offs between different ecosystem services. For example, a spruce monoculture may deliver high timber production but low recreational benefit, whereas a mixed broadleaf forest may yield less timber but support high levels of biodiversity. This talk presents results from a UK case study of a production forest (Thetford Forest, East Anglia), working in close collaboration with forest managers and stakeholders to identify the range of viable future management scenarios, including management options targeted for conservation benefits. The delivery of a comprehensive suite of ecosystem services has been quantified for these management options to give a detailed analysis of trade-offs and synergies. The talk discusses the implications of this analysis in guiding future forest management, presenting an assessment of how trade-offs can be reconciled to maximise the delivery of ecosystem services and to inform evidence-based decision-making.

(1) FAO (2016) How are the world's forests changing? Global Forest Resources Assessment 2015. Second Edition.

(2) Quine, C., et al. (2011) Woodlands. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, UNEP-WCMC, Cambridge.

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## Functional plasticity of ground beetles can presume the changes in their community composition by forestry treatments

(Oral)

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Although the functional trait approach can facilitate the understanding of mechanisms that underline both community responses to habitat alternation and ecosystem functioning, only few studies are available exploring the effects of forest management comparing the response of taxonomic approach focusing on the composition, diversity and the response of the functional traits (morphological, phenological and behavioral). We studied the short-term effects (2014-2016) of forestry treatments including preparation cutting, clear-cutting, retention tree group and gap-cutting in a temperate managed forest on the selected community structure descriptors and functional traits responses of ground beetles.

Based on the community descriptors, only the species composition was slightly influenced by treatments; control, retention tree group and preparation cutting formed relatively homogeneous groups separated from each other, while other treatments scattered randomly in an ordination biplot. The species richness decreased in clear-cutting and gap-cutting between years, while the retention tree group was the most influential treatment type with the significantly highest number of species between treatments. Although there was an overall decline in the abundance of ground beetles between years, the treatment effect was not revealed. Based on the functional trait analysis, we proved that the increase of the species richness in the retention tree can be explained by the dominance of small-sized winged ground beetles. Analyses of habitat affinity types well characterized the variation in the species pool of the carabid assemblages in the different treatments, suggesting the dominance of forest species in control plots, while the high association of open-habitat species with the retention tree group. Individual species response analysis revealed that the *Abax ater* was associated with the control plots, while the *Carabus scheidleri* was associated with the clear-cutting and gap-cutting. The rapid mark-recapture survey of *C. scheidleri* proved that the individuals still remained in the plot where they were marked first, but they could take some high distances occasionally which were sex and time independent. Our results showed that ignoring functional features of carabids assemblages can mask or partly explain the changes in the assemblages by various forestry treatments; however the inclusion of functional -including behavioral- aspects might bring direct evidence for conservation actions in managed forests.

The study was supported by Hungarian Research Found (OTKA 111887) and by the National by the National Research Development and Innovation Office (GINOP-2.3.2-15-2016-00019), website of the Pilis Experiment project is <http://piliskiserlet.okologia.mta.hu/en>. Innovation Office (GINOP-2.3.2-15-2016-00019).



## Species in the Virtual World: Culturomics meets Biogeography

(Oral)

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Since the evolution of consciousness, animals and plants have been core components of mental models that humans use to make sense of the world. The species that populate these models inevitably include those that have become familiar through the direct interactions of individuals with the natural world. While modern urban living has severed much of our once intimate connection with non-human species, opportunities for surrogate interactions (in written or visual media) with nature have expanded beyond the imagination of our recent ancestors. Humans thus appear to be increasingly disengaging with wild nature, while simultaneously expanding the representation and documentation of the natural world into the virtual world of the internet. Nevertheless, digital representation of species is not random: it broadly reflects the interests, cultural history and intrinsic preferences of the individuals responsible for the generation of media content. In turn, this biased representation of species will influence the degree to which individuals become familiar with certain species (e.g. elephants or elephant shrews), driving the generation of further content and interactions in a positive feedback process. Beyond these simple generalities our understanding of what drives the differential representation of biological species in global culture is, at best, rudimentary. However, this may be about to change as culturomic methods provide scientists with an increasingly sophisticated and nuanced profile of cultural visibility and public interest in species at scales from national to global. In this presentation I outline the conceptual basis and current state of knowledge about the distribution and abundance (biogeography) of representations of biological species on the internet and discuss the potential applications of this exciting new area of research (1).

1. Ladle, R. J. et al. Conservation culturomics. *Frontiers in Ecology and the Environment* 14, 269-275

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## High-resolution mapping of the trade in tropical commodities: a tool to estimate impacts of corporate zero deforestation commitments

(Oral)

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Conservation threats in tropical landscapes are increasingly related to telecouplings, i.e. linkages between distant places such as those embodied in trade flows. Developing solutions to address these threats require novel approaches for measuring and understanding these telecouplings. In this presentation, I outline methods and results from the Trase initiative (<http://trase.earth/>), a flagship effort to map international supply chains of deforestation-risk tropical commodities. I explain the diversity of datasets required to piece together international trade flows, link actors (e.g. individual companies) to the places where they operate, and estimate the impacts of that trade, including on biodiversity. Using examples from the Latin American soybean sector, I first explain how Trase can shed light on the efficacy of Zero Deforestation Commitments (“ZDCs”, i.e. commitments made by companies or countries to ensure that deforestation does not occur in their supply chains). I discuss variability in the strength of ZDCs, quantify the growth in their market share, reveal the variability in their geographic coverage, and present some of the first analyses of their net effects, ultimately outlining the potential for meeting their stated goal of ending commodity-associated deforestation by 2020.

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## Assessing ecosystem service co-benefits and trade-offs across alternative land management practices in semi-arid rangelands: a Multi-Criteria Decision Analysis

(Oral)

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Land degradation undermines ecosystem service provision, limiting economic returns from semi-arid rangelands. We apply a Multi-Criteria Decision Analysis (MCDA) to assess the value of ecosystem services, using monetary and non-monetary techniques in semi-arid rangelands in Kgalagadi District, southern Botswana. In doing so, we provide an empirical understanding of the linkages between policy, land use and the provision of ecosystem services based on the perspectives of local stakeholders identified through interviews and a workshop consultation. Findings suggest communal grazing provides the widest range of monetary and non-monetary values linked to ecosystem service delivery.

Current economic incentives and policy initiatives supporting the livestock sector, linked to fencing and borehole drilling, create perverse incentives that over-emphasise commercial food production at the expense of other services. We identify a need for policy reforms to support livelihood diversification through the provision of a wider range of ecosystem services, and for further research to explore market opportunities for veld products and carbon trading. We show that MCDA offers a useful holistic assessment framework that could be applied more widely to semi-arid rangelands globally.

### References:

Favretto N, Stringer LC, Dougill AJ, Dallimer M, Perkins JS, Reed MS, Athlpheng JR, Mulale K. 2016. Multi-Criteria Decision Analysis to identify dryland ecosystem service trade-offs under different rangeland land uses. *Ecosystem Services* 17: 142-151. doi: 10.1016/j.ecoser.2015.12.005



## Ecological solidarity as an avatar of Animist spirituality

(Oral)

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Animism is a worldview of Siberian origin that diffused out in the Americas thousands of years ago. Shamanism is its main spiritual expression, but it is also perceptible in hunting and gathering practices. It relies on the idea that human and other living beings are societies related to each other, among which cooperation, reciprocity, but also wars and retaliations (e.g. because of overkilling) can happen. Animist peoples understand the world not as a hierarchy, but as constituted by different beings, and the shaman plays the role of an intermediary between these entities, thanks to his power of transformation and mental trips among the underworld of master-spirits. Thus, animist societies are generally recognizable because they do not, or only slightly, transform their environment. Unlike many other human societies and cultures, the search for balance, sobriety, and reciprocity are the condition for ensuring the survival of the Earth – the reason why biodiversity hotspots coincide with surviving animist societies. Our presentation will present these premises and explain how animist societies can inspire and help shaping the ecological solidarity concept, by considering the world as a network including human and natural beings (or better, “entities”). Indeed, solidarity, through reciprocity and sharing of food or space, is the cement that holds human and animal societies together.

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## Uncovering Illegal Wildlife Trade on Social Media: Automatic Data Collection, Deep Learning Filters and Identification

(Oral)

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Illegal wildlife trade is one of the biggest threats to biodiversity conservation, as many species, including iconic species such as rhinoceros and elephant taxa, are targeted for their meat, trophies and other body parts. Over the last years, the scale and nature of illegal wildlife trade has changed dramatically. The Internet is becoming a major market for wildlife products, as it provides cost-effective solutions, vast outreach and anonymity for illegal wildlife traders. A 2014 study by the International Fund for Animal Welfare found 33 000 items for sale on 280 online marketplaces. More recent findings suggest that the illegal market for wildlife has moved to social media and, to a lesser extent, to the dark web.

So far, the use of social media data in conservation science has been limited [1]. There are survey efforts ongoing to determine the quantity, origins and destinations of illegal wildlife trade on social media, which are carried out in a manual, labour-intensive fashion.

Machine-learning, and especially deep learning, has seen a surge in interest over the last decade. The amount of data produced by social media increased manifold and the involved stakeholders gained in interest in analysing the collected data on users, their actions, behaviour and networks. Deep learning describes a machine-learning approach in which input data from training sets is abstracted into a network tree of numerous abstract levels. It performs reasonably efficient on modern graphics processors and is able to process unstructured data. The use of deep learning in conservation science is still limited, but recently it has been applied for identifying wild animals in camera-trap images [2].

In a recent contribution [3] we demonstrated the usefulness of a deep learning approach in the search for illegal wildlife trade on social media.

Here, we propose a framework using deep learning to filter and identify data pertaining illegal wildlife trade from social media platforms. We show how such an approach can be used to identify species and wildlife products – e.g. rhino horn and elephant ivory –, their origins, destinations, routes, and involved actors more efficiently from social media data.

The proposed presentation is a methodological contribution. It will discuss, in a hands-on manner, the necessary steps to i) collect data from social media, ii) train a neural network, and iii) detect content which is relevant in the context of illegal wildlife trade.

[1] Di Minin, E., Tenkanen, H. & Toivonen, T. (2015). Prospects and challenges for social media data in conservation science. *Frontiers in Environmental Science*.

[2] Norouzzadeh, M.S., Nguyen, A., Kosmala, M., Swanson, A., Packer, C. & Clune, J. (forthcoming). Automatically identifying wild animals in camera-trap images with deep learning.

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## Increasing influence of the surrounding landscape on saproxylic beetle communities over 10 years succession in dead wood

(Oral)

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In a previous study of saproxylic beetle fauna on fresh artificially created high stumps of spruce and birch on 20 clear-cuts (whereof 10 in hotspots) we found only weak relations between beetle fauna and forest-landscape variables associated with hotspots for biodiversity. The stumps were distributed over a large part of south Sweden in an area covering 200 km from East to West and 50 km North to South. The result gave weak support for the strategy of concentrating measures to mitigate the decrease of dead-wood dependent insects to hotspots. We hypothesised that the relationships would be stronger when the wood was in a later successional stage, as habitat predictability increases with a longer turn-over time of beetle assemblages. In this study we therefore resampled the saproxylic beetle fauna on the same high stumps after ten years, and analysed the results together with the data from the previous study. This generated 51,390 saproxylic beetle specimens, belonging to 445 species. By analysing the species numbers and species composition with variance partitioning we found that the first years after the high stumps were created, the beetle fauna was mainly explained by regional factors (longitude and latitude) which explained species composition to 21%, 4% and 25% for all saproxylic, birch associated and spruce associated beetles respectively. At this time, forest-landscape variables describing the surrounding forest in buffers up to 5 km radius explained almost nothing. After ten years the pattern was the opposite, with surrounding forest variables explaining up to 27% of the variation, and longitude/latitude almost nothing. Our results suggest that hotspots exist also for species associated with trivial wood types and that successional stage of the dead wood might help explain at which scale saproxylic species respond. The result also suggests that species later in the succession are more indicative of where hotspots are situated than species early in the succession.

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## Public awareness of extinction threats in European threatened species

(Oral)

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The level of societal awareness of and interest in major threats facing endangered species is a critical determining factor for public support for conservation initiatives and programs, which might in turn impact conservation funding, effectiveness, and policy. Based on a quantitative analysis of internet webpages, we assessed the internet salience of climate change and invasive species as key threats to threatened amphibian, reptile, bird and mammal species in France, Germany and United Kingdom. The analysis indicated a higher prominence of climate change, as well as a higher prominence of the two threats in native species than in species that are inhabiting other countries and regions. The two threats received better recognition in threatened than in non-threatened species, while the patterns also differed among the four species groups and the three countries. Internet salience generally matched the established susceptibility of species to the two threats, as identified by species experts within the IUCN Red List. We discuss major implications of the results and policy recommendations.

2018/06/14

10:15

Room: K307 Elsi



## Framing biodiversity conservation: an ecological solidarity perspective

(Oral)

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Abstract of this presentation is not public

2018/06/14

10:30

Room: A3 Wolmar



## Decentralized forest management simultaneously reduces deforestation and poverty

(Oral)

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Abstract of this presentation is not public





## Exploring the resilience of telecoupled social-ecological systems with agent-based models

(Oral)

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Local land-use transitions, e.g. from a diverse to a specialized system, are increasingly dependent on distant drivers. Therefore, the resilience of social-ecological systems (SEs), i.e. their capacity to absorb ongoing change and maintain ecosystem service provision, needs to be evaluated in the light of socioeconomic and environmental interactions across space - so-called telecouplings. In contrast to traditional approaches, Agent-based models (ABMs) can capture dynamic responses to distant drivers across different levels of organization and scales, which offers important insights into resilience. In this study, we reviewed the potentials and needs to investigate the resilience of telecoupled SEs with ABMs. Moreover, we developed a generic model to assess (i) when agricultural systems respond to distant drivers and sending systems emerge, (ii) when this leads to resource use specialization, and (iii) how this subsequently affects system resilience. ABMs have a great potential to deal with the multidimensionality of resilience and complex systems through extensive manipulation in a fully controlled system. To successfully investigate telecoupled systems, models need to systematically consider the relevant dynamics, feedbacks and flows between and within the coupled systems. Multiple patterns observed in real systems at different spatial and temporal scales, and levels of organization will allow us to design, parameterize, and validate such ABMs. Our initial model indicates that while distant demand for agricultural products typically favors profit maximizing agents, cooperation, green subsidies and alternative investments can support smallholders and maintain higher land-use diversity. ABMs provide a way forward in exploring the consequences of telecoupling on the resilience of SEs. Unveiling the importance of different factors in facilitating local responses to distant drivers can help to identify real-world landscapes where future telecouplings may emerge.

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## Evaluating behaviour change interventions delivered through mass media

(Oral)

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Conservationists are increasingly aware of the importance of behavior change interventions to tackle threats to biodiversity. One of the most common strategies for the dissemination of demand reduction messages is the use of mass media (e.g., radio or television). The mass media are highly appealing as they can reach thousands or even millions of people simultaneously. However, there are important barriers to the effective evaluation of these behavior change interventions. One of them is self-selection bias, which stems from the fact that people actively choose to be either part of the control or treatment groups. This bias means that comparing listeners to non-listeners, as is commonly done, is likely to yield biased estimates of impact, as those that actively choose to listen to programs containing wildlife related messages are more likely to have an interest in wildlife and its conservation. We investigate this issue through the case study of an intervention to reduce demand for bushmeat in five communities, in northern Tanzania. The intervention was centered around 25 episodes of a radio drama, part of a one-hour radio show. Each episode of the serial radio drama was accompanied by a 45-minute interactive call-in show, which featured interviews with experts, local information about community resources, and provided the audience with a platform to reflect on the drama, share opinions and ask questions. We evaluated this intervention using a Before-After-Control-Impact framework based on longitudinal data from 168 respondents. To account for potential selection bias we used a matching algorithm together with ordinal regression to build a credible control for our listener group. This was done by matching respondents on their knowledge and attitudes towards bushmeat, their community of origin and baselines values for all outcomes of interest. Our analysis did not uncover any statistically significant differences between the treatment and control groups, suggesting that the intervention was not effective. Yet, given the proximity of some of the outcomes variables to statistically significant effect sizes and the lack of statistical power arising from a small sample size, we also undertook falsification tests, which test for changes in variables that would not be expected to change as a result of the intervention under consideration (e.g., variables related to ecotourism). We found that there were indeed several statistically significant changes. This indicated that other factors may have driven behavioral changes in the target audiences and thus that it was likely that those outcomes variables approaching statistically significant values were spurious results and not the result of lack of statistical power. Only through more robust evaluation of behavior change interventions and the sharing of lessons learned can conservationists successfully tackle complex issues such as the demand for bushmeat.



## Evaluating environmental and social impacts of protected areas in South America

(Oral)

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In light of the persisting conservation pressures despite considerable conservation efforts, there have been increasing calls for rigorous approaches to evaluate conservation impacts to ensure that conservation efforts have their intended impacts. While government-controlled protected areas (PAs) have been the main conservation strategy globally, relatively little is still known about the performance of PAs under different governance regimes and the factors influencing their impacts. We therefore reviewed the recent literature concerning the social and environmental impacts of different PAs across South America and the methods used to evaluate them. In addition, we evaluated the performance of PAs under different governance regimes in reducing the pressure of deforestation and forest degradation in the Peruvian Amazon. We integrated data derived from remote sensing, GIS datasets, and interviews to better understand: (1) whether government-controlled PAs, Indigenous Territories and Conservation Concessions (CCs) helped to reduce deforestation and forest degradation between 2006-2011 in the Peruvian Amazon, using a counterfactual approach; and (2) the factors influencing the impacts of government PAs and CCs. CCs are a novel conservation tool promoted in various countries, including Peru. They comprise public land given to non-state actors for conservation purposes. The study highlights that compared to matched unprotected land, PAs under different governance regimes reduced the likelihood of deforestation and forest degradation between 2006 and 2011. While Indigenous Territories and CCs were more effective in this respect than government-controlled PAs, several institutional, social and political challenges have constrained the conservation impacts of CCs. This corroborates findings found in other South American countries. The study further highlights some of the key advantages and limitations of using counterfactual matching approaches to assess the social and environmental impacts of conservation interventions.

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## Ecological solidarity and Marine spatial planning: a creative link to make?

(Oral)

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Marine environments are subject to growing pressures such as traffic, increasing demand changing land-use of coastal areas, seabed exploitation, dredging or mining, fishing, tourism, and development of renewable energies, etc.

Marine spatial planning (MSP) is now considered as a way to sustainably manage human activities at sea by conciliating human uses and nature conservation. MSP was developed in the 2000s under the influence of scientists, especially that of Ehler and Douvère - defining it as “a practical way to create and establish a more rational use of marine space and the interactions among its uses to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way” (Ehler & Douvère, 2009). European law (Directive 2014/89/EU of 23 July 2014 establishing a framework for maritime spatial planning) gives a binding legal definition. Various approaches of MSP cover the span from mapping to strategy making. Depending on how MSP is designed, it could represent a sound opportunity for developing and emerging countries to fully benefit from their marine resources; alternatively, it could turn out to be a tool reinforcing ocean grabbing by foreign interests. The importance attached to the underlying objective of nature conservation could also vary depending on the building of this political process.

Ecological solidarity has been mainly studied in terrestrial fields. Addressing ecological solidarity in marine environments implies a differentiated analysis as, for example, traditional legal concepts (i.e. individual property) are no longer relevant. Role of solidarity in maritime sector could be linked with the complexity of ecological solidarity. Contrary to terrestrial legal solidarity, directly ensued from formal texts and thus not presumable, maritime solidarity is presumed and based on a broader and more compassing common ground: that of ocean hazards. This conception of maritime solidarity permeates henceforth in diverse regulations to answer ecological, economic and human issues.

This communication will illustrate how ecological solidarity can offer an interesting viewpoint to re-think MSP in order to increase both common uses of marine spaces and planetary wellbeing.



## Almost one century of forest inventory data: how bright are the prospects for the Finnish forest biodiversity?

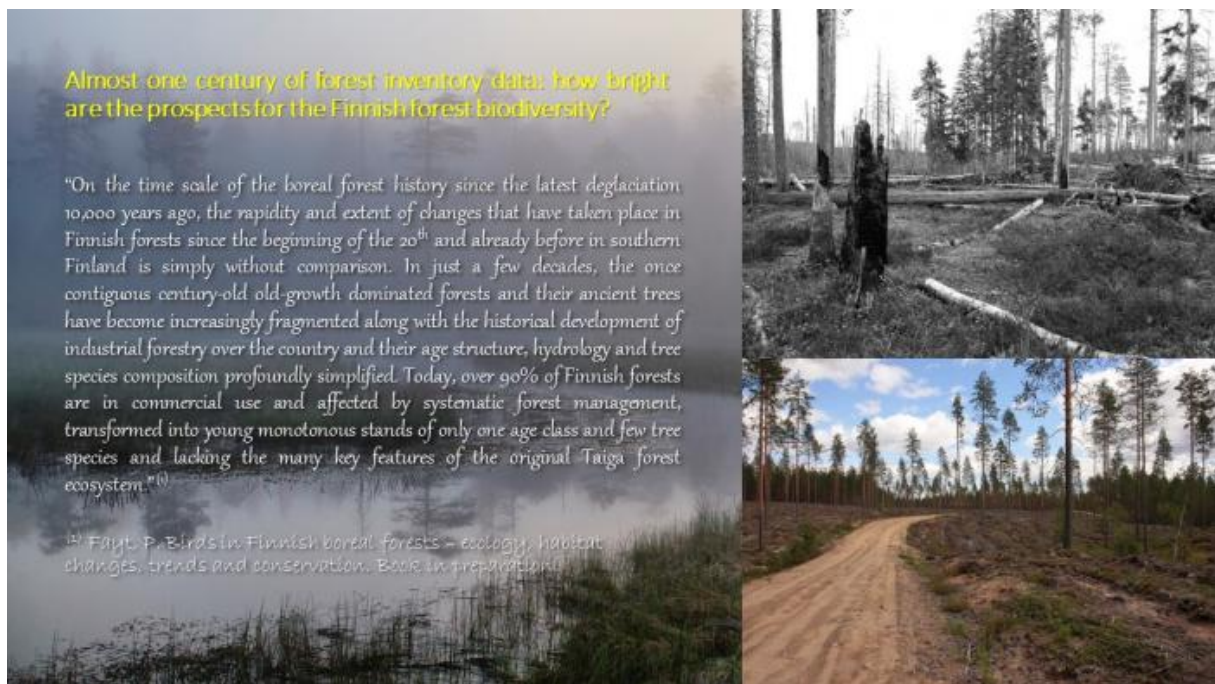
(Oral)

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With 73% forest cover and 26.2 million ha of forestry land, Finland is the most forested country in Europe, hence contributing significantly to its forest biodiversity. The forestry land is classified into forest land (20.3 mill. ha), poorly productive forest land (2.5 mill. ha) and unproductive land (3.2 mill. ha), depending on the potential annual increment. The majority of nature conservation areas (3/4 of the land) are located on the poorly productive and unproductive forest land, making them susceptible to fragmentation and isolation as a result of forestry-driven habitat changes on the dominant productive forest land. Here I present a detailed historical overview of ecological changes that took place in the Finnish forests within 1924–2013 and discuss their implications for biodiversity conservation.

Despite the 13% reduction in forest area in the 1940s due to the territory loss in World War II, Finland's tree growing stock has never been so high. Yet, the tree species composition, age structure and soil hydrology of the forest, three key drivers of the boreal forest biodiversity, have radically changed in just a few decades, with marked differences between the north and the south.

On the productive forest land, pine trees have become increasingly dominant at the expense of spruce forests, raising concerns for the spruce-associated biota. In Northern Finland especially, right after the war, the pine forest cover has steadily increased from 55 to 75% while the spruce cover declined from 31 to 16%. Similar changes took place in the south from the 1960s. An abrupt decline in the amount of deciduous forests is another nationwide post-war phenomenon, causing its original cover to drop from 17 to 8% by 1984. It is only recently that deciduous forests have increased again in proportion, accounting now for 11.5% of the southern forest land, although being of limited ecological value due to their younger age.

In addition to tree species composition, the simultaneous large-scale implementation of both clear-cutting and forest ditching practices that mainly took place from early 60s to late 90s, with a peak in the 70s, have caused fundamental changes in the original age structure and productivity of the forest. Today, in Northern Finland where they are mostly situated, species-rich natural forests over 120, 140 and 160 yr old only represent 17, 14 and 10% of the regional forest land. This is a pale figure compared to their 55, 45 and 36% respective coverage in the early 1920s. Based on linear regressions, the continuously declining primeval forests, despite their prime importance for the boreal biodiversity, are expected to largely vanish from the Finnish productive forest land by the beginning of the next century unless adapted new conservation measures are taken. It took at least 40 years for natural forest mires to be converted into dry production forests, demonstrating long-lasting effects of drainage on the northern ecosystem.

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## Management and harvesting constraints influence the attainment of wildlife population targets

(Oral)

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An increasing number of wildlife populations are the target of intensive management schemes aimed at preventing their extinction or over-abundance, both of which are detrimental to human well-being [1]. These schemes typically involve a manager, whose role is to regulate the activity of those having a direct impact on the wildlife population through legal – and sometimes illegal – harvesting activities, i.e. harvesters. Both manager and harvesters face constraints on their ability to regulate and harvest, respectively, yet how these constraints interact to affect management effectiveness is very rarely considered [2]. Using a novel generalised management strategy evaluation framework [3], we explore the manager-user constraint relationship and its impact on management success for a range of simulated and real-world examples. We show that the potential for variation in both the ability of a manager to regulate harvester behaviour and the ability of individual harvesters to affect a wildlife population shapes a landscape of management effectiveness. We further reveal that only a subset of this landscape corresponds to the successful attainment of a given management target, and that its extent may vary depending on the species in question, the stated management target (i.e. population recovery, stabilization or eradication), and the existence of time lags between monitoring and management policy change. Our work highlights the importance of accounting for manager and user constraints when setting targets for and implementing wildlife management schemes.

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## Rethinking standard biodiversity offset calculations: Combining standard offset metrics with more ecologically relevant measures to improve biodiversity persistence

(Oral)

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Biodiversity offsetting has been increasingly used around the world to compensate for the rising environmental impacts caused by development[1]. There is considerable scepticism about the effectiveness of offsets to achieve ‘no net loss’, particularly due to the lack of consistent metrics for measuring biodiversity losses and gains[1]. Current habitat based metrics often fail to capture biodiversity values at development sites [2], resulting in offsets which rarely compensate effectively for what is lost. Here we aim to understand how commonly used offset metrics differ from the larger pool of biodiversity metrics in science, and to identify options for improvement.

We reviewed 259 publications within the fields of offsetting, conservation planning and ecology. The offsetting literature was, as predicted, dominated by habitat and area based metrics. However, within the offset research, those focused on the outcomes of offsets tended to employ more explicit metrics of population ecology and biodiversity. These metrics were also prevalent in the conservation planning and ecology literature. The discrepancy between the metrics used to calculate and assess offsets reveals a clear mismatch in the way biodiversity is represented in current offset practices and in conservation/ecology research[3]. This raises the question of whether simple area and habitat based metrics can truly capture aspects relevant to preventing biodiversity loss. Our literature review highlighted several relatively simple metrics, such as estimated abundance and diversity, that could potentially be incorporated into offset calculations to improve their ecological relevance.

We conclude that the performance of offset metrics should be more systematically tested, as accurately measuring losses and gains is essential to maximising biodiversity persistence and facilitating progress toward sustainable development practices.

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## The twelve operationally important decisions in offsetting: why biodiversity offsets may fail

(Oral)

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Every development project, whether it is about construction of factories, mines, harbors, roads, railways, sports fields, skiing centers, shopping malls, new suburbs, or even individual houses or cabins, has negative environmental consequences. Harvesting wood, mining of crushed rock, clearing new agricultural fields, and many other forms of resource extraction inevitably reduce space available for biodiversity, thereby leading to reductions in availability of ecosystem services. These activities that cause environmental deterioration can on the other hand be seen as positive and important for national economies. Ecological damage caused by infrastructure projects or other societal activity may be compensated by restoring or protecting habitats elsewhere. This process, which resembles the ‘polluter pays’ principle, is called ecological compensation or biodiversity offsetting.

This presentation reviews concepts of offsetting and summarizes a dozen (or so) decisions that effectively determine how well ecological damage becomes compensated and the frequently cited goal of offsetting, no-net-loss, is achieved. Factors treated cover the three major axes of ecology, biodiversity, time and space as well as additional considerations inherent to implementation of offsets via restoration or protection measures. While doing so, I address the major pitfalls in offsetting, which arise from failures in planning, failures in implementation, and systemic failure due to changes in behaviour of the society. Failures in planning arise from too much simplified biodiversity measurement, unrealistic expectations of the benefits of habitat restoration and avoided loss, and from ignorance about special factors such as additionality and leakage. Failures in compliance arise, for example, from cost-savings, difficulties in making offsetting plans operational, or outright fraud. The most insidious failure arises from changes in human behaviour, when utilitarian ethics, market-based instruments, and profit-seeking replace our sense of obligation towards nature. While there are arguments to be made about the utility of offsets, attention clearly needs to be paid to their adequate specification and regulation. It should also be accepted that credible no-net-loss replacement of natural or semi-natural habitats will be expensive.

The few existing reviews of the ecological performance of mitigation and offsetting are not promising: recent publications have found up to 99% losses of ecological value while the usual goal of offsetting is stated as no net loss of biodiversity (and ecosystem services). A survey of recent offset cases in the Nordic countries also reveals deficiencies in the design of offsets. Offset ratios seem to frequently come out as so low, that no net loss cannot credibly be expected.

Moilanen, A., & J. S. Kotiaho. 2017. Design of biodiversity offsets: twelve operationally important decisions. TemaNord, in press.



## Influence of human disturbance on resting site selection of the Eurasian otter

(Oral)

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In agricultural and urban dominated landscapes, the riparian vegetation belt is one of the few remaining covered structures available to wildlife. Riparian areas are also highly attractive landscapes for human leisure activities. However, human disturbance is one of the determinants for the distribution of many species e.g. by eliciting a strong anti-predator response that exceeds the reaction to natural predators. The loss of riparian vegetation and a concurrent increase of human activities in remaining habitat may therefore pose a serious threat for the survival of wild animals in these habitats. Nocturnal species may be more severely affected in such landscapes as they depend on safe resting sites during the day.

One of the species potentially affected is the Eurasian otter (*Lutra lutra*). This semi-aquatic mammal forages in the water at night and rests in the vicinity at day. To study the impact of human presence on resting site selection of otters we radio-tracked nine otters for up to 30 months and analysed resting site selection in relation to human disturbance.

Altogether, we identified 285 otter resting sites. These sites were distributed throughout the territory with an average of 144 m between them. Natural riparian vegetation was an important variable explaining resting site selection of otters: 95% of the resting sites were situated in the riparian vegetation. We found evidence that human disturbance shapes resting site selection. While otters rest in small riparian strips when there is no human presence, they selected areas with a wider vegetation belt when the disturbance level increased. Outside the vegetation period, animals rested below ground more often than above, suggesting that vegetation functions as cover.

Our results indicate that otters are dependent on natural riparian vegetation and that human presence influences the resting site selection. Our study highlights the importance for wildlife to restore riparian stretches in depleted landscapes. A combination of spatial distribution of resting sites and the habitat requirement under human disturbance provides information for effective conservation measures for otters. This suggests using the protected and charismatic otter as ambassador for the restoration of riparian landscapes – a natural habitat from which other wildlife will benefit.



## Can Payments for Ecosystem Services schemes reduce deforestation? A robust evaluation example from the Bolivian Andes.

(Oral)

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There is growing interest in Payments for Ecosystem Services (PES) as a habitat conservation approach. Key questions remaining are 1) the extent to which conservation funded is additional (would not have occurred in absence of the scheme), and 2) the extent to which habitat degradation leaks away from enrolled land, and 3) whether improvements in outcomes of interest can be robustly attributed to the intervention. We explore these questions for Watershed, a widely implemented payment for watershed services scheme in Bolivia which incentivises upstream farmers to cease deforestation and exclude cattle from riparian forest to protect habitat and water quality. To robustly evaluate the effectiveness of the scheme at reducing deforestation, we made use of a Randomised Control Trial set-up, where 128 communities were divided randomly into treatment and control categories, and treatment community households were offered contracts on a voluntary basis. We evaluated additionality of enrolled land using 509 participating households' responses to a survey on individual land parcels. Leakage was examined by evaluating deforestation at the community scale, thereby accounting for deforestation next to enrolled land. Intervention effect on deforestation was assessed using openly available Global Forest Change data to model the relationship between the PES scheme and control + treatment deforestation after implementation (2011-2016), accounting for competing predictors such as past deforestation (2000-2010) and geographical factors (e.g. slope, distance to road and river). We did not detect an effect of the scheme in an intention-to-treat analysis where control and treatment communities were included as a binary variable, which could plausibly be influenced by two factors. Firstly, only 13% of the area or 22% of contracts included in the survey were additional, showing a predominance of business-as-usual, and secondly, land enrolment across treatment communities was highly variable (0-80% of community area), limiting the use of binary analysis. Indeed, significant negative relationships between deforestation and % enrolled land were apparent both at the community (% deforestation) and the pixel (deforestation probability) scale of analysis ( $p=0.02$ ,  $p<0.001$ ), suggesting that the scheme reduces deforestation given adequate uptake. Importantly, this negative relationship also shows that leakage is not sufficient to offset conservation gains of the PES scheme. In a hypothetical scenario where the study communities all have 60% land enrolled, the gains in forest area would be ca 1000 ha compared with a 0% scenario, equating to >30% reduction in deforestation. We conclude that despite the small proportion of land enrolled being additional, measurable reductions in deforestation have occurred due to the PES scheme. Given the rapid spread in PES schemes but limited robust studies exploring their effectiveness, this research lends support to their wider use.



## Best management practices for multiple ecosystem services: subject-wide evidence synthesis and multi-criteria decision analysis

(Oral)

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When a farm is managed for one ecosystem service, such as soil conservation, what happens to other ecosystem services? For example, if cover crops are used to reduce erosion or increase fertility, what happens to below-ground biodiversity or water quality? If management practices cause trade-offs between multiple ecosystem services, which practices cause the fewest trade-offs? Based on the methods developed by the Conservation Evidence project ([www.conservationevidence.com](http://www.conservationevidence.com)), we show how subject-wide evidence synthesis, expert assessment, and multi-criteria decision analysis can be used to make transparent and evidence-based decisions about which management practices are the best for multiple ecosystem services. We reviewed the evidence for the effects of twenty farmland management practices (e.g., cover cropping or riparian restoration) on seven ecosystem services (crop production, soil and water regulation, climate regulation, pollination, pest regulation, and biodiversity conservation) in agroecosystems with Mediterranean climates. For each publication that we reviewed, we summarised the effects of each practice on each ecosystem service for which there was quantitative evidence. A group of conservationists and agronomists assessed the evidence that we summarised (scoring each practice for benefits and harms to each service, and scoring the certainty of the evidence), and assigned each practice to an effectiveness category for each service (e.g., “likely to be beneficial” or “trade-offs between benefits and harms”). Based on the scores from this expert assessment, we used multi-criteria decision analysis to make a structured decision about which practices were the best for which combinations of ecosystem services and cost. We also developed an online decision-support tool that allows users to make their own decisions, based on the evidence, by stating their relative preferences for cost, crop production, and other ecosystem services.

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## A comparison of offsets policies and mitigation banking approaches in natural and cultural heritage management

(Oral)

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Conservation policies have evolved from wilderness preservation to include the protection of certain places 'in exchange for' destruction of other areas. So-called 'offsets', 'offsite mitigation' or 'mitigation banking' approaches are designed to compensate for the deleterious consequences of land use change and provide that development may convert sites of value on the condition that similar areas are preserved elsewhere. There is unprecedented pressure being placed on natural and cultural heritage landscapes as a result of population growth, escalating development activity and resource extraction and consumption worldwide and offsets approaches are promoted as mechanisms by which the multiple values of heritage landscapes may be managed more sustainably. However, the approach is not without risks, most obviously the challenge of equivalence and comparing and exchanging 'apples and oranges'. Rigorous oversight is essential to ensure that offsets do not become a 'license to destroy' and remain a low priority option on the mitigation hierarchy. Previous experience in biodiversity conservation suggests that extension of the approach to other fields, including cultural heritage, may be premature. The case studies conducted for this research demonstrate that significant policy failures have occurred and public good objectives thwarted. Past practice indicates that reforms are required in both parameters as well as the philosophies underpinning offsets approaches. Comparing cultural heritage management to biodiversity preservation may also be another case of comparing unlike categories. A policy that may work for a certain set of values in particular circumstances, may not work for all. However, integration of the management of cultural and heritage may provide benefits, including respect for Indigenous co-creation of landscapes. Integration of the consideration of natural and cultural values through a landscape approach may achieve better outcomes for both, considering that such a frame would reflect the reality of human and environment inter-relationships and embeddedness. This may also lead to useful reforms of offsets approaches. Shifting to an integrated focus at a landscape scale would facilitate much-needed regard for cumulative damage and legacy issues. Future offset policies could go beyond compensation for current losses, and incorporate treatment of the debts incurred by harmful practices in the past.

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2018/06/14

11:45

Room: A3 Wolmar



## Open discussion with symposia speakers

(Oral)

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Abstract of this presentation is not public





## Social media data for conservation science and practice

(Oral)

**Enrico Di Minin<sup>1</sup>✉, Christoph Fink<sup>1</sup>, Anna Hausmann<sup>1</sup>, Vuokko Heikinheimo<sup>1</sup>,  
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Despite the increasing wealth of user-generated content posted online, the use of data mined from social media platforms is still limited in conservation science and practice 1. Many social media platforms provide an application programming interface that allows access to user-generated text, images and videos, as well as to accompanying metadata, such as where and when the content was uploaded, and connections between users. Here, we first demonstrate how data mined from social media platforms can be used to inform national park management and planning. Specifically, we show the usability of different social media platforms (Instagram, Twitter and Flickr) in estimating the visitation rates in national parks 2. We also show that social media data can be used to understand tourists' preferences for biodiversity experiences and assess what kind of activities tourists conduct when visiting national parks. In both cases, social media data performed as well as data generated from traditional visitor surveys and counters. Second, we show how social media data offer a new means of investigating the illegal wildlife trade that is booming online. Specifically, we show how machine-learning algorithms offer new possibilities to automatically identify content pertaining to the illegal wildlife trade from high-volume data mined from social media platforms 3. We also investigate whether poachers can use information posted by national parks' visitors to locate and kill commercially valuable species.

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2018/06/14

10:15

Room: K305 Alvar



## Translating policy aspirations into durable policy: the case of biodiversity offsetting in South Eastern Australia

(Oral)

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Abstract of this presentation is not public

2018/06/14

10:00

Room: K309 Gustaf



## Biodiversity conservation in a telecoupled world: a framework

(Oral)

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Telecoupling is a global process that increasingly dominates land-use interactions and trade. Despite its obvious large implications for biodiversity conservation, how to manage telecoupled forces and how to implement biodiversity conservation policies in the light of telecoupling has received little attention. We propose a framework to identify the spillover effects of conservation interventions under telecoupling. We then use this framework to identify threats and opportunities for biodiversity. The threats are very rapid habitat loss that jeopardizes most land-based conservation interventions. The opportunities are consumer-based pressure on producer for higher environmental standards, green financing and the use of social media for conservation. These opportunities can be very powerful to attain conservation objectives and we call for further research to learn to manage them to counter rapid biodiversity declines caused by telecoupling.

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## Cultural Brand or Resource Reserve? : a 'Yellowstone Index' of public interest in National Parks

(Oral)

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DOI: 10.17011/conference/eccb2018/107558

The term national park has public meaning and institutional definition. The first derives from an ideal, promoted by prominent citizens between ca. 1850 and 1970 that, through the preservation and enjoyment of spectacular natures in parks a sense of nationhood, cultural identity and citizenship could be forged or reimagined. In this sense, National Parks act as a brand. Subsequently, the national park term has acquired an institutional definition within the protected area categorisations of the IUCN. This specifies that national parks should be "large areas in an 'intact natural state' protected to conserve biodiversity and functioning ecosystems, to educate and excite people concerning the need for conservation and to provide a foundation for tourism economies". In the IUCN sense, national parks are resource reserves of national significance with the potential to generate co-benefits. Conflating these two distinct concepts of national park within international policy and conservation science has served to generate ambiguity concerning the purpose and implementation of this 'gold standard' of place-based conservation.

At a time when identity politics is on the rise and international finance for biodiversity is in decline we suggest it is relevant to disaggregate national parks into those that play a role in 'branding' and shaping cultural identities and those that are primarily concerned with the conservation of biodiversity and ecosystem services. To this end we have developed a 'Yellowstone Index' of public interest in national parks as a heuristic tool for reassessing their role in public policy. Our index is calculated from Wikipedia page view data and can be applied at multiple scales. We demonstrate distinct geographies for iconic parks and reveal different national approaches to national park policy. Our Yellowstone index offers a heuristic tool for reassessing the role of national parks in public policy. It supports among other things: i) mapping and quantifying the degree to which nature conservation is part of the cultural identities of nations and regions, ii) identification of NPs and associated natural features that support, or have the potential to support, place branding and tourism economies, iii) identifications of NPs with little public interest and that may be at risk if political support changes in favour of economic land development. Perhaps most importantly it enhances democratic transparency of national park policy and thereby the potential to reinvent and align the national park designation with wider trends in society.

2018/06/14

11:00

Room: K308 Cabinet



## **Movement and habitat use of the pool frog (*Pelophylax lessonae*) in Sweden: gaining ecological insights to improve forest management practices**

**(Oral)**

**Lina Widenfalk<sup>1</sup>✉, Gustav Wikström<sup>2</sup>, Frauke Ecke<sup>1</sup>, Anton Hammarström<sup>2</sup>,  
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The pool frog (*Pelophylax lessonae*) has a limited distribution in Scandinavia and is red-listed in Sweden. Most of the ~120 Swedish localities are concentrated along a limited coastline in south-central Sweden. The major threat to the species is loss of suitable habitat, e.g. due to forest drainage ditching and clear cutting. Understanding important pathways between local subpopulations (ponds) is important for conservation and landscape management. To improve forest management practices around populated ponds, knowledge on habitats used for dispersal and hibernation is crucial.

We conducted a landscape connectivity analysis for the main region of the Swedish populations, based on presence/absence data on populated ponds from a survey in 2009; and a cost raster based on habitat data, forest data and a wetness index. To verify these theoretical dispersal routes, we performed radio-telemetry tracking of 43 individuals around four ponds, during the summer and autumn of 2017. As most frogs did not move away from the pond, translocations 500 m into localities connected with the ponds were conducted for 20 individuals. Six individuals were followed to their hibernation sites. Home range of individuals was estimated by utilization distributions which were calculated with the assumption of biased random walks. We determined habitat use preference with GLMMs of usage/available habitat using forest data and wetness indices.

Most individuals moved according to theory, in distinct moves along the wet habitat strings predicted from connectivity analysis. Translocated individuals moved quickly to suitable water bodies and remained there, often showing homing behavior. Habitat use of these individuals showed preference for open water bodies and open wetlands. Pine forests were avoided, while proximity to streams and distance from forest favored habitat usage.

The theoretical dispersal routes (in low cost areas from the connectivity analysis) were used more often than high cost areas, verifying their relevance for conservation planning and landscape management. Hibernation sites were not located in burrows, as previously suggested, but instead directly in litter on the forest floor. All individuals hibernated on solid ground, within 250 meters from breeding ponds.

To maintain functional connectivity we suggest that also stream networks that interconnect neighboring ponds and have low presence of pine, should be preserved as dispersal corridors. Around the breeding ponds, hibernation sites at up to 250 meters should be considered during management activities. This project exemplifies the potential of combining theoretical analyses and practical field studies to improve our understanding of the requirements of a threatened species. Furthermore, it shows how an adaptive management approach and cooperation between forestry owners and managers, authorities, nature conservation consultancies and researchers may improve management and conservation practices.

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UNIVERSITY OF JYVÄSKYLÄ



## Extent of the impact of the Chinese wildlife trade on the world's wildlife

(Oral)

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Overharvesting is one of the key drivers of biodiversity loss. With rising human population and standards of living in many emergent and developing countries, demand for wildlife is on the increase. As it endangers such charismatic and evolutionarily distinct species as elephants, rhinoceroses or pangolins, the particular case of China has been in the spotlight in recent years. The number of species impacted by the Chinese wildlife trade seems to be very high, and numerous taxonomic groups to be affected. Species targeted originate from many places worldwide beyond the mere borders of China or its neighboring countries. I therefore aimed to quantify the exact extent of the impact of the Chinese wildlife trade on species endangerment worldwide. I focused on Amniotes ('Reptiles', Birds and Mammals) and used the IUCN Red List of Threatened Species (version 2017-1) and market surveys to review which Amniote species threatened by biological resource use were affected by the Chinese wildlife trade. CITES databases and IUCN/SSC specialist groups provided further information. I found a total of 267 threatened or near-threatened Amniote species to be affected by the Chinese wildlife trade. Of these, 45% are turtles and tortoises. In this group, 50% of all evaluated species are (near-) threatened by the Chinese wildlife trade. Of all traded species, 62% are imported and 48% originate from China. Myanmar and Viet Nam are the main source countries, followed by Indonesia and the USA. Food is the primary use, followed by pet and traditional Chinese medicine. Finally, a minimum of 74% of species are illegally traded; 84% of imported species are listed on CITES Appendix I or II. I aim to emphasize how better regulations and law enforcement at a single country scale could significantly reduce threats over a wide range of taxons worldwide.

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## Effect of forest naturalness on assemblages of different morphological groups of wood-inhabiting fungi

(Oral)

**Jenna Purhonen<sup>1</sup>✉, Nerea Abrego<sup>2</sup>, Atte Komonen<sup>1</sup>, Seppo Huhtinen<sup>3</sup>,  
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Forestry is known to have clear negative effects on the diversity of fungal species, especially on those that are producing large, long living fruitbodies. However, the effect of forestry has not been comprehensively studied among different fungal groups and host tree species in boreal forests. Also most often a study plot based approach has been utilized in which the substrate quality is always very different between the managed and unmanaged forests. In the present study, we studied the effect of forestry on fungal assemblages inhabiting large logs of similar quality among the different management classes. We included all non-lichenized fungal species producing sexual fruitbodies on 42 decaying logs of *Betula* spp., *Picea abies*, *Pinus sylvestris*, and *Populus tremulae* in 6 mature and 6 natural forests, totaling 192 logs. The detected fungi were split into groups based on the morphology of their fruitbodies, namely agarics, discomycetes, pileates, pyrenomycetes, ramarioids, resupinates, stromatic pyrenomycetes, and tremelloids. We analyzed the effect of management and characteristics of the study logs to the total fungal species richness at site and log level. The effect was also tested separately for the different fruitbody groups and host tree species. We also analyzed how the above variables and their different combinations correlate with the composition of the fungal assemblages. We found 666 fungal taxa, out of which 546 occurred in the natural, and 486 in the mature sites. The average species richness of the total species data differed significantly at site and log level, natural forests having more species than mature forests but especially at the log level the effect was very weak. At site level the difference was mostly due to the discomycete group on *Pinus*, whereas at the log level due to the pileate group on *Picea*. For the majority of the groups we did not detect a significant effect of any of the variables. The composition of the total species assemblage was mostly explained by the tree species, bark cover and decay stage of the log. The most important variable or their combination explaining the composition varied depending on the fruitbody group and host tree species. To conclude, our study demonstrates the importance of considering different fungal groups and host tree species simultaneously in applied surveys. Different drivers for the observed trends can be revealed when comparing site and log level results. And finally, when the quality of the substrate is similar between the mature and natural forests the effect of forest management is still visible but the effect is very weak.



## Large carnivore attacks on humans: a worldwide study to investigate spatial-temporal patterns, triggering factors, scenarios, and species attributes

(Oral)

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Large carnivore attacks on humans are increasing globally in the last decades. The expansion of human population and activities in areas inhabited by large carnivores, together with the recovery which several of these species are undergoing, increases the probability of risky encounters, some of which end with the death of people or/and the carnivores involved. Since this type of human-wildlife conflict affects both humans and large carnivores, gaining a deep knowledge of the scenarios in which these attacks have occurred, as well as of the factors that might have triggered them, has a double positive effect. Indeed, reducing the number of attacks will not only increase human safety, but it will also benefit large carnivore conservation. After an attack, indeed, one or more individuals of the species are lethally removed. Moreover, each attack generally generates lasting media attention, which often overplays the facts, consequently causing increased negative public attitudes towards these species. Thus, because public opinion has become crucial in political decisions, large carnivore conservation is highly influenced by public perception and the media.

Although some studies exist on attacks on humans by single large carnivore species, the recent increase in the number of attacks by all species of large carnivores in many areas highlights the need for a comprehensive approach including all large carnivore species and a wide geographical area. Our aim is to broaden the knowledge of this phenomenon by analysing and comparing scenarios of large carnivore attacks on humans worldwide. Specifically, we collected attack reports and analysed factors related to (a) carnivore and human characteristics (e.g., species, population density, age, sex); (b) temporal patterns at different scales (i.e., circadian, seasonal, annual); (c) features of the attack location (e.g., natural vs. urban areas, presence of protected areas and their proximity to human developments); (d) characteristics of the geographical region where the attacks occurred (e.g., economic development of the local population, types of recreational and agropastoral activities) to try identifying potential factors and provide solutions to this issue both at a global and local scale. So far, main results of our research are: (1) about half of the attacks occurred in North America and Europe in the last decades involved risky human behaviours, such as leaving children unattended and walking an unleashed dog; (2) people in a group were less vulnerable to an attack than a person alone. In North-American urban areas, (3) dogs were involved in almost half of the attacks and (4) certain landscape characteristics (e.g., vegetation cover) may be important factors in the occurrence of an attack. These results suggest that human behaviour plays a key role in the occurrence of such incidents both outside and inside urban areas and that further research is needed to investigate the role of other factors.



## Internet-based monitoring of public perception of conservation

(Oral)

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Monitoring public perception of conservation is essential to ensure successful conservation outcomes. However, evaluating attitudes towards conservation projects presents daunting challenges because it is time consuming, expensive and open to social biases and small sample-size errors. Here, we present a recently developed approach to overcome these limitations – Internet-based methods - in particular offsite and onsite metrics. Offsite methods refer to Internet data mining tools that extract Internet search queries, such as Google Trends, while onsite methods refer to programmes that monitor traffic within websites, such as Google Analytics. We explore the potential of these methods rather than focus on the particular details of the case-studies provided to illustrate them. We used offsite methods to determine patterns in public interest in a reintroduced flagship species. We employed onsite metrics to assess the success in communicating a conservation outcome. Our results indicate that both offsite and onsite metrics are able to track changes in public interest across time and space. In particular, onsite metrics provide high levels of temporal and spatial resolution with a high degree of flexibility. These tools could add reliable information to traditional social surveys and represent an opportunity to improve our understanding of the drivers of interest in conservation.

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## Promoting multiple ecosystem services through agri-environmental interventions

(Oral)

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Agri-environmental interventions such as wildflower strips and other greening measures in agro-ecosystems aim to promote regulatory ecosystem services to sustain crop production in conventional cropping systems. However, the extent to which multiple ecosystem services are fostered with current measures remains poorly studied. Here we look at measured effects of agri-environmental interventions on the delivery of insect pollination and natural pest control in crop fields. Key questions are whether multiple services can be provided with one type of agri-environmental intervention and how potential effects translate into crop yield, while taking into account agricultural management practices.

We measured insect-mediated pollination and natural pest control service provisioning in 18 winter oilseed rape fields as a function of the independent and interactive effects of local agri-environmental interventions and landscape-scale greening measures.

Our results suggest that the establishment of agri-environmental interventions can promote multiple ecosystem services in conventional production systems. Benefits may be maximized when combining local with landscape-wide interventions. However, agricultural management practices were the main drivers of crop yield. Neither insect pollination or natural pest control nor agri-environmental interventions significantly affected crop yield in addition to agricultural management.

Further research is needed to better understand how to improve the effectiveness of agri-environmental interventions in promoting multiple ecosystem services. Especially interactions among ecosystem services and with agricultural management practices are crucial to understand, when valuating, mapping or predicting ecosystem service delivery for ecosystem management and policy aimed at maximizing ecosystem services for sustainable agriculture.

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## Tradeoffs and Synergies in MPA impact for Social and Ecological Objectives in Indonesia

(Oral)

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Marine conservation strategies often allocate considerable resources towards the establishment and management of Marine Protected Areas (MPAs) with the expectation they will both provide sustainable fisheries that support community livelihoods and well being (including food security), as well as biodiversity benefits for coral reef ecosystems. This rigorous, interdisciplinary study tests the common rhetoric that increases in ecosystem benefits lead to increases in social benefits. We investigate both the ecological and social impacts of MPAs, and examine short-term synergies and tradeoffs that have occurred among objectives. We applied a quasi-experimental design to control for observable bias in MPA placement and outcomes to disentangle MPA impacts from broader social-ecological trends in human well-being and coral reef conditions in Eastern Indonesia. Baseline and repeat data was collected at six MPAs at over 150 coral reef monitoring sites, and 112 settlements within and outside of MPAs. Ecological and social MPA impacts vary across indicators and in both magnitude and direction of impact. We apply a decision-theoretic framework to examine the synergies and tradeoffs among and between the ecological and social MPA impacts, finding evidence for trade-offs and synergies between MPA social and ecological objectives, which vary at different spatial scales. These insights will inform ongoing adaptive management and marine spatial planning and policy, as well as advance our understanding of the dynamics of complex social ecological systems.

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## Beyond the fragmentation debate in forest planning: how do habitat amount and spatial arrangement matter for saproxylic beetle diversity?

(Oral)

Gwendoline Percel<sup>1</sup>✉, Fabien Laroche<sup>1</sup>, Christophe Bouget<sup>1</sup>

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In managed forests, intensive silvicultural practices reduce the density/diversity of deadwood and tree microhabitats at the forest stand scale. This negatively affects biodiversity, especially saproxylic beetles which dependent upon these old-growth attributes. At the landscape scale, forest management plans lead to a spatial heterogeneity of these attributes which can be perceived as a source of fragmentation by many saproxylic species. However, the influence of saproxylic resources distribution at large scales received little attention to date. More particularly, the relative importance of quantity vs. fragmentation *per se* (spatial configuration of resources independently from quantity) on biodiversity is currently a controversial issue.

In this study, we addressed this latter question within a temperate hardwood forest located in the north of France. Our aim was to evaluate how the quantity and/or configuration of saproxylic resources considered at different spatial scales, could affect local  $\alpha$ -diversity of saproxylic beetles with focus on the response of several ecological guilds.

First, we calibrated predictive models of saproxylic resource abundance (cavities, polypores and deadwood) based on field data and using forest stand characteristics as predictors (e.g. stand age, species trees composition). From this spatial distribution mapping of resources across the whole forest, we selected 8 landscape windows (500 ha) characterized by a similar amount but contrasting configuration of resources. In each of these landscape windows, we set up 6 sampling 1-ha plots consisted of two flight-interception traps. In total over 13,000 individuals were captured during 4 months representing 353 species. We used generalized linear mixed models to assess the effect of amount/configuration of cavities, polypores and deadwood at three spatial scales (1-ha plot, 26-ha buffer and 500-ha window) on the  $\alpha$ -diversity of three ecological species guilds (cavicolous, fungicolous and lignicolous beetles, respectively).

We found that species richness of all ecological guilds did not significantly respond neither to the quantity nor the configuration at any spatial scale. In contrast, the abundance of cavicolous and fungicolous species responded positively to amount of cavities and polypores, respectively but only at 26-ha buffer scale. These results emphasize that amount of saproxylic resources rather than configuration seems to be a key factor for maintaining diversity at fine scale, in particular by increasing the abundance of individuals - i.e. population sizes - for several ecological guilds. Further analyses are carrying out to evaluate the relative contribution of  $\alpha$ - and  $\beta$ -diversity to the regional  $\gamma$ -diversity, and thus provide important information to identify efficient conservation strategies for saproxylic biodiversity in managed forest.



2018/06/14

11:45


Room: K306 Anton



## Apex predators' top-down effects decouple mesopredator-prey population dynamics

(Oral)

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Abstract of this presentation is not public



## Biodiversity threats embodied in global trade: Moving beyond species richness loss

(Oral)

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The limited success of traditional conservation practices such as expanding protected areas signals a need for new, integrated approaches to halt biodiversity declines. In particular, biodiversity-benign production methods can be complemented by changing human or national consumption patterns such that the global demand for products most damaging to biodiversity is reduced. Life cycle assessment (LCA) is a promising tool to quantify the land use impacts associated with everyday products but within LCA, most methods focus on loss of species richness only. In recent years, evolutionary history (also referred to as phylogenetic diversity or PD) has been argued to capture biodiversity better than simple measures of species richness. Here we combine countryside species-area relationship with species-specific evolutionary isolation scores of mammals, birds and amphibians to derive new characterization factors (CFs) providing evolutionary history lost per m<sup>2</sup> of different human land use types in each of the 804 terrestrial ecoregions and 176 countries for use in LCA. To illustrate their application, we combine the new CFs with global crop yield maps and food trade databases to quantify evolutionary history loss embodied in both global consumption and bilateral food trade. For the three taxa combined, we project a total loss of 9472 million years (MY) of evolutionary history due to habitat loss caused by all human land uses globally. Agriculture is responsible for loss of 1579 MY; pasture 1990 MY, forestry 5381, and urbanization 522. Results show that 18% of total loss due to agriculture land use can be attributed to land use for export production. The United States, China, Japan and Germany are projected to inflict most damage abroad due to food imports while Indonesia, Sri Lanka, Ecuador, India and Philippines are projected to incur highest evolutionary history loss due to land use for export production. We found that different hotspots of global biodiversity loss emerge depending upon which metric (species richness or evolutionary history) is considered. Our results and approach are useful in life cycle, footprinting and product sustainability assessments and can inform nations designing regional strategies to achieve the Aichi 2020 biodiversity targets.



## Disentangling homonyms- using artificial neural networks to separate the cream from the crop in large text corpora

(Oral)

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Recent years have seen a great influx in scientific publications as well other sources of text corpora that are used for conservation research. This surge holds much promise in promoting great advancements in science, but also presents new challenges. One of the great issues of utilizing this plethora of information is how to efficiently sort through it and retain only its relevant sections. Homonyms - terms that share spelling but differ in meaning - present a unique challenge within this respect as they do not contain inherent information that can aid in their classification across narratives. This issue is of relevance for an array of different conservation culturomics studies, as homonyms add a lot of noise to results which cannot be easily identified. In this work we constructed a semi-automated approach that can aid in the classification of homonyms between narratives. We used a combination of automated content analysis and artificial neural networks to quickly and accurately sift through large corpora of academic texts and classify them to distinct topics. As an example, we explore the use of the word 'reintroduction' in academic texts. Reintroduction is used within the conservation context to indicate the release of organisms to their former native habitat, however an 'ISI' search using this word returns thousands of publications that use this term with other meanings and contexts. Using our method, we were able to quickly and correctly classify thousands of academic texts with more than 99% accuracy between conservation related and unrelated publications. Our approach can be easily used with any other homonym terms and can greatly facilitate sorting data in cases where homonyms hinder the harnessing of large text corpora. Beyond homonyms we see great promise in the combination of automated content analyses and machine learning methods in handling and screening big data for relevant information.

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## Multi-functional production systems: from research to practice

(Oral)

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Multifunctionality is the inherent characteristic of ecosystems to simultaneously perform multiple functions that provide ecosystem services (ES) and might be able to provide a particular ES bundle or bundles. ES within these bundles can interact with each other, potentially leading to synergies and trade-offs, depending on the demand for the ES from the different stakeholders involved. The choices and uses of ES by stakeholders is central to understanding trade-offs (Turlkelboom et al. in press). However, there may be limits to the extent of realisation of the synergies due to constraints on the ability of the ecosystem to deliver each service to the desired level and/or management practices and/or the negative interactions between certain ES (Berry et al., 2016). The nature of these associations also may depend on the spatial and temporal scale being considered.

This paper will examine the impacts of a selection of conservation agriculture interventions on multiple ecosystem services to illustrate the nature of these interactions (both intentional and unintentional), particularly in the context of some of the trade-offs that could occur between provisioning and other ES categories. For example, while reduced tillage agriculture may contribute to the ES of food provisioning, water quality, water flow regulation, climate regulation, however, the impacts on biodiversity and cultural ES and on pest regulation are not always beneficial. Thus it will explore the importance of management in affecting outcomes through the realisation of synergies and minimisation of trade-offs. It will also consider how a more holistic assessment of the potential benefits and beneficiaries can demonstrate more fully the value of conservation interventions to human well-being.

Berry, P. et al. (2016) Ecosystem Services Bundles. In: Potschin, M. & K. Jax (eds): OpenNESS Ecosystem Services Reference Book

Turlkelboom, F., et al. (in press) When we cannot have it all: Ecosystem services trade-offs in the context of spatial planning. Ecosystem Services. <https://doi.org/10.1016/j.ecoser.2017.10.011>



## Living in a landscape mosaic: Movement patterns and resource selection of swamp wallabies

(Oral)

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Broad-scale habitat fragmentation is a visible result of human land-use throughout the world, often resulting in deleterious ecological outcomes. Animals inhabiting fragmented landscapes need to access different habitats to acquire resources such as food and shelter which can pose risks if human disturbances are present. To mitigate these risks, animals may change their patterns of resource selection on a temporal scale.

Phillip Island, located in south-east Australia, is a highly human-modified and fragmented landscape that contains patches of native vegetation amongst a matrix of agricultural farmland and urban developments. The island supports an abundant population of swamp wallabies (*Wallabia bicolor*), but little is known about how they use a modified landscape and select resources within it.

We developed inexpensive custom-made wildlife trackers to gather fine-scale GPS data of 48 swamp wallabies and examined the circadian variation in resource selection within habitats of low (i.e. remnant vegetation) to high (i.e. roads) human disturbances. We compared real wallaby trajectories to simulate random walks and applied generalised linear mixed models to analyse the data on a temporal scale. Firstly, we investigated which habitats are selected by wallabies and secondly, we determined whether the distance to different habitat types changes, depending on the level of disturbance. Finally, we created habitat suitability maps to identify areas of use and avoidance. Information generated by the analysis will inform and improve the conservation of swamp wallabies in a fragmented and human-disturbed landscape by implementing effective management actions and more generally enhance our understanding of the challenges faced by fauna in changing environments worldwide.



## Habitat fragmentation and predation: Experiments with bank voles (*Myodes glareolus*) and least weasel (*Mustela nivalis nivalis*)

(Oral and Poster)

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Habitat loss and fragmentation are the main causes for innumerable population declines and species having become threatened or extinct. Habitat fragmentation inevitably affects behaviour and social interactions of individuals. These are likely to form an essential part of the mechanism behind observed population declines. Predator - prey interaction is strong factor shaping population viability and individual numbers and it is thought to change after habitat loss and fragmentation. The prediction is that specialized predators, dependent on a certain habitat type, should be more vulnerable to habitat loss compared to generalist predators, but habitat fragmentation effects are unknown.

In this presentation, I summarize the results from our predator - prey experiments conducted in experimentally fragmented habitat, created in to 0.25 ha small mammal proof enclosures. Enclosures consisted of either non-fragmented (one patch) or fragmented (four patches) habitat of the same total area surrounded by low vegetation matrix. We have been measuring the fragmentation effects on behaviour and fitness of prey species the bank vole (*Myodes glareolus*) and predator species the least weasel (*Mustela nivalis nivalis*) in a series of experiments. We found that fragmentation led to increased matrix use in male voles and weasels, when resources were distributed into separate habitat patches. Small habitat fragments kept female bank voles closer to their nest where they were better able to protect pups against nest predators, infanticidal males. However, this did not affect the number of offspring recruited per female 1. Mammalian predator odor, a cue about increased predation risk in the habitat patches, decreased vole movements and voles directed movements towards matrix where the avian predation risk was higher 2. During high avian predation pressure, survival of male voles was poorer in fragmented habitat. Especially, males who moved most and spent time on open and risky matrix during radio - tracking were more likely to be depredated. Weasels killed more voles in the continuous habitat, which provided them safe hunting habitat from avian predators. However, this was only during autumn, when the kill rate was also higher due to cold weather 3.

To conclude, habitat fragmentation has direct survival and fitness consequences for individuals and it changes species interactions, but direction of these effects depend on fragmentation types and duration and scale of experiments.

1 Haapakoski M. et al. Infanticide effects on behavior of the bank vole (*Myodes glareolus*) in the fragmented breeding habitat. *Behav Ecol Sociobiol* 2015; 69: 49–59.

2 Haapakoski M. et al. Conservation implications of change in antipredator behavior in fragmented habitat: Boreal rodent, the bank vole, as an experimental model. *Biol Conserv* 2015; 184: 11–17.

3 Haapakoski M. et al. Mammalian predator-prey interaction in a fragmented landscape: Weasels and voles. *Oecologia* 2013; 173: 1227–1235.



## Combining culturomic datasets to assess the potential for digital monitoring of cross-cultural progress towards Aichi Target 1

(Oral and Poster)

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Assessing public interest in nature is one of the key areas where culturomics shows great potential to contribute towards conservation science and practice. For example, internet search volume data has been suggested as a potential tool for measuring progress towards Aichi Target 1, which states that ‘by 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably’. The underlying assumption of such an approach would be that changes in internet search volume, generally considered a metric of public interest, would generally reflect changes in public awareness of biodiversity. However, this assumption holds true only if searches for biodiversity related content result in a similar volume of web-content ‘consumption’. In other words, interest – “the feeling of wanting to know or learn about something or someone” – in biodiversity does not necessarily result in increased awareness – “knowledge or perception of a situation or fact”. Here we aim to provide a first assessment of the relationship between these two dimensions across 15 language groups by combining two separate datasets: search volume data obtained from Google Trends and language-specific page views to Wikipedia’s biodiversity page. Wikipedia is one of the most popular web domains across the world and generally ranks among top search engine results, making it a potentially suitable resource for this purpose. Specifically, we i) assess the correlation between search volume and page views for a period of 2.5 years; ii) explore how socio-cultural factors relate to changes in this relationship; and, iii) test for differences between the trends observed for each dataset. Results show that correlation scores between search volume and page views vary greatly between languages (0.46-0.96), and are positively associated with the relative popularity of the Wikipedia page but negatively associated with the number of countries where the language is spoken. Interestingly, the relative quality of the Wikipedia page for different languages showed no significant association with correlation scores. Finally, we show that search volume and page views show significantly different trends for some language groups during the same period raising questions regarding the capacity of each dataset to measure interest in biodiversity individually. While future analyses should expand the set of terms explored to further validate such an approach, this work exposes the pros and cons of individual datasets and how future applications of culturomic approaches to conservation topics may greatly benefit from increasing integration of independent datasets.





## Density-dependent detectability in dynamic occupancy survey: a case study on a vulnerable beetle species in hollow trees

(Oral and Poster)

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Conservation of threaten species living in fragmented habitats crucially relies on evaluating their occupancy and their ability to colonize and persist in habitat patches. Fitting stochastic patch occupancy models (SPOMs) to occupancy data can help assessing these features. However it is critical to account for the limited detectability of target species in this type of analysis to avoid severe biases in estimation.

Detectability of a population in a habitat patch often tightly depends on the local density of individuals. This connection between density and detectability has rarely been used in SPOM analysis, even when abundance data are available. The two quantities are often considered independent and estimated separately. Here, we propose a framework for using density-dependent detectability in the analysis of a SPOM.

We illustrate our approach with the example of *T. opacus*, a beetle inhabiting hollows in old trees. We use a 6-year survey of adults abundances in an woodland pasture area harbouring a high density of old oaks, in Östergötland, south-east Sweden. *T. opacus* is classified as "vulnerable" on the Swedish red list.

We first modeled abundance data in occupied trees as a function of tree and environmental features. We used this model to predict density-dependent estimates of detectability in all the trees of our study site. Importantly, we could explore how the environmental features affect carrying capacity and detectability of trees, with the latter aspect being rarely explored in metapopulation studies. Secondly, we showed the good match between our density-dependent estimates of detectability and those obtained from repeated occupancy surveys (Pearson  $r = 0.54$ ,  $p < 2E-16$ ). Thirdly, we found that omitting density-dependent detectability had little effect on metapopulation parameter estimation in our example (except lowering the goodness of fit to data), probably because we performed many repeated surveys in sites. Ultimately, accounting for density-dependent limited detectability did not eliminate unstructured colonization from our study system, which may indicate the contribution of the cryptic larval stage of *T. opacus*.

Our study thus shows that density-dependent framework allows for a simple integration of limited detectability into metapopulations studies, based on a more thorough use of abundance data than classic approaches. In particular, it may be applied even with no or a limited number of repeated surveys, although a statistical survey would be necessary to assess this point. More generally our work also suggests that accounting for limited detectability is only the first step towards deriving reliable metapopulation model estimates for conservation planning.



## Biodiversity offsets: can we push the threshold for offsettable impacts by translocation of substrates and species?

(Oral and Poster)

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Biodiversity offsets: can we push the threshold for offsettable impacts by translocation of substrates and species?

Land-use have led to changes in ecosystem structures and processes, biodiversity loss, and declines in ecosystem services. However, biodiversity offsetting aimed at compensating for residual adverse biodiversity impacts arising from land-use projects potentially provides an approach that links biodiversity conservation and human development. In Sweden, biodiversity offsets has had limited use so far, but there are expectations that an increased use of biodiversity offsets could help reduce biodiversity loss and maintain ecosystem function.

To fulfill these expectations we need to increase our understanding and knowledge regarding biodiversity offsets both from a theoretical and practical perspective. In this project we will address three main topics 1) Method development: We will evaluate a novel methods for biodiversity offset, translocation of dead wood, which potentially could push the threshold for offsettable impacts and technical solutions feasible for this novel method. 2) Currency (methods for quantifying damage): We will assess how the choice of currency (metrics to estimate biodiversity) influence biodiversity offset planning and performance. 3) Robustness of offsetting methods over time: We will develop long-term management plans for our case study and other types of biodiversity offsets based on expert knowledge and experience from national and international biodiversity offsets.

Our case study will be a unique novel large-scale long-term biodiversity offset project initiated in northern Sweden as a consequence of the expansion of the Aitik mine. To compensate for loss of ca 250 ha of forest with high or very high conservation values the Land and Environmental Court of Appeal decided that two offsets areas should be sets aside and that a large number (540) of dead wood substrate should be translocated (including associated insects, epiphytes and wood fungi) from the impact area to the compensation area. To allow for a scientific evaluation of this project we conducted baseline measures of insects, bryophytes and wood fungi in both impact and compensation areas as well as the reference landscape prior to the translocation in 2017. In addition, we have designed a field experiment were we vary the number of translocated dead wood substrates in 30 plots in the 400ha large compensation area. Beginning in 2018 we will monitor survival and spread of translocated species using trapping, field inventories and molecular methods with regular intervals.

Never before have deadwood translocation of this magnitude been undertaken making this project unique and we basically lack knowledge regarding the outcome of these translocation, i.e. if translocated species will survive

and establish in the compensation area. But if the method is successful it could be extremely useful in biodiversity offsetting and ecological restoration.

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## Documenting Biogeographical and Socio-Economic Patterns of Illegal Wildlife Trade worldwide

(Oral and Poster)

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Currently, illegal wildlife trade is one of the greatest threats to biodiversity conservation. Understanding the causes that make some countries participate as wildlife suppliers or consumers is crucial to fight this criminal business in a more effective way. Using data provided by TRAFFIC, the wildlife monitoring network, the World Bank, the Agriculture Organization of the United Nations and the Migration Policy Institute, we identified 34 supplier countries (exporters) and 44 consumer countries (importers). Our objective was to determine which socio-economic factors could explain the geographical patterns of 42 vertebrate taxonomic groups that are involved in illegal wildlife trade. We used a hypothetico-deductive approach based on falsifiable hypothesis testing through observable predictions. We proposed that the main factors leading countries to become exporters could include economical needs (e.g. poverty), easy access to species on demand (e.g. lack of wildlife protection), and weak law enforcement (e.g. corruption). For importer countries, motivations were the increased consumption of luxury goods in emerging economies, weak law enforcement, demography (e.g. population size), and specific cultural reasons (i.e. Asian Traditional Medicine). Our hypotheses were tested using logistic regression to analyze the participation vs. non-participation of countries in illegal wildlife trade according to 17 predictor variables. We quantified the relative influence of different factors using variation partitioning analysis. Our results showed that a wide variety of factors potentially lead countries to participate in the illegal wildlife trade. Supplier countries are concentrated in Africa and Asia, and may be primarily motivated by economic needs and eased by weak law enforcement. There is a high overlap (63.2%) between the effects of both factors on wildlife export, but they still have individual explanatory capacity (27.7% and 9.1%, respectively). Demand countries are mostly found in Asia, followed by America and Europe. Their motivations could be mainly demography (39.2%), emerging economy (39.1%) and Asian Traditional Medicine (12.2%). The two former factors partially overlap with the Asian Traditional Medicine (>21%). We suggest that, in order to decrease the rates of illegal trade, crime prosecution and punishment should be complemented with international strategies for improving livelihoods in exporter countries. Better education, legal certainty and government transparency would also help minimizing illegal trade, by favouring a suitable social environment for law enforcement. Regarding consumer countries, we suggest a combination of environmental education and awareness, especially targeted at the wealthy middle class in emerging countries. In Asia, countries with deeply rooted traditional medicine could complement promoting environmental awareness with the search for sustainable and legal substitutes for wild-animal-origin ingredients.



## Behavior in a wide range of choices: substrate preferences of threatened wood-inhabiting species in a mixed old-growth boreal forest

(Oral and Poster)

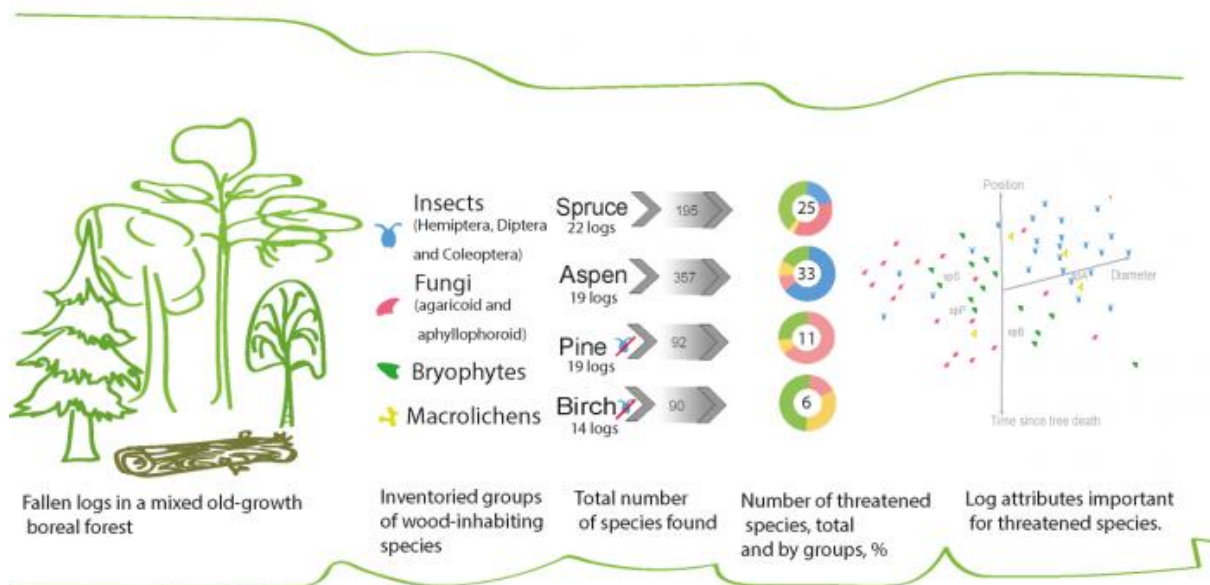
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When everything is available: substrate preferences of threatened wood-inhabiting species in a mixed old-growth boreal forest

In intensively managed forests, many wood-inhabiting species became threatened because of the lack of their habitat - deadwood, especially coarse woody debris (CWD).

We examined a multi-taxon diversity of species associated with fallen logs of *Picea abies* (22), *Betula pubescens*, *B. pendula* (14), *Pinus sylvestris* (19) and *Populus tremula* (19) in a chronosequence of decomposition in the old-growth (OG) forest located in the State Strict Nature Reserve 'Kivach', Russia. We hypothesized dynamic and log (tree) species specific patterns for threatened (red-listed and regionally rare species and indicators of OG) wood-inhabiting species.

Insects (only the *Hemiptera*, *Diptera* and *Coleoptera* data are presented) were collected using trunk emergence traps. Fungi (only the agaricoid and apyllophoroid basidiomycetes data are presented) were recorded based on the repeated inventories of fruitbodies. The epixylic lichens and bryophytes were recorded on all possible log microhabitats. The species distribution patterns were analysed using non-metric multidimensional scaling based on presence/absence data. Log attributes were fitted to the ordination using the vector fitting procedure.

The total (threatened) number of found species was 341(25), 140 (20), 39 (4) and 61 (14) of insects, fungi, macrolichens and bryophytes, respectively. The distribution patterns of threatened species were influenced mainly by the log (tree) species identity ( $r^2=0.55$ ,  $p<0.001$ ). The next important factors - time since tree death (TTD) ( $r^2=0.19$ ,  $p=0.009$ ) and cover of feather mosses and vascular plants ( $r^2=0.17$ ,  $p=0.013$ ) indicated successional status of wood-inhabiting species.

Most threatened insects were associated with aspens fallen one (*Aulonothroscus laticollis*), seven (*Leptura thoracica*) or 0-16 (*Rhizophagus puncticollis*) years ago, or spruces fallen 17-24 years ago (*Ceruchus chrysomelinus*). Most threatened lichens (*Lobaria pulmonaria*, *Nephroma parile*) were associated with aspens fallen 0-25 years ago. Most threatened fungi occurred on conifer, mainly spruce logs fallen 0-25 (*Asterostroma laxum*, *Flaviporus citrinellus*, *Fomitopsis rosea*, *Phlebia centrifuga*), or more than 45 (*Crustoderma corneum*, *Phellinus viticola*, *Postia sericeomollis*, *Rhodonina placenta*) years ago or on aspen logs fallen 4-40 years ago (*Lentaria afflata*, *Punctularia strigosozonata* and *Tomentella crinalis*). Most threatened bryophytes preferred spruce logs with the age of 6-25 (*Cephalozia macounii*, *Syzygiella autumnalis*, *Tritomaria exsecta*) or 26-40 (*Lophozia ascendens*, *Scapania apiculata*) years.

Thus, aspen and spruce logs in a full range of TTD provided ecological niches for almost all found threatened species. This result provides new implications for biodiversity conservation.

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## Conspecific attraction boosts local density while causing lags in range expansion despite high dispersal ability: experiments with a reintroduced endangered mammal

(Oral and Poster)

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The potential range of many species is shifting, reflecting changing ecological conditions due to climate change or the disappearance of causes of decline.

The length of any lag between new habitat becoming available and being colonised is likely driven by a complex interaction between individual decisions, habitat configuration and how population growth rate and persistence depends on local and neighbourhood density. Where such lags are lengthy the consequences for a species realised distribution may be profound.

In fragmented landscapes, dispersers may preferentially settle in proximity of conspecifics, increasing persistence of small populations but restricting the colonisation of suitable but empty neighbourhoods. Thus during range expansion lags may occur when some equally suitable neighbourhoods become densely occupied while others remain vacant.

Species reintroductions offer an ideal opportunity to answer fundamental questions on how patterns of occupancy emerge at the range edge. We performed and monitored experimental translocations of water voles, the UK's fastest declining mammal, to quantify the influence of occupancy and habitat suitability on colonisation and local persistence. We used a novel statistical method to simultaneously consider the effect of occupancy across a range of spatial scales.

Densely occupied neighbourhoods were highly persistent and frequently colonised. Persistence was more likely in highly suitable habitat, whereas colonists settled irrespective of habitat quality, suggesting conspecific attraction strongly influenced settlement decisions by dispersers. Distant, sparsely occupied neighbourhoods were colonised less frequently than expected from colonisation patterns and dispersal ability observed in established metapopulations of this species. The low persistence of such populations, far from the range edge, contributed to a lag in range expansion.

There may be a mismatch between colonisation dynamics in the core and edge of the range, and dispersal potential of a species may not be realised where individuals preferentially settle in proximity to conspecifics. Where consolidation of extant neighbourhoods precedes colonisation of empty yet suitable range, the pool of potentially longer distance colonists is depleted causing lengthy lags.

These findings will help optimise conservation delivery, especially during transient vulnerability post reintroduction before spatial equilibrium arises. Those seeking to speed up recolonisation by recovering species should consider reinforcing nascent populations at the range front, as well as reintroductions beyond the expanding edge.

Under climate change, lags may lead to a mismatch between rates of movement of trailing and expanding edge of range shifting species, with detrimental consequences for a species realised distribution, conservation status and contribution to ecosystem function.

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## The ecological negotiation

(Oral and Poster)

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The question of the biodiversity conservation cannot be reached without ecological negotiation. The thing is that, those who negotiate already have an interest in destructing or modifying the nature. They are in charge of realizing the environmental impact assessment, and of managing the process to communicate informations to the public. How can biodiversity conservation be negotiated to make sure that its future is decided in an equilibrate relation between all the actors? Our purpose is to show how the implementation of the law and actors actions on the ground can promote biodiversity conservation. Our study case was France.

In France, the law applicable to environmental impact assessments has evolved considerably since its creation by the Nature Protection Act of 10 July 1976. From a right based on a segregated nature to a right based on a systemic and dynamic approach of the interrelations between man and his environment, we work in 2017 with a flexible and negotiated right. Knowledge exchange through expertise gradually opens up a space for negotiation where economic interests and scientific reality merge, giving rise to a modernized conception of nature: the assessment of biodiversity by Services it renders to man. However, the complexity of nature surpasses the apprehension that man can have. Therefore, although the legal procedures applicable to environmental impact assessments still reflect the limits imposed by the economic power over nature, the law nevertheless opens up a breach through the development of digital tools that could equilibrate forces. The emergence of an ecological negotiation in which secular scientific expertise, public participation and the creation of a common knowledge of biodiversity would also influence public decision-making may well be emerging.

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## Applying the positive deviance approach to identify sustainable social-ecological settings

(Oral and Poster)

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Abstract of this presentation is not public



## Hierarchical Bayesian models reveal the habitat characteristics of Arctic marine mammals

(Oral)

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So far the remoteness of the Arctic has limited the number of biological surveys in the region and thus, estimates about distributions and abundances of Arctic marine mammals (AMMs) are missing in many areas. A better knowledge about distributions of AMMs would improve the assessment of their sensitivities to the impacts of climate change and increasing human actions. We present how this data shortage can be tackled by combining several (heterogeneous) data sets within a single spatiotemporal Poisson point process framework. We demonstrate our approach with a study on distributions of polar bears, walruses and ringed seals in the Kara Sea. We combined species observations from multiple studies which had differing survey methods. Based on the data we estimated how species respond to the habitat covariates and created a hindcast of species relative densities in the study area.

Our data set was mostly based on survey cruises where researchers had made species sightings with varying effort. The novelty of our modelling methodology is in taking into account the survey bias and spatiotemporal autocorrelation, which come as downsides of utilizing an extensive but poorly controlled data (Fithian et al. 2015). We built a hierarchical Bayesian framework, which allowed us to model observations as a Poisson point process and to formulate an additive regression model for the species density process (Warton & Shepherd 2010). In the additive model we assigned fixed effects for covariates and random effects for survey specific observation bias and spatiotemporal autocorrelation.

According to our results, the (relative) density of polar bears was mostly explained by the relative density of seals. As apex predators polar bears are dependent on prey abundance, which has not been considered in earlier estimates of polar bears' habitat suitability. Hence, the response of seals to shrinking ice cover may be an important feature for the future of the polar bear distribution. Seal density was highest in areas with ice cover around 70 % and walrus density was highest relatively near coastal regions (shallow water areas), which support that they are both dependent on access to prey. Moreover, there was strong variation assigned to both random effects. The spatiotemporal effect explained variation caused by unmeasured environmental covariates and possibly by spatiotemporally structured survey bias.

Our model structure could treat the heterogenic sampling protocols, which came with the cost of predicting only the relative densities instead of absolute ones. Anyhow, this did not have an effect on the estimates of species' habitat characteristics. The novel methods in SDM field proved their efficiency in our study and created quantitative knowledge and new understanding about the Arctic ecosystem.

Fithian, et al. (2015). *Methods in ecology and evolution*, 6, 424-438.

Warton & Shepherd (2010). *The Annals of Applied Statistics*, 4, 1383-1402.



## Introduction of non-indigenous benthic marine species in the Normand-Breton Gulf (France) over the two last centuries

(Oral)

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The introduction of non-indigenous species (NIS) is considered as one of the main threats to indigenous biodiversity, and because their eradication after introduction remains highly challenging and debatable, the prevention of their introduction and dispersion is crucial. Exploring the spatio-temporal patterns of introduction of NIS may allow identifying the vectors of introduction and dispersion, and thus may avoid future introductions. However, historical data are often lacking, especially in the marine realm, and many marine NIS are detected when already well-established in an area. Here we built a database gathering all the data of the macro-zoobenthos recorded since the beginning of the 18th century in the Normand-Breton Gulf (Western English Channel, France). We collected 97,000 data on 7,400 stations, corresponding to more than 2,100 species, among which at least 60 were NIS. These NIS were mainly introduced during the last decades and are mainly distributed within and around shellfish farms, and, to a lesser extent, around the ports. The natural isolation of the Gulf, due to strong gyres, as well the absence of large ports, and the massive development of shellfish farming explains the strong influence of this human activity in the introduction of NIS. The constant exchanges between different areas of the cultivated species and the associated material should be strongly controlled to avoid any additional introduction in the future.

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## Introduction and the EU 2013-2018 guidelines for assessing Favourable Conservation Status of species

(Oral)

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Introduction and the EU 2013-2018 guidelines for assessing Favourable Conservation Status of species

The conservation status of the habitats and species listed in the EU Habitats Directive (92/43/EEC) is to be assessed and reported by the European Union's Member States every six years according to the Directive's Article 17. The previous time was in year 2013, and for the reporting period 2013-2018 updated guidelines were published in May 2017 (1). The assessment of conservation status for species requires the setting of "favourable reference values" for range (FRR) and population size (FRP); the updated guidelines introduce a stepwise approach for estimating these reference values and were made clearer. Also it is clearer that, e.g. for the large carnivore species, the Favourable Reference Population (FRP) is larger than the Minimum Viable Population sizes for both genetic and demographic long-term viability. The latter was more unclear in the 2011 reporting guidelines. For example, Nilsson (2) demonstrated that MVPs fulfilling the <10% extinction risk /100 years criterion did not by far meet recognized criteria for genetic viability. Since large carnivore populations often occur in multiple adjacent biogeographic zones or countries, i.e. are transboundary, the delimitation of the biologically functional population, and to what extent gene flow occurs between subpopulations in different zones or countries, are key issues in the assessment of reference values for their long-term genetic viability. This workshop aims at synthesizing knowledge and views from science and government agencies to help in such conservation status assessments and to help increase successful co-management and conservation of transboundary large carnivore populations.

References:

(1) Reporting under Article 17 of the Habitats Directive - Explanatory Notes and Guidelines for the period 2013-2018. Final version - May 2017. <https://circabc.europa.eu/sd/a/d0eb5cef-a216-4cad-8e77-6e4839a5471d/Reporting%20guidelines%20Article%2017%20final%20May%202017.pdf>

(2) Population viability analyses of the Scandinavian populations of bear (*Ursus arctos*), lynx (*Lynx lynx*) and wolverine (*Gulo gulo*). <http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6549-2.pdf?pid=7417>



## Environmental information provision and preferences for marine and coastal protection in the case of plastic waste

(Oral)

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The immediate reduction of plastic waste in the marine and coastal environment is deemed crucial in order to ensure and preserve environmental sustainability and ecosystem services for human well-being. Public information campaigns may contribute positively towards this direction, as they can have beneficial effects on increasing environmental knowledge, and thus, influencing citizens' environmental preferences and behavior. We attempt to examine the effectiveness of a public information campaign for the reduction of plastic waste, and specifically plastic bags, in the local marine and coastal environment of a major Greek island (Syros). A choice experiment was performed to evaluate individual preferences for reducing plastic waste pollution under different status of environmental awareness, prior and shortly after the information campaign, by means of a stated preferences method. The choice experiment was used to assess the values of several ecosystem services, likely to be affected by the accumulation of plastic litter in the coastal/marine environment, in order to incorporate all the related impacts that can be perceived by citizens and may influence their individual welfare. We selected four appropriate attributes that can be used to evaluate a public program which protects the marine and coastal environment of Syros from plastic waste pollution. Specifically: i) Recreational activities (e.g. bathing, water sports, sunbathing, etc.), ii) Landscape quality, iii) Biodiversity and iv) Commercial fishing activity. Subsequently, we formed a set of alternative policy options with different attribute levels (profiles) and paired these profiles to construct the "choice cards" (choice sets). Two surveys were conducted in Syros Island, administered by four trained interviewers, using face-to-face interviews by means of a structured questionnaire. The first one was conducted before the information campaign (first sample consisting of non-participants) and a total of 185 completed and useful questionnaires were collected. The second one was conducted during the campaign (second sample consisting of environmental campaign's participants) with 156 questionnaires being collected in total. The results indicate: (a) significant differences between the preferences of the two samples, (b) variations in the willingness to pay (WTP) values for the protection and preservation of the local marine/coastal environment between the two samples, though (c) there were not significant differences in their willingness to adopt new policy instruments (e.g. restrictions or bans of plastic bags). The most important finding of our study is that the public information campaign significantly influenced the preferences of participants and was effective in terms of WTP, as the participants had a significantly higher WTP compared to the non-participants, assigning a higher economic value in terms of the overall (coastal/marine) ecosystem services affected by plastic waste.





## Conservation Costs of Retention Forestry and Optimal Habitat Network Selection in Southwestern Germany

(Oral)

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Promoting the maintenance of biodiversity in managed forests should take into account economic efficiency of conservation plans. Therefore, novel economic valuation schemes must be developed in order to support conservation programs and mitigate biodiversity loss. Here, we assess the economic implications of retention forestry practices and create a habitat network in a mixed-montane forest in Southwestern Germany. We applied a simulation-optimization approach for i) evaluation of retention forestry practices applied in the region, ii) creation of forest reserves with a minimum eligible area for biodiversity conservation and establishing a connecting corridor with minimum cost, and iii) allocation of deadwood islands inside the connecting corridor with minimum cost. The average opportunity cost arising from retention forestry practices amounted to 1795 EUR/ha by leaving a minimum deadwood volume of 35 m<sup>3</sup>/ha and 2.5-5 habitat trees /ha. The optimized plan for establishing a habitat network would reduce the net present value (NPV) of forest management between 3.7% and 4.2%, and the novel design for the allocation of deadwood islands would impose a marginal reduction (<1%) to the NPV. We conclude that the creation of a habitat network for biodiversity conservation can be realized with the minimum trade-off to forest management profitability.

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## Wolves at the crossroad: Fission–fusion range biogeography in the Western Carpathians and Central Europe

(Oral)

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Abstract of this presentation is not public



## Semi-subsistence communities in Brazilian Amazonia: Livelihoods and conservation

(Oral)

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Deforestation and defaunation threaten tropical forest integrity. Human communities in the tropics rely on forest resources to meet their livelihood needs, but are disparaged for practicing slash and burn agriculture and bushmeat hunting. Conservationists therefore question whether the development aspirations and semi-subsistence livelihoods of rural tropical communities are compatible with tropical forest conservation[1].

To better understand the role of semi-subsistence communities in deforestation and defaunation in the Brazilian Amazon, we conducted interdisciplinary research at community, landscape and regional scales. At the regional scale, we used Geographic Information Systems and a georeferenced dataset of >600,000 rural households to analyse the patterns and drivers of deforestation and inferred hunting adjacent to 45 Amazonian hinterland rivers. At the landscape and community scales, we conducted fieldwork in agricultural mosaics and forest areas controlled by 63 semi-subsistence communities in the Médio Juruá and Uatumã regions of Brazilian Amazonia. We deployed 383 camera traps, 157 quantitative interviews and 164 Global Positioning System units. We sought to quantify and explicate the 1) livelihood costs incurred through the raiding of staple crops by terrestrial forest vertebrates, 2) degree of depletion that communities exert on the assemblage of forest vertebrates and 3) spatial behaviour of hunting dogs and their masters during simulated hunts.

Our results indicate that at the regional scale, fluvial accessibility and transport infrastructure modulated the drivers, spatial distribution and amount of anthropogenic forest disturbance. In accordance with other research[2], we found that roads were associated with substantial anthropogenic disturbance adjacent to otherwise inaccessible rivers. At the landscape scale semi-subsistence farmers lost 8% of their staple crop annually to crop raiders and invested significant resources to suppress crop raiders, and to avoid losses an order of magnitude higher. Crop raiding was heightened in sparsely settled areas, compounding the economic hardship faced by communities disadvantaged by isolation from towns. A select few harvest-sensitive species were repelled or depleted by human communities. Aggregate species biomass was depressed near towns rather than communities. Hunting depletion was predicated on species traits, with large-bodied large-group-living species worst impacted[3]. At the community scale, hunting dogs travelled ~13% further than their masters. Urban hunters travelled significantly further than rural hunters. Hunting dogs were recognised to have deleterious impacts on wildlife, but were commonly used to defend against crop raiders.

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2. Barber, C.P., Cochrane, M.A., Souza, C.M. and Laurance, W.F., 2014. *Biological Conservation*, 177, pp.203-209.


3. Abrahams, M.I., Peres, C.A. and Costa, H.C., 2017. *PIOS ONE*, 12(10)



## Partnering for nature conservation. NGO-farmer collaboration for meadow bird protection in the Netherlands

(Oral)

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In order to reverse the trend of continuous decline in species diversity and abundance in agricultural landscapes, various governance arrangements have been implemented that promote, organise and finance nature conservation by farmers. The scientific literature predominantly focuses on agri-environment schemes (AES), i.e. publicly funded financial compensation schemes for farmers who implement prescribed conservation measures. Less attention has been paid to governance arrangements initiated by actors outside the public domain. This paper analyses a unique partnership between a nature conservation NGO – BirdLife Netherlands (VBN/BLN) - and a network of about 130 dairy and cattle farmers, aimed at meadow bird protection in the Netherlands. Meadow birds breed in large numbers in the Netherlands, mainly on farmland, but their numbers have been declining as a consequence of agricultural intensification, urbanisation and predation, amongst other things. Established in 2010, the partnership is gradually evolving from bilateral cooperation between VBN/BLN and individual farmers into a network. Based on desk research, interviews and five focus group sessions with almost 40 representatives of the partnership, we conclude that the main (perceived) achievements include: a large contribution to awareness of and recognition for the important role and efforts of farmers in meadow bird protection among citizens, politicians, policy-makers and companies in agri-food chains; a modest contribution to improving conservation efforts by participating farmers; and a modest contribution to their knowledge about conservation of meadow birds. The main success factors are the alignment of interests and complementarity of the partners and motivation derived from meeting peers. The partnership clearly complements AES in terms of its functions.

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## ‘Nature inclusive’ agriculture requires a systemic transition of the agricultural sector

(Oral)

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European agriculture, and Dutch agriculture in particular, is at a crossroads. Due to rationalisation, including intensive use of fertilizers and pesticides, biodiversity in rural areas is declining at an unprecedented rate. Socioeconomic developments in the agricultural sector also show ‘a race to the bottom’. Farmers produce on world markets and are only able to compete on input costs. This results in lower income per unit crop or animal and leads to an ever increasing farm size. In turn this leads to a further decline of habitat of species bound to rural areas and farmland. To turn these negative trends around the Dutch Ministry of Agriculture has proposed an alternative form of farming, labelled ‘nature inclusive’ farming, that 1) benefits from the services that natural processes provide, 2) delivers agri-environmental practices to maintain agro-biodiversity and 3) strongly reduces its negative impacts on the environment. Currently this Ministry supports the adoption of nature inclusive farming practices by funding innovative experiments led by farmer initiatives. Despite some promising results, such innovations have large difficulties to be scaled up, largely due to counteracting forces of the current agricultural system. Using the Technological Innovation System (TIS) framework developed by Hekkert and Negro (2009), we argue that a systemic transition of current agricultural practices is required to mainstream ‘nature inclusive’ farming. Such a transition can only be realised when a shared vision on the future agricultural sector is developed, set out by the government and societal parties. Such a shared vision can then lead to new enabling (policy) environments/landscapes in which these innovations can rise. Without such shared vision, innovations will be locked-in into the current agricultural system, to the extent of a very low prospect of nature inclusive innovations. Furthermore, we observe that the many experiments currently running suffer from a lack of interconnected learning platforms, a lack of documentation of failures and successes and little attention for the forces leading to lock-in and preventing a regime shift. Using two examples, we will illustrate what type of interventions are needed to up-scale nature inclusive innovations.

Keyword 1: innovation studies

Keyword 2: sustainable agriculture

Keyword 3: agricultural policy



## Small coastal lagoons under human pressure

(Oral)

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The Quark region in the Baltic Sea is known for high postglacial rebound; the isostatic land uplift measuring up to 8,5 mm/year, providing 700 ha new land area annually. This forms the landscape continuously, and gives rise to unique features that are characteristic to the area, like the many small lagoons, so called flads, found along the coast. During the land uplift process, new bays emerge as old ones get cut from the sea and build small isolated water areas. The restricted water exchange with the surrounding sea creates distinctive conditions forming important habitats for many species, such as reproduction sites for fish. Shallow bays are ecosystem service providers at a large scale (Austin et al. 2017) but are under high human pressure as they are preferred sites for recreational use. Dredging and boat traffic as well as land runoff highly alter these delicate environments. Today over 60% of these shallow coastal lagoons have been modified by human activities.

Climate change and the subsequent sea level rise is a new upcoming threat, that will have considerable effects on these fragile ecosystems. The current upper predicted sea-level rise is 9mm a year which means that the “birth of new land” would stop since sea level rise would be equal to land uplift (Poutanen & Steffen 2014). This leads to a decrease in emerging new flads which raises the importance of protecting current flads by a) gathering knowledge of biological and physiochemical data b) raising the awareness regarding potential damage causing actions.

The Quark area has approximately 2500 flads and shallow bays. Out of these, 33 in Finland and 19 in Sweden were chosen for closer research. Different parameters such as temperature, salinity and pH were measured. The amount of pike, perch and roach as well as their hatchlings were investigated. This data will be compared with physiochemical data, vegetational data maintained by aerial mapping and snorkeling for information about preferred spawning sites.

The aim is to gather the data from the 52 well studied areas and then interpolate on all the other bays in the Quark area. By modelling the results on other flads in the region we will be able to evaluate ecosystem services that flads offer and make assumptions of their function as fish reproduction areas. We will be able to draw conclusions about human induced impacts on the functioning of the ecosystem.

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15:00

Room: K308 Cabinet



## Sharing biodiversity data openly or restricting the access?

(Oral)

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Open biodiversity data could be very useful for monitoring and perhaps even for conservation science, but is it worth the trouble? Is it possible to share good (enough) quality data and are there risks involved? How to have a cake and eat it too?

I will present some cases from personal experience, dealing with the openness skeptics, data paranoids, openness advocates, citizen scientists etc. and share their concerns as data providers or data users. Hopefully we will find some solutions in our discussion!

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## Biodiversity and ecosystem services in forest - the 'BioHolz' project

(Oral)

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Whenever a tree dies, it makes room for millions of organisms contributing to the crucial ecosystem process of decomposition. The diversity of saproxylic organisms, which are depending in at least some stage of their life on decaying wood, comprises about one third of all forest species. Forest management in Europe of the last centuries changed forest structures and in particular reduced the amount of available dead wood, which is mirrored by the current extinction risk of saproxylic species<sup>1</sup>. However, society expects a forest to be a multi-functional ecosystem, which provides, among others, timber, recreation and biodiversity conservation. In the trans-disciplinary project 'BioHolz', we try to develop management approaches combining ecological, economical and social science perspectives. One challenge is to integrate restoration of saproxylic diversity in managed forests in the economically most efficient way. We established several field experiments, which investigate biodiversity, economic costs and public perception associated to dead wood. The balance between ecological and economic demands is mostly a question of how much dead wood is needed for effective conservation. However, in two experiments it could be shown that for saproxylic diversity dead wood heterogeneity is more important than just dead wood amount. In one of these experiments the importance of dead wood in the forest canopy was highlighted<sup>2</sup>. In addition to a reduction in economic gain through deadwood increase, bark beetles colonising Norway spruce pose a potential threat to the remaining stand, with the consequence that conservation of other saproxylic beetles plays a minor role in bark beetle management. Within two experiments, a new technique of on-site bark scratching was developed facilitating the opportunity to reduce bark beetle populations while promoting saproxylic diversity<sup>3</sup>. Furthermore, public perception towards bark scratching was more favourable than formerly applied full debarking strategies. In a further experiment within the 'BioHolz' project, we investigate ecological, economic and social aspects of standing and lying logs in different spatial arrangements and under different microclimatic situations at the forest stand level.

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UNIVERSITY OF JYVÄSKYLÄ



## The Status and New Perspectives of World Fisheries in the Context of Sustainable Development Goals

(Oral)

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Fisheries and aquaculture make significant contributions to global food security, livelihoods and economy, producing 167 million tonnes of fish, providing 17 percent of global populations' intake of animal protein and supporting the livelihoods of 12 percent of the world population. The United Nations has initiated and led a series of initiatives to achieve sustainable development, including the Millennium Development Goals in 2000, the Rio +20 agreement in 2012, and the Sustainable Development Goals (SDG) in 2015. All these initiatives set a target of ending overexploitation of fishery resources, and the SDG Target 14.4 requests all fisheries managed sustainably and restoring depleted fish stocks to the level that produces maximum sustainable yield by 2020.

The FAO has monitored the state of the world's fishery stocks since 1974 by tracking about 500 stocks, which account for about 80% of the global catch. A myriad of data were used in our assessment, including FAO landings data from 1950-2015, assessment results from regional fisheries management organizations and country institutions, life history parameters, fishing effort and fishery independent information such as survey data.

To balance the goals of using the best available data and assessing stock status worldwide, some stocks were evaluated based on formal model-based assessment, but others using catch rates or surrogate measures of biomass. When data are insufficient for formal assessment, catch trends and expert judgment were also used to assess stock status. The FAO uses two measures for quality control. One is close consultation with local or regional experts on the fishery and the other is seeking supplementary information when the assessment is based on qualitative diagnostics or unpublished information.

The percentage of world fish stocks fished within biologically sustainable levels decreased from 90% in 1974 to 67% in 2015. The continuing decline indicates a worsening state of global fisheries sustainability and sounds the alarm that the SDG Goal 14.4 - zero overfishing by 2020 - may not be achieved. The results also show great variations among regions in the proportion of sustainable fish stocks from 91% in the East Central Pacific (FAO Area 77) to 38% in the Mediterranean and Black Seas. This highlights the need to strengthen fishery policy, governance, legal framework and management practice and to establish an effective global partnership that facilitates the implementation of the SDGs in an inclusive approach at the global level.

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## Drivers of forest $\beta$ -diversity in different organisms and its relevance for conservation

(Oral)

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Land-use intensity has been shown to not only affect local alpha-diversity, but also beta-diversity, i.e. the turnover of species among sites, resulting in a homogenization of communities at landscape scale [1]. Thus, for the conservation of forest biodiversity at larger spatial scales beta-diversity needs to be considered. However, the drivers of forest beta-diversity and its underlying processes in different taxonomic and functional groups are yet not well understood. We studied the drivers of beta-diversity in 15 organism groups from bacteria to vertebrates across 150 forest sites (unmanaged and managed beech, managed conifer) in three region of Germany, including environmental drivers (climate, soil, deadwood, forest stand structural properties), management intensity and geographic distance. In particular we addressed the following questions: (1) What is the relative importance of different drivers for beta-diversity and its components (spatial turnover, nestedness) in different organisms / trophic groups?, and (2) What are the underlying processes and does the importance of processes change with management intensity?

Our predictors explained up to 70% of the variation in beta-diversity, but the percentage of deviance explained highly varied among organism groups. While a change in soil variables was the major driver of beta-diversity in soil bacteria and ectomycorrhizal, forest structure was the main driver of beta-diversity in birds and vascular plants and spatial distance, climate and management intensity in beetles.

Overall our predictors explained more of the turnover than of the nestedness component of beta-diversity. However, in some groups, such as in vertebrates and spiders, richness differences were better explained by single drivers than spatial turnover. In other groups, such as plants, bryophytes and lichens, turnover and nestedness were caused by different drivers.

Our results demonstrate that different drivers are important for beta-diversity in different taxonomic and functional groups with varying underlying mechanisms (e.g. non-random species loss, environmental sorting). The high relative importance of interactions among drivers, e.g. with management intensity, suggests that processes underlying a change in beta-diversity are greatly shaped by management. In order to protect larger spatial scale forest biodiversity and related functions, the varying processes driving forest beta-diversity in different organisms need to be considered.

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## Institutional fit in the maintenance of dynamic habitat networks for metapopulations

(Oral)

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Species living in metapopulations depend on connected habitat networks for survival. If habitat networks experience fast temporal dynamics, species conservation requires preventing habitat discontinuities that could lead to metapopulation extinctions. Few institutional solutions exist for the maintenance of dynamic habitat networks.

Institutional fit is a conceptual framework to study how well institutions are aligned with the realities they manage or govern. We studied the institutional fit of false heath fritillary (*Melitaea diamina*) conservation in Finland from the perspective of conservation institutions' ability to manage early successional habitat availability for this endangered species.

We carried out thematic interviews to detail the goals, priorities, decision-making processes, collaborations and practices of false heath fritillary conservation in Finland. We contrasted our findings against literature on (false heath fritillary) metapopulation dynamics in dynamic habitat networks. We found functional, spatial and temporal misfits in the institutions that manage habitat availability for the false heath fritillary. Consequently, we identified four institutional arrangements that enable effective conservation management of dynamic habitat networks - they provide institutional flexibility for responding to temporal changes in habitat availability and therefore alleviate the found institutional misfits.

(1) Acknowledgment of habitat dynamics in the levels and forms of governance that control local-level task prioritization, operational tools and resources is needed to address habitat discontinuities as a conservation challenge. Such acknowledgement could be invoked e.g. in the documented causes of threat or in the objectives of species-specific recovery plans.

(2) Monitoring changes in the habitat network, organized at shorter time intervals than the expected habitat lifetimes, allows management plans to be iterated based on up-to-date data on the system state. The use of standardized measures in monitoring accumulates data for predicting system dynamics and for estimating the annual need for maintenance.

(3) Management of resources for fluctuating resource needs allows conservation managers to respond to changes in the habitat network across time and space with activities that best minimize habitat discontinuities for the species of interest. This requires understanding of the species' metapopulation dynamics and budgets that can be allocated flexibly in time and space despite land property type.

(4) Scaling of activities through flexible collaborations enables fast responses to increased maintenance needs. Wider time frames of resource availability, longer planning horizons and long-term contracts enable the build-up of collaboration networks.

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14:15


Room: A2 Wivi



## The role of retention forestry in bird conservation: a meta-analysis.

(Oral)

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Abstract of this presentation is not public



## Practical considerations for evaluating effects of connectivity and harvest on transboundary carnivore populations

(Oral)

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Carnivore ecologists globally have eagerly embraced the remarkable advances in field techniques (eg GPS telemetry, genetic sampling) for studying movements and vital rates of wide-ranging species. However, equally impressive modelling tools also exist – but are less often used -- to illuminate practical management recommendations by marrying genetic and demographic outcomes of connectivity and harvest. I will focus on two related areas that demonstrate practical outcomes at the genetic – demographic interface, using examples from carnivores in North America and Scandinavia. First, genetic rules of thumb such as “One Migrant Per Generation” (OMPG) are best interpreted in a demographic context. Of course, this means that an immigrant serves as a ‘genetic migrant’ only if it breeds. However, a less recognized corollary is that the demographic costs and benefits of a given level of gene flow (e.g. OMPG) depend on life history traits such as population growth rate. Second, I will assert that among population connectivity can affect population growth rate more than within-population vital rates. This somewhat non-intuitive principle has substantial implications for managing wide-ranging species because it means that conventional management to improve population trends within a country may be less important to population persistence than management on or across administrative or national borders. Just as sophisticated cutting-edge tools have emerged to estimate movements and vital rates, tools also exist to integrate genetic and demographic processes in powerful new ways.

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## Impacts of the Common Agricultural Policy (CAP) on biodiversity and ecosystem services

(Oral)

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As part of a 'fitness check' evaluation of the Common Agricultural Policy (CAP), completed in autumn 2017, we conducted an in depth literature review to evaluate both direct and indirect effects of the CAP on biodiversity (BD) and ecosystem services (ESS). Beyond instruments that are designated towards the protection of BD and

ESS, such as agri-environment(-climate) schemes (AECM), greening, and cross compliance (CC), we considered and evaluated non-designated instruments such as Direct Payments, that likely have indirect effects on BD and ESS by affecting land-use changes, farm structure and management.

Although literature suggests that AECM can be locally effective (1), their effectiveness at the EU level remains limited due to a restricted budget and extent, low uptake and acceptance by farmers, lack of spatial design, and poor implementation in many cases. Greening measures are both ineffective and cost-inefficient since most farmers are either exempt or can comply with the greening requirements without any action (2). Additionally, administrative requirements bias farmers toward choosing the simplest and least effective measures (3) and management requirements and spatial design are lacking. With respect to supporting farming systems that can be considered as sustainable, our review indicates that the CAP offers adequate support to promote organic farming, but much greater support is given to unsustainable farming systems. Moreover, the protection of High Nature Value farming systems is scarce and inadequate. Concerning ESS, current measures (AECM, CC) are somewhat effective with respect to soil protection and water quality but the performance of the CAP is very low with regard to climate issues by failing to address the most important sources of greenhouse-gas emissions, namely livestock production and nitrogen fertilization.

Overall, the CAP's design and implementation poorly takes up existing knowledge and experience with respect to necessary interventions and best indicators, and its various instruments operate with little coherence (e.g. AECM and organic farming) or even in conflict (e.g. AECM and greening). Moreover, the CAP only marginally addresses the EU's global ecological footprint and its contribution to land-use changes outside of Europe. Thus, the global efficiency and effectiveness of the CAP in terms of BD and ESS remains weak.

Our literature review indicates the availability of a wealth of evidence to inform current and future policy design processes. Integration of all available knowledge, in collaboration with the scientific community, will be essential for achieving higher effectiveness, efficiency, and coherence within instruments and among the CAP and the EU's biodiversity strategy. A much more inclusive, transparent and evidence-based process will be necessary if the European Commission wishes to address the concerns over the CAP's performance with respect to public goods.

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## Structural complexity in managed and strictly protected mountain forests: effects on the habitat suitability for indicator bird species

(Oral)

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Increasing the proportion of unmanaged forest in multi-functional forest landscapes is a central goal of international and national conservation strategies. However, the structural development in newly created forest reserves and its impact on forest species remain are controversially discussed, especially with regard to potential negative effects on light-demanding species in the first phase after reserve designation. We evaluated the effect of management cessation on habitat characteristics of four bird species indicative of different seral stages and structural components: Capercaillie (*Tetrao urogallus*), Hazel grouse (*Bonasa bonasia*), Three-toed woodpecker (*Picoides tridactylus*) and Pygmy owl (*Glaucidium passerinum*). We analysed the forest structure and composition in 42 forest reserves and 300 managed forest sites in four mountain regions in Southwestern Germany and Switzerland. We first modelled habitat selection independent of forest management status and then compared habitat characteristics and suitability of forest reserves to managed forest with species presence or absence. Further we evaluated habitat suitability in relation to the time since reserve designation. For all model species, except Pygmy owl, habitat suitability in forest reserves was significantly higher than in managed forests with species' absence, but not different from managed forests with species presence. For the three species associated with open forest structures habitat suitability decreased significantly in the first three decades after reserve designation and increased afterwards up to the maximally recorded time of 100 years. No such correlation was found for the three-toed woodpecker, probably because this species is mostly associated with temporally unpredictable bark-beetle infestations. While on average forest reserves can provide suitable structures for different indicator bird species, structural characteristics vary greatly in abundance and distribution, with variance being only partly linked to the reserve age. Especially open structures can be limiting for light demanding species in the first decades after designation, when relatively young forests of about 80-120 years grow dense. We therefore recommend focusing on old, near natural or recently disturbed and structurally diverse forests when new reserves are designated.



## Frontiers for conservation: targeting European borders as conservation areas

(Oral)

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It has been long recognized that political borders should not hamper wildlife, and that conservation actions involving several countries are known to bring large scale benefits to nature while helping to resolve social and political conflicts. While many neighboring countries have lived a considerable long peace time, namely the European western countries, several eastern countries were isolated from the west regions due to the so called "iron curtain". More recently, in the former Yugoslavia and currently along the border of Ukraine-Russia, devastating conflicts are also isolating regions and countries.

On the other hand, human development, and particularly transportation networks, are serious threats to biodiversity. For example, roads inflict serious mortality rates due to animal-vehicle collisions, can obstruct the animal movement, or represent important pathways for the spread of invasive species. It is normal for conflict zones to have a lower density of roads and populations.

We suggest that former isolation and conflict areas can be regarded as opportunities for biodiversity conservation and to strength cross country relations. In fact, as already shown with the German Green Belt project, border areas can become important areas for conservation due to higher habitat quality, namely forest cover and reduced density of infrastructures.

Here we provide an assessment of the potential for political European borders to function as key conservation and connectivity areas by evaluating and comparing the number and size of roadless areas within countries and along their borders.

The northern and eastern countries have the highest cover in roadless areas, together with Spain. However, Borders of eastern countries have significantly higher cover of roadless areas, namely from Belarus down to Croatia and Greece. Moreover, all European border with Russian Federation has also much higher cover of roadless areas. Interestingly, the borders of the northern countries, Norway, Sweden and Finland have also a higher cover of roadless areas.

We further discuss how focusing on conservation action at borders can become a "win-win" outcome with advantages for both biodiversity and human peace. In particular, conservation of flag species, as bear and lynx, at borders of main geo-political blocks can be used to increase the cooperation between such regions and with that ensure long last peaceful coexistence.



## Challenge to define and quantify ecosystem collapse debt

(Oral)

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Degradation and loss of ecosystems are of great global concern. It is likely that decline of ecosystems will continue and a debt of ecosystem loss exists, comprising of 1) direct and expectedly continued forcing by detrimental anthropogenic actions and 2) of indirect ongoing gradual change of defining characters set in motion by an initial perturbation. Both direct destructive actions and indirect gradual changes contribute to collapse, i.e. loss of defining characters of certain type of ecosystem. Classification and typology are central to any assessment of risk of ecosystem collapse. Following indirect gradual change, an ecosystem does not vanish, but it may lose its characters and fall beyond its definition. Resulting state after such change may present another known ecosystem type or a novel ecosystem type. The recognition between these alternative states can be based on identifying novelty, degree of deviance from existing ecosystem typology, e.g. using measures of dissimilarity of biotic communities.

Ecosystem Collapse Debt (ECD) refers to the amount or proportion of certain ecosystem type that has not yet collapsed, but is predicted to collapse as a direct consequence of continued actions or as indirect response to prevailing or foreseeable future circumstances. This prediction needs to be based on known processes and mechanisms. Examples are presented of cases of peatland ecosystems. Intensive drainage and peat extraction activities, representing destructive exploitation, have caused tremendous loss of natural peatland ecosystems during recent past. However, the remaining untouched peatland areas are changing too, although more gradually, e.g. due to climate change or hydrological alterations of catchments. Such changes may contribute to ECD of peatlands even if most destructive utilization had ceased.

In Finland, approximately 15 % of boreal aapa mire area (patterned fens) has been lost during recent past (ca. 50 yr) due to direct effect of drainage of these peatlands, representing a relatively low level of disturbance among different peatland types. However, it is estimated that approximately 40 % of the remaining aapa mires occur in situations, where their hydrology is disturbed by drainage of surrounding areas. From case studies we know that such changes can lead to collapse within few decades, as defined by major vegetation changes readily observed from remote sensing proxies. If all disturbed aapa mires are changing beyond our definition of aapa mires, the ECD in this case may amount up to about 150 000 ha or about one third of the remaining area of this ecosystem type in Finland. Furthermore, it is likely that climate change will have impact on this northern ecosystem and contribute to build up ECD. This is a rough calculation of limited precision and conditional to many details, including the definition of the ecosystem. However, it should work to exemplify how ECD works to communicate the extent of ecosystem degradation.





## Population genetic assessment of the brown bear across Northern Europe - National and transboundary perspectives and challenges

(Oral)

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Nowadays the brown bear (*Ursus arctos*) in Northern Europe is distributed from Russia to Scandinavia in the west. Refuge areas in which some brown bears survived, and immigration of bears from Russia, were assumed to be the forces behind the recovery of these populations. For some years now, large parts of Northern Europe are monitored using non-invasive genetic sampling and microsatellite markers for individual identification as well as other genetic analyses. I compare the results of the different population genetic assessments of these transboundary populations covering Norway, Sweden, Finland and parts of Northwestern Russia (1-4), plus latest updates. Population genetic structure was analyzed with Bayesian methods as well as classical population genetic indices (e.g.  $F_{ST}$ ). The varying results and implications of genetic differentiation ( $F_{ST}$ ,  $G_{ST}$  etc.), gene flow (private alleles, BayesAss) and population subdivision (Structure, Geneland) will be discussed. Although the majority of results support each other, a single result in itself would not be sufficient to understand the current status or be illustrative of the genetic connectivity or disconnection among different regions. At the same time, sampling scheme and geographical scale have considerable impact on the result and thus the reliability of the assessment. Overall, the results showed limitations of gene flow between the east and the west and indicated population genetic boundaries where no obvious, geographical barriers exist. Further, a mismatch between

demographic and genetic connectivity was found. The multiple analyses of population differentiation and genetic variation revealed that the recovery processes of the Scandinavian brown bear population probably were different to the immigration driven recovery of the Finnish brown bear population.

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Photo: Alexander Kopatz. Male brown bear at the Finnish-Russian border.

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## Conflicts at Sea: Modeling the occurrence of biotopes and human pressures

(Oral)

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Planning ecologically sustainable use of marine areas requires recognition of the ecological values and understanding what effects anthropogenic activities might have. Parks & Wildlife Finland has started series of projects to create methods for biological modeling as well as human pressure modeling to aid the MSP –processes. These methods will also be used in assessing the protection status of marine protected areas.

Man has been using the sea as a source of food and a passage for traveling throughout history. During the past 100 years, ways of utilizing the sea has become more diverse and their intensity have drastically increased. Growing demands of different actors have led to increasing problems at sea. Situations where human activities are overlapping with areas of high environmental values is quite common but could be avoided in many places with sufficient planning efforts.

Mapping ecological values such as occurrence of species and biotopes is essential for assessing human impacts. Inventories have been conducted along the Finnish coast for the past 10 years and vast amounts of information have been gathered. However, the field inventories have relatively small spatial coverage and it is concentrated to the protected area network. Parks & Wildlife Finland has deployed modeling efforts to spread the information from the field to cover all national sea areas. Biological modeling strives to describe environmental conditions in areas where field observations are sparse or does not exist. The modeling process uses information on physical features such as salinity and temperature to indicate what kind of areas are most preferable for certain species or biotopes. During the SeaGIS 2 project modeling methods have been used to reveal the spatial occurrence of 23 of the most common underwater biotopes from Finland and Sweden in the Kvarken region. These methods will be applied on modeling all off Finnish marine areas in 2018-2019 and the methods will be further developed in the SeamBOTH project in the Bothnian Bay.

In SeaGIS 2 we have used cumulative human pressure modeling to indicate the overall impacts from human activities on the marine environment. By modeling we have estimated influence areas of human activities for each pressure they are expected to cause. For e.g. where noise from ship traffic is frequent/ disturbing and where dredging causes bottom sediment disturbance. The modeling process needs information on human activities, the marine nature and how much each activity is estimated to cause disturbance for each species or biotope. With this information it is possible to calculate areas that have most likely been affected by human activities. The method has already been used on the SeaGIS 2 –project area and will be applied on the whole Finnish coast in 2019.



## National and transboundary perspectives of large carnivore conservation and management in Norway

(Oral)

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Norway shares its populations of lynx (*Lynx lynx*), wolverine (*Gulo gulo*), brown bear (*Ursus arctos*), grey wolf (*Canis lupus*) and Golden eagle (*Aquila chrysaetos*) with mainly Sweden, but also Finland and Russia. Norway and Sweden have a long history of dialogue and collaboration in questions relating to large carnivores (LC) in population monitoring and financing of long-term research. Monitoring collaboration has intensified in recent years with shared methodology and database, shared reporting of monitoring results and regular meetings to ensure that methods do not diverge between the two countries.

That Norway and Sweden share LC populations is nothing new, but using the same monitoring methodology and registering the data in a common database has provided an improved platform for studying transboundary issues [1,2,3].

It is clear that Norwegian and Swedish management strategies do not operate independently of each other, and may affect the other country's ability to achieve its LC management objectives. It is equally clear that population management would benefit from greater collaboration between the two countries also in the practical management of these species.

Norway and Sweden, as signatories to the Bern Convention, share the basic premises of LC protection and what is permitted as derogations from that protection. However, the Norwegian management policy is based on a principal of geographically differentiated management. This is a form of zonation to allow for viable large carnivore population while still enabling cultural and agricultural use of natural resources, of which free-range grazing of livestock is a significant part. Management in both countries is decentralised, but the manner in which this is organised differs between the countries. Norwegian population targets are precise and populations should be neither below nor above the set targets, whereas Sweden (as an EU member) identifies reference values for Favourable Conservation Status that act as de facto minimum population levels. These are all part of national frameworks that sometimes result in conflicting management objectives between the two countries.

These differences make it a challenge to achieve the same level of cooperation in the practical LC management as in monitoring. There is extensive dialogue between the Norwegian Environment Agency and the Swedish Environmental Protection Agency as central management authorities, and both central and regional management authorities are actively working to identify possible areas of cooperation. This includes, for example, a common handling of reports of wolves in close proximity to humans, and development of population level viability studies and harvest models.

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## Evidence for positive population-level effects of an agri-environment scheme on grassland butterflies

(Oral)

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Many studies have reported positive effects of agri-environment schemes (AES) on species richness and abundance, but studies demonstrating demographic, population-level responses, which is the desired outcome from AES, are rare. This is at least partly due to the difficulty in distinguishing between behavioural and demographic effects in snapshot studies. Here we report positive population-level effects of environmental set-asides (currently included in the national AES of fallows in Finland) in grassland butterflies and day-active moths.

We firstly identified a set of conditions that a species should meet in order to succeed in establishing a local population in an area where the focal agri-environment scheme has been applied. Secondly, we identified indicators for distinguishing the species that show true population growth from species merely visiting the AES area from the surrounding landscape. We then applied these indicators to two long-term butterfly and moth monitoring data sets (totaling 6925 butterfly and 11232 moth individuals) originating from (i) an eight-year set-aside experiment and (ii) a large, >10 years old set-aside field, thus identifying the grassland species that were capable of forming breeding local populations on long-term set-asides. We then tested predictions based on the two long-term monitoring data sets in another, independent butterfly and moth snapshot data set originating from 78 set-aside fields of different age.

Twenty-five out of the observed 65 species showed evidence of local population establishment, and 24 (96%) of these are considered as species preferring semi-natural grassland as their habitat. A large proportion of all the observed grassland-preferring species (53% of butterflies and 65% of moths) indicated local population establishment. As predicted, the probability of occupancy of the local population establishing species increased with set-aside age in the 78 set-asides. Moreover, the species establishing populations had a more strongly increasing occurrence probability with set-aside age than the species observed to occur on the experimental set-aside without actually breeding there.

Our results suggest that a substantial proportion of the Finnish grassland butterflies and moths form local populations in long-term environmental fallows of the Finnish national agri-environment scheme. Nine butterfly species with evidence of local population establishment on the set-asides comprise 25% of the 36 grassland-preferring species occurring in Finland. The average occupancy probability of these grassland species was 38% in the 45 out of 78 set-asides that were at least 5 years old. Our results indicate that the Finnish environmental set-aside scheme covering ca 5% of the national agricultural field area has positive population-level effects in many common grassland species. Thus it forms a significant means of supporting grassland biodiversity besides conservation management of semi-natural grasslands.



## Linking conservation biology to community assembly processes with hierarchical modelling of species communities

(Oral)

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Applications in conservation biology require a profound understanding of community ecology, in particular of the processes that determine the assembly and dynamics of species assemblages at different spatiotemporal scales. To facilitate the integration between conceptual and statistical approaches in community ecology and conservation biology, we have developed Hierarchical Modelling of Species Communities (HMSC) as a general, flexible framework for modern analysis of community data (1,2,3). HMSC belongs to the class of joint species distribution models, and it makes it possible to derive simultaneously species- and community level inference from data on species occurrences, environmental covariates, species traits, and phylogenetic relationships. HMSC applies to a wide variety of study designs, including hierarchical data, spatial data, temporal data, and spatio-temporal data. I describe the general HMSC framework and discuss with examples how it helps making more out of data in the context of applications in conservation biology.

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## Green or Brown, Built or Open? Correlations between landscape preferences in an arid ecosystem, underlying environmental values and demographic characteristics.

(Oral)

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Understanding the determinants of natural landscape preferences has attracted theoretical and practical interest. Researchers suggest both universal and particular preferences, with particular preferences correlating with ethnicity, age, gender and other variables. In previous work, we found correlations between political opinions and disciplinary expertise and landscape preferences. In the current research, we evaluate the relationship between landscape preferences and two sets of indices, one defining environmental values orientation (Schultz, 2000), and one characterizing nature relatedness (Nisbet et al. 2009).

Using a questionnaire and photo album featuring natural and human-altered landscapes in Israel's Negev Desert Highlands, we queried 425 respondents regarding landscape preferences. Respondents included local residents and tourists, and representatives of diverse ages and economic, ethnic, and educational backgrounds. The questionnaire also included two sets of environmental/nature values clarification questions.

Results revealed significant correlations between landscape preferences and environmental values, on the one hand, and landscape preferences and some demographic characteristics, on the other. Respondents who identified as biospheric (as opposed to altruistic or egoistic) were strongly associated to landscapes devoid of anthropogenic artifacts (e.g. roads, power lines or agricultural fields). Respondents whose attachment to nature was deemed by the nature-relatedness indices as intellectual in character were drawn to landscapes with no obvious human interventions, as were those whose nature relationship was experiential. On the other hand, those whose nature relationship was more spiritual showed higher preference for landscapes with human settlement. Respondents who were considered anthropocentric had a higher appreciation for agricultural landscapes and lower preference for natural landscapes with no discernible human impact.

There were significant differences between Bedouin and Jewish respondents, with Bedouin ranking human (Bedouin) landscapes higher and undisturbed landscapes lower than Jewish respondents. Alternatively, local (non-Bedouin) residents ranked human disturbed landscapes lower than visitors (tourists), who ranked agricultural landscapes with high preference value.

The research shows that environmental values and nature relatedness indices may be strong predictors of landscape preferences. Underlying environmental values are correlated to positions in favor of or against human intervention in arid landscapes. Demographic profile (Bedouin or Jewish, tourist or resident) also correlates with landscape preferences. Landscape management decisions will thus depend on potentially contradictory desires to contradictory desires to conserve natural landscapes or to develop tourism targeting visitors from out of the region, who prefer green and developed landscapes despite the desert context.



## Can walking dogs influence experience of nature and conservation attitudes? Results from a cross-cultural study

(Oral)

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Urbanization threatens both biodiversity and people's opportunities to interact with nature. This progressive disconnection from the natural world is profoundly concerning as it affects human well-being, health, attitudes and behaviors towards nature [1]. In search of a solution, increasing the quantity of experiences of nature (EoN) has been found to enhance health and well-being benefits [2], but it remains unclear whether it can also affect attitudes and behaviors towards nature. Additionally, current understanding of the outcomes of EoN is case limited, while this expanding extinction of experience of nature is a global crisis [3].

Here, we conducted a cross-cultural survey among 741 people from France, Israel and the UK to explore how measures of affective and cognitive relation to nature and conservation attitudes differ between dog-owners (who are entailed to go out more often), non-pet and cat-owners. This setting was used as a pseudo-experiment to explore the relationships between EoN, nature relatedness, ecological literacy and conservation attitudes. We first demonstrate that affective and cognitive responses to nature significantly vary across countries. We also confirmed that dog-owners go out more often and in more diverse places. However, we found that although dog-ownership was associated with people's relatedness to nature, the increased quantity of EoN did not correlate with either increased ecological literacy or conservation attitudes. Thus, the quantity of EoN may not be sufficient for mitigating the extinction of experience and consequently a more profound understanding of the quality of EoN and the means to enhance it are needed. Overall, this study demonstrates the importance of scaling-up from single-country to cross-cultural studies, as a "one-size-fits-all" approach is unlikely to work with respect to appropriate metrics for measuring the quantity and quality of EoN, and when promoting policies that can enhance meaningful interactions with nature.

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## Evidence for the critical importance of anti-poaching patrols to protect African wildlife

(Oral)

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Tropical forests are on the front lines of the current global extinction crisis, and effective conservation strategies are crucial to prevent continued wildlife declines and extinctions. The establishment and maintenance of protected areas have constituted a primary strategy to safeguard wildlife against anthropogenic threats including overhunting and habitat destruction and degradation. Empirical research is critical for determining their effectiveness. Part of West Africa's Upper Guinea Forests biodiversity hotspot, protected areas in Ghana include both Wildlife Protected Areas (WPAs) and Forest Reserves (FRs) where all hunting is prohibited. Their management differs in that WPAs feature active anti-poaching patrols, whereas FRs lack law enforcement staff. WPAs and FRs include both logged and unlogged forest, but only FRs feature active logging concessions. We conducted surveys and camera trap sampling to assess forest mammal communities and poaching pressure in nine protected forests in Ghana, including both WPAs and FRs featuring both logged and unlogged forest. From April 2009 to April 2010, we completed 134 hours of surveys, comprising a total distance of 193 km, as well as 1170 trap nights of camera trap sampling. We assumed that not all species were detected and used a bootstrap approach to estimate species richness from empirical species abundance curves generated by our sampling data. Many mammal species, such as diurnal primates and forest elephants, were predominantly or exclusively in WPAs with active anti-poaching patrols, and rarely or never in FRs. We found more evidence of poaching than of mammals in FRs, whereas we found significantly higher mammal species richness and abundance in WPAs with active anti-poaching patrols. In FRs, we found that mammal species richness was four times higher, and abundance five times higher, in unlogged compared to logged forest, indicating a strong negative influence of logging on mammal species richness and abundance. These results are comparable to parallel studies of forest birds (Arcilla et al. 2015, Holbech et al. *In review*), which indicated severe adverse effects of logging and poaching on wildlife species richness and abundance in the absence of law enforcement. These findings highlight the acute poaching pressure and habitat degradation faced by wildlife in logging concessions, and demonstrate the effectiveness and crucial importance of anti-poaching patrols for wildlife conservation.

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## Conservation status of the Endangered Pygmy Hippopotamus choeropsis liberiensis in Sapo National Park

(Oral)

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Sapo National Park (SNP), Liberia's largest protected area is globally recognized as a biodiversity hotspot and a stronghold for many threatened species in the Upper Guinea Rainforest, including the Endangered pygmy hippopotamus *Choeropsis liberiensis*. However, little is known about the current status (distribution, population density, and threats) of the pygmy hippopotamus in SNP. To address this data gap, this study surveyed 62 transects of 2 km each across the SNP and set up camera traps in the south-western part of the park where the first footage of this species was recorded in 2011. Pygmy hippopotamus signs were recorded on 11 transects with an estimate of about 22 individuals. Out of 24 camera traps, pygmy hippopotamus were captured by four cameras in 178 images. The distribution map showed high concentration of the species in the south-western part of SNP compared to other areas. In addition, hunting signs including trails, camps and gun shells were recorded and increasing mining activity was also observed in this part of the park. While this study reconfirms the presence of the species, the presence of anthropogenic threats in the areas where the species is present, plus anecdotal evidence from local communities about the killing of the animal suggests that they face huge existential threats. Findings from this study will provide baseline information for future research and will inform management practices aimed at more effectively managing SNP as an important habitat for pygmy hippopotamus.

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## Biodiversity accounting in life cycle assessment – a novel method

(Oral)

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Biodiversity accounting in life cycle assessment – a novel method

Life cycle assessment (LCA) of products may be an indispensable tool in the transition towards a sustainable lifestyle and planetary wellbeing – but parameter evaluation has often been limited to greenhouse gas emissions and inclusion of biodiversity effects has shown to be notoriously difficult. I developed a new and universally applicable method for biodiversity accounting in LCAs. The biodiversity effect measure BE quantifies the change in extinction risk of all species in an assemblage as a result of a land use change or some other kind of external influence impinging on the species, summed across the assemblage. It consists of four components, impact overlap IO<sub>i</sub>, population impact PI<sub>i</sub>, national and international Red List risk categories (PENat, i; PEint, i), and a concentration measure C<sub>i</sub>. Impact overlap IO<sub>i</sub> quantifies the spatial relationship between impact area and species range. Population impact PI<sub>i</sub> specifies the degree and direction of the land use change consequences for a population of the species *i* within the impact area. The use of national and international Red List categories is based on the consideration that extinction risk change owing to land use change intervention depends on extinction risk in the first place – the first derivative of an exponential function is also an exponential function. Finally, the effect on a particular species depends on the concentration of populations C<sub>i</sub> in the impact area; the more a species is restricted to the impact habitat and impact area, the higher the quantitative weight of the species within the assemblage. The measure BE, accounting for biodiversity effects in a standardized area, is then obtained by summing up the values obtained for single species. To obtain universally comparable values, the quantification method is currently restricted to mammals, birds, amphibians and reptiles, organism groups for which Red List categorizations are largely complete and ecological information is in most cases easily accessible.

The method can be applied both to subtle local changes in land use intensity and to large-scale or global product comparisons, as three application examples show. The first example quantifies the biodiversity effects of setting aside field margins as flower strips in Central Europe. The second example compares the biodiversity effects of conventionally grown potatoes and potatoes from organic agriculture. The third example quantifies the biodiversity effects of soybeans cultivated in Austria with those cultivated in Brazil based on several land use change scenarios.

Reduction of the equations developed for the general case – biodiversity accounting in LCAs – makes the method applicable to special cases, for example biodiversity accounting in monitoring or Environmental Impact Assessment.



## Tracking the origin of ivory through genetic analysis in Cambodia

(Oral)

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Cambodia is one of 13 countries that still contain dwindling numbers of wild Asian elephants, *Elephas maximus*. Now in highly fragmented populations, the Asian elephant is classified as endangered on the IUCN red list and they are believed to have declined by at least 50% in the last 60-75 years (Choudhury et al. 2008). The Asian elephant is facing multiple threats including deforestation, habitat fragmentation and illegal poaching. The latter, also a huge threat to its closest relatives in Africa, is often driven by demand for ivory. Although the trade of Asian elephant ivory is prohibited in Cambodia, trading non-native species, e.g. African Ivory, is unlegislated, and therefore ivory can be found for sale legally within the Cambodian domestic market. However, the origin of ivory is difficult to trace without laboratory analysis and so African and Asian ivory are often interchangeable in the market place. With the increasing wealth of China, the world's biggest market for ivory (Milliken et al. 2016), and the increasing number of Chinese tourists visiting Cambodia there is a high risk that this could increase demand for ivory. Not only could this threaten Cambodia's dwindling populations of Asian elephants but potentially create a hub for illegally trafficked ivory from around the world (Nguyen & Frechette 2017). We are therefore establishing in-country conservation genetic analysis capacity for the determination of species identification and origin of ivory samples traded within Cambodia.

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## Tree microhabitat abundance and richness in Central European montane forests as indicators for future old growth elements

(Oral)

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The continued provision of old-growth elements in forest landscapes has been identified as a critical factor for biodiversity conservation in Central Europe. A well-established method of estimating the potential of forests to maintain biodiversity is to quantify tree microhabitat structures. Our aim is to predict the microhabitat abundance and richness for collectives of potential habitat trees (15 largest trees per plot). Microhabitats were inventoried on 2085 trees across 139 plots (each 1 ha) and assessed based on a detailed catalogue comprising 64 different microhabitat structures in montane forests of the Black Forest, southwest Germany. We tested the influence of forest management, forest cover in surrounding landscape, forest type, structural complexity (number of standing dead trees), altitude and average tree size on the abundance and richness of microhabitats on living trees. Generalized linear models (GLM) were used to identify the significant drivers of abundance and richness of microhabitats. The results indicate that the abundance of microhabitats of the respective 15 trees is greater on plots located in higher altitudes. Increasing average tree diameter leads to significantly higher abundances and richness of microhabitats. The collectives of inventoried trees located in monospecific coniferous forests have the highest abundance but those in mixed-coniferous-broadleaved forests have the greatest richness of tree microhabitats. Additionally we explored to which degree specific microhabitat types are influenced by the forest variables. The occurrences of 11 out of 64 specific microhabitat structures show a relation to forest management, forest type, altitude or average tree diameter. Specific microhabitats are increasing in mixed-coniferous-broadleaved and in relation to average tree size. The altitude influences especially abundances of epiphytes on potential habitat trees. This study demonstrates that based on the selected forest attributes the average abundance and richness of microhabitats can be reasonably well predicted and the occurrence of specific microhabitats can be identified.



## Biodiversity conservation on farmland: start at the landscape level

(Oral)

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For decades, policy makers, NGO's, companies in the agro-production chain and farmers are struggling to improve biodiversity in Europe's countryside. Most efforts focus on individual farms. However, we know that in biodiversity conservation the landscape level is highly relevant. Basic conditions like the area of non-cultivated land are of major importance for most species groups. Just like the close proximity of nature areas. The EU proposed in its Common Agricultural Policy that 3–7% of EU farmland should be managed as Ecological Focus Area in order to halt biodiversity loss. We empirically assessed the implications of this policy by evaluating the effects of the density of natural elements in the agricultural landscapes of The Netherlands on multi-taxon species richness, including vascular plants, breeding birds, butterflies, hoverflies, dragonflies, and grasshoppers. We found that species richness increased as a function of the proportion of natural elements in the landscape. Even landscapes with 3–7% of natural elements harboured generally 37–75% of maximum species richness. However, differences between the 3 and 7% limits were considerable for butterflies, birds, and hoverflies. To improve biodiversity it is necessary to develop tailor-made approaches at regional levels, including all relevant stakeholders.

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## National and transboundary perspectives of large carnivore conservation and management in Finland

(Oral)

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Finland's large carnivore (LC) populations have been increasing and expanding during the last 20 years; brown bear and wolverine populations have doubled, and populations of Eurasian lynx and grey wolf many-folded. However, based on IUCN criteria for national assessment, brown bear and lynx are currently red-listed as near threatened, and wolf and wolverine still classified as endangered. Population growth has mainly taken place south of the reindeer husbandry region. Wolverine is the only species that was protected from hunting until winter 2016/2017 when the first licenses for the husbandry region were approved. Annual harvest quotas, issued by the Ministry of Agriculture and Forestry, are regional, based on monitoring programs (all species) and Bayesian scenarios for sustainable harvest (bear, lynx), executed by Natural Resources Institute (Luke) as well as on the extent of damages caused by LC, concerning especially depredation in semi-domesticated reindeer herds. Finnish Wildlife Agency processes applications for hunting licenses which are specific for each applicant with an exception of autumn season bear hunting in the reindeer husbandry area. Local displeasure and frustration on wolves and wolf management, owing e.g. to wolves' attacks on domestic dogs and fear is fueling poaching that has a great influence on wolf population size and management interventions in Finland. Several measures for conflict mitigation have been launched in recent years, including e.g. territory-based cooperation groups comprised of local stakeholders. From a transboundary perspective, connectivity between eastern and western populations is not strong in Fennoscandia, largely due to fragmentary LC populations in most districts of the reindeer husbandry area. In view of e.g. spatial wolf pack data and dispersal distances by Finnish wolves, a major role of Russian wolf packs, as potential source packs, appears to be obvious. The major chapters in transboundary cooperation are genetic research on population histories and current connectivity, and the change of information concerning wolves and other large carnivores moving near border between Finland and Scandinavia.



## Does EU matter for Conservation? The Birds and Habitats directives from a Nordic perspective

(Oral)

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The EU Birds and Habitats directives (and the associated Natura 2000 network) has recently been evaluated within the so called "Fitness Check" (EC 2016). This has resulted in a new Action Plan aiming to "rapidly improve practical implementation of the Nature Directives and accelerate progress towards the EU 2020 goal of halting and reversing the loss of biodiversity and ecosystem services, including in relation to climate resilience and mitigation" (EC 2017). However, not all European Countries belong to the EU and conservation efforts has clearly been taken also in the countries not belonging to EU. During this workshop we aim to explore to what extent the EU system provides added value to efforts taken at national level in non-EU countries. By contrasting the Nordic nations, we may be able to identify which aspects that are supported by international initiatives. Among the Nordic nations, Finland, Sweden and Denmark are members while Norway and Iceland are not.

Although ecological differences exist, the Nordic countries share many common aspects both concerning ecosystems, environmental policies and legislation. The workshop will open with short statements given by researchers, governmental representatives and legal expertise, and include a panel discussion to which the participants are invited to contribute. The workshop will highlight what is known today about the effects of EU legalisation on conservation work, but more importantly to identify gaps in our current knowledge and pointing at new research (and possible co-operation) needed.





## Assessing population coherence and connectivity: some methods and caveats

(Oral)

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Genetic tools have been championed as providing novel and sensitive ways to detect the otherwise cryptic movements of organisms, and their genes, in the context of landscape connectivity. A variety of statistical approaches have been developed to detect migrants and their descendants within populations of conservation concern. These methods have taken advantage of increasingly powerful molecular approaches, initially from microsatellite DNA profiling, now to whole genome resequencing<sup>1</sup>. The transition from standard molecular ecology techniques to population genomics not only allows the demographic consequences of migration and gene-flow to be better inferred, but the fitness consequences may become predictable too.

Inferring movement between populations that are genetically very similar (possibly because they recently lost contact, or because gene-flow is reciprocal) has been traditionally challenging using a handful of DNA profiling markers, but the resolution of this approach will be transformed by the application of genome-wide datasets. Recent and ongoing studies, using whole genome resequencing of species benefitting from well-annotated reference genomes, have been able to shed light on likely chromosome and finer scale effects of immigration and for managed translocation/gene-flow, which potentially puts individual fitness-defining genomic variants in the hands of conservation managers.

The conservation implications of this transformation in our ability to resolve connectivity and population coherence remains, however, unclear. For instance, when assessing the likely benefits of gene-flow, whether natural or by assisted translocation, the balance between genome-wide versus locus-specific management has yet to be fully assessed, especially in the context of environmental heterogeneity. One possible solution is the use of so-called landscape genomics tools that simultaneously evaluate genomic and large-scale environmental datasets<sup>2</sup> but these methods can produce conflicting results and/or different rankings and priorities. I will discuss these problems and methods in the context of ongoing conservation initiatives in Europe and at a global level, with the aim of proposing research avenues and policy discussions that could be relevant to advancing this exciting new field.

1. Carroll EL, Bruford MW, et al (2018) Genetic and genomic monitoring with minimally invasive sampling methods. *Evolutionary Applications*. In press.

2. Stucki S, Orozco-terWengel P, et al (2017) High performance computation of landscape genomic models including local indicators of spatial association. *Molecular Ecology Resources* 17: 1072-1089.



## Landscape level conservation needs more than a plan: understanding conditions for forest biodiversity governance

(Oral)

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Despite the introductory and concluding remarks in most conservation papers and funding applications, the main bottleneck for applying knowledge towards effective conservation is not our understanding of forest structures that support species diversity, required parcel sizes or connectivity. Instead, the understanding of the institutional conditions for different management solutions and the core characteristics of governance mechanisms and their feasibility constitute a genuine knowledge threshold. In this setting, the knowledge needs do not feed to the conservation science community. Neither does the conservation science community have access to the learning and innovation taking place in the policy and practice of forest management. At the same time, forest conservation science is producing a wealth of knowledge about species interactions, structural and functional connectivity, and spatial analyses of ecosystem service provision and trade-offs in the landscape. The mismatch between an understanding of governance and ecology generates unnecessary delays in knowledge diffusion to practice. Even worse, it might result in the ecological understanding produced by science never meeting the target of improving conservation.

In this conceptual paper, I position the commonly identified conservation knowledge gaps, i.e. endangered species, valuable habitats and ecosystem services, as well as their spatial constellations, against governance mechanisms. I develop the conceptualization of governance from institutional theories in literature and illustrate it with cases from published empirical analyses of forest conservation and sustainable management.

The analysis pays attention to the different functions and benefits of forests that are manifested at the landscape level as well as to formally and informally stated rights and responsibilities of actors as regards these functions and benefits. The goal of the paper is to show that the recognition of these institutions is a prerequisite for any governance solution that should change conservation policy and practice.

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2018/06/14

13:45

Room: K306 Anton



## Modeling the habitats of the wild Asian elephant (*Elephas maximus*) in western Terai of Nepal

(Oral)

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Abstract of this presentation is not public



## Conserving biodiversity in agricultural landscapes: a win-win for farmer and wildlife?

(Oral and Poster)

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Although agriculture depends critically on biodiversity-based ecosystem services such as insect pollination, conservation of biodiversity in agricultural landscapes has seen little uptake by the agricultural sector. We argue that this is largely because we lack knowledge on the relative importance of pollination compared to conventional agricultural inputs. Using the real-world variation in pollination and agricultural management of 36 commercial leek seed production fields in France and Italy, we show that the benefits of having more wild pollinators is at least as large as the benefits of management enhancing plant quality. Although the bulk of the pollination services was delivered by a few abundant bumblebee species, a diverse pollinator community replaced, or complemented these dominant species, depending on the crop variety. We furthermore show that crop yields are equally large, or even larger with 50% less agricultural inputs, and are consistently larger with more pollinator visits. Both the dominant and the scarce crop pollinators were positively correlated with cover of semi-natural habitats and the regional pollinator species pool, illustrating the benefit of conserving natural elements in agricultural landscapes. However, the dominant crop pollinators were largely absent in the landscape just prior to leek flowering, possibly because they are specialized in exploiting mass-flowering (crop) plants. Identifying where these important pollinators acquire their resources in agricultural landscapes throughout their flight period is essential to convince the agricultural sector to conserve biodiversity in agricultural landscapes and how to take measures.



## Managing elephants in the modern world: the impact of changes in traditional handling on semi-captive Asian elephant welfare

(Oral and Poster)

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The current extinction crisis is leaving us increasingly reliant on captive populations to maintain vulnerable species. Approximately one third of the remaining global Asian elephant population (~15,000) are managed by humans and live in captivity to some extent (1). The vast majority reside in semi-captive conditions in range countries, and their relationship with humans stretches back millennia. Despite this long history, they have never been fully domesticated as they have always reproduced independently of humans (2). Instead, we rely on expert knowledge accumulated over generations of specialised elephant handlers, known as mahouts, to handle these essentially wild animals. This ancient profession, and the associated prestige and lifestyle, may be under threat in the modern day. Little is known about how invaluable mahout knowledge will survive, and how any recent changes may affect elephant welfare. Our study focuses on the keeping system of semi-captive timber elephants in Myanmar. As the only country still extensively employing elephants in the logging industry, Myanmar has the largest captive population of Asian elephants in the world (~5000), with the largest remaining traditional mahout system (1). Here we investigated how recent changes within the country may have affected the mahout system and the elephants in their care. Through interviews with experts of over 10 years' experience and with current mahouts from camps in Northern Myanmar (n=145), we found that mahouts now are younger (median age 22), less experienced (median 2 years), and change elephants frequently; factors indicating a threat to traditional knowledge transfer. We next assessed the impact of these mahout characteristics on elephant health (haematology, nutrition, serum chemistry) and stress hormone levels (faecal glucocorticoid), to better understand the effects of these demographic shifts on the well-being of elephants across their range countries. Our study provides an insight into how changes to the traditional handling of semi-captive populations need to be considered within the conservation management in this endangered species, which is applicable across their range. We specifically suggest a need for an active circulation of expert knowledge through formal training, rather than relying on passive knowledge transfer.

1. Sukumar, R. The living elephants: evolutionary ecology, behaviour, and conservation. Oxford University Press (2003).

2. Lair, R. C. Gone Astray: The Care and Management of the Asian Elephant in Domesticity. FAO, Bangkok (Thailand); Rome (Italy) (1997).

2018/06/14

13:45


Room: K308 Cabinet



## The conservation value of ecosystem engineers

(Oral and Poster)

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Abstract of this presentation is not public



## More networking, more local success in plant conservation

(Oral and Poster)

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Our actual activities in plant conservation are very obvious: we want to restore long-term and healthy populations of species and conservation experts need the results to be more effective on the field, in practice and measure the indicator values of restoration or reintroduction. The key points of the network are the wide membership status of the members: more than 70 institutes of about 40 countries have been involved in the



activities of the network during 23 years. The positions of the members are also very wide: from the practical conservationist to the high academic researchers there are several members from every age. The thematic plan and the programmes are coordinated by the advisor board and the steering committee members. The biennial conference is the most important forum of the network where the thematic programme presents research results from all areas of wild plant conservation activities mainly from Europe but sometimes there are presentations from other areas, too. Art exhibitions, photo competition of wild plants, education and volunteer activities can be presented during the conferences, which have been organised 8 times until now. The main purpose of the network is to make every personal effort visible which has been done for wild plant protection in Pan European countries. The authors of the presentation give a cross section of the European Strategy for Plant Conservation (ESPCS) which was the first initiative to define a vision for European plant conservation beyond 2010 and the importance of publishing its review in 2018, as a relevant background for the upcoming drafting process of new agendas for the next decade 2020-2030. This Strategy brought coordination and a clear focus to a wide range of issues, focusing on many activities which existed or were planned to halt the loss of plant diversity in Europe. The targets have been developed by the Planta Europa Network and the Council of Europe in partnership with other related conservation organisations. . The number of species, the number of endemic species for a certain area, the data deficient areas must be public and visible as many other data. But it is also important to share national projects, databases and online national flora sites, to promote local ex situ plant nurseries or share field experiences to work effectively for plant conservation. The results of Planta Europa conferences and meetings which were published in print and online are also representative examples for effective plant conservation.

1. Planta Europa (2008) : A Sustainable Future for Europe; the European Strategy for Plant Conservation 2008-2014. Plantlife International and the Council of Europe ISBN: 1-904749-91-7.

2. Hamilton, A. Hamilton, P. (2013): Plant Conservation: An Ecosystem Approach: People and plants conservation series. Earthscan, London.



2018/06/14

15:00

Room: C1 Hall



## Community-assessment on Participatory Conservation of Mount Cameroon National Park

(Oral and Poster)

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Mount Cameroon National Park (MCNP) is located in the South West region of Cameroon. It's ecologically significant with >2000 flora species influenced climatically by average annual temperatures of 24 to 35 (c) degrees, volcanic soils, excess sun shine, and average annual precipitation >2500 mm.

By 21st century, MCNP became of political interest; identified as an IUCN biodiversity hot spot, and designated a protected area by Cameroon's government in 2009. In addition, legal agreements such as Cameroon's 1994 Forestry Law ensures rights and benefits of indigenous people living close to protected areas.

In terms of local communities, Bakweri people have arguably been the most known early hunter-gatherers and settlers in the area of whose livelihood depend greatly on subsistence agriculture as documented far beyond 16th century. Forest not only serves for ancestral worship, but for harvesting medicinal plants, sheltering during hunting, transportation, harvesting of wood and spices, and cultural events. Such activities have eventually been modified by influx of outsiders from neighboring and distant places who introduce new habits of trading for income.

In 2014, a Ministerial decree established a management plan for MCNP focusing on Policy of Participatory Conservation. This provided mechanism for village representatives to decide on issues of conservation directly affecting the village and in collaborative-consultation with MCNP Service which is the core-authority in charge on management of the park. In return, villages receive financial bonuses based on monitoring and assessment reports which highlight if villagers are acting (or not) in conformity to laws that discourage unsustainable practices of forest exploitation.

Therefore, my study aims to; assess levels of village satisfaction on policy of Participatory Conservation, based on quantitative values assigned to levels of high, average, and low, derived from a case study and comparative analysis of 14 villages across the Bomboko and West Coast clusters of MCNP, and what implications this has for policy implementation. Applying methods of purposeful sampling, focus group discussions, and surveys, 238 respondents were interviewed. Findings show 53.6% high, 40% average, 6.3% less recorded for Westcoast; meanwhile >38% high, 59% average, and 23% less recorded for Bomboko. This was accounted for by road accessibility and nearness to CBD. We conclude that effectiveness of policy intervention in our study area depends on urban-proximity, accessibility and state amenity supplies, which seems to conform with dependency theories.

- 1.) Awung, N.S., and Marchant, R. (2016) Investigating the Role of the Local Community as Co-Managers of the Mount Cameroon National Park Conservation Project. MDPI Journals, Environments. Vol. 3(4), pp. 1-22.
  - 2.) MCNP Service (2014) Management Plan for MCNP. Archive data, MCNP Office, Buea, SW. Region, Cameroon.
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## People, pollution and pathogens – Global change impacts in mountain freshwater ecosystems

(Oral and Poster)

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Mountain catchments provide for the livelihood of more than half of humankind, and have become a key destination for tourist and recreation activities globally. Mountain ecosystems are generally considered to be less complex and less species diverse due to the harsh environmental conditions. As such, they are also more sensitive to the various impacts of the Anthropocene. For this reason, mountain regions may serve as sentinels of change and provide ideal ecosystems for studying climate and global change impacts on biodiversity. We here review different facets of anthropogenic impacts on mountain freshwater ecosystems. We put particular focus on micropollutants and their distribution and redistribution due to hydrological extremes, their direct influence on water quality and their indirect influence on ecosystem health via changes of freshwater species and their interactions. We show that those changes may drive pathogen establishment in new environments with harmful consequences for freshwater species, but also for the human population. Based on the reviewed literature, we recommend reconstructing the recent past of anthropogenic impact through sediment analyses, to focus efforts on small, but highly productive waterbodies, and to collect data on the occurrence and variability of microorganisms, biofilms, plankton species and key species, such as amphibians due to their bioindicator value for ecosystem health and water quality. The newly gained knowledge can then be used to develop a comprehensive framework of indicators to robustly inform policy and decision making on current and future risks for ecosystem health and human well-being.

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## Water for African Elephants (*Loxodonta Africana*): faecal microbial loads affect use of artificial waterholes

(Oral and Poster)

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Surface water availability is a fundamental constraint on herbivore distribution in semi-arid savanna regions. Artificial water provisioning has become a common practise in managing herbivore populations, especially in water scarce protected areas, where the aim is to increase populations while limiting their spatial dispersion. Artificial waterholes in semi-arid protected areas ensure that water is locally available to animals for extended periods, and make wildlife more accessible to tourists. On the other hand, they limit animal movement which contributes towards habitat deterioration. Challenges of artificial water provisioning exacerbate in the presence of African elephants (*Loxodonta africana*), an ecosystem engineer capable of transforming environments. We used camera traps to monitor elephant visitation at 21 artificial waterholes in various regions of the Kruger national park, and assessed water quality properties to determine the drivers of waterhole preference. The abundance of adult elephant per sampling site in relation to water quality metrics was assessed using linear mixed models (LMMs). A total of 1421 elephants were recorded drinking from the waterholes. There were no significant correlations between elephant abundance and physicochemical properties. However, there was a strong negative interaction between elephant abundance and levels of *Escherichia coli* in water. Our findings show that elephants avoid drinking water with high levels of faecal microbial loads. Since elephants are water dependant, we therefore concluded that their local landscape use and movement patterns at a fine scale is also primarily influenced by the quality of available water.

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## More effective Agricultural Environmental Schemes by professionalisation of farmer collectives?

(Oral and Poster)

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Agricultural environmental schemes (AES) have been implemented in twenty-eight countries in Europe. In 2013 the agricultural area under agri-environmental schemes was 26.3 % of the utilised agricultural area in the twenty-eight countries (Eurostat, 2017). There is however still mixed evidence about their effectiveness and efficiency (Kleijn, Berendse, Smit, & Gilissen, 2001; Kleijn, Rundlöf, Scheper, Smith, & Tschardtke, 2011; Kleijn & Sutherland, 2003; RLI, 2013). Over the past ten years different directions of enhancing a more effective and efficient AES have been conducted. One of these directions is the collaboration between farmers, government and other organizations. The new EU's Common Agricultural Policy (CAP) for the period 2015-2020 made it possible for collectives of farmers and other land users to be applicant and final beneficiary of subsidies. The Dutch Government decided on the renewal of the agri-environment scheme (AES). In this new system new farmer collectives have the role of final beneficiary for the AES. This should lead to higher effectiveness of nature management and lower implementation costs. One of the ambitions in the new system of AES is working with "professional" farmer collectives (Kamerbrief 390202a3 Nieuwe Stelsel Agrarisch Natuurbeheer, 2013). In 2013 the government and the agriculture associations started an extensive process of development, design and implementation of the new system. In 2015 a countrywide network of 40 new farmer collectives was established. (Snoo et al. 2016). Depending on the results of this period of Common Agriculture Policy (CAP), the next period of CAP 2021-2026 the farmer collectives will have again the role of final beneficiary for the AES. There has not been research about the current professionalization of the farmer collectives. As part of my PhD thesis to gain insight in the professionalization process of the farmer collectives in the new system of AES and the contribution to a more effective and efficient AES. The research question of this paper is: How to conceptualize professionalization of farmer collectives with an assignment for a government task? What are the essential key-elements in the professionalization? Professionalisation is a process by which individuals, organizations and systems in close collaboration become a professional association (Dowling et al., 2014). The first results of this research is a theoretical framework for professionalization checked by farmer collectives. In my presentation I will discuss this framework with examples of the farmer collectives.



## Learning Outcomes of an International Program in Cuba that Offers Undergraduates Opportunities in Authentic Research in Environmental Policy

(Oral and Poster)

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Short-term study abroad experiences are the most common type of undergraduate study abroad programs in the United States. Despite their prevalence, very few pedagogical frameworks exist that assist faculty in developing and implementing such educational programs. Moreover, and to the best of our knowledge, little empirical research exists on students' learning outcomes following their participation in a short-term study abroad experience with an integrated, authentic research praxis. To address these potential gaps in the literature, two pedagogical frameworks were used to structure an international embedded program in Cuba which allowed students to engage in authentic research experiences topically centered in international environmental policy.

While in field, students were able to explore and investigate the biodiversity of Cuban terrestrial and aquatic ecosystems, initiate conversations focused on environmental policy and sustainability with local experts and faculty, and work on methods to confront prominent environmental and sustainability issues that afflict this developing nation and the world at large. Following their field work, students worked to synthesize and analyze all collected field information and data while furthering their research through extensive primary literature and policy review. at their home institution.

Two frameworks were used to shape this course and implement a Course-based Undergraduate Experience (CURE): a three-step 'field course experiential learning model' for short-term study abroad programs, and a simple and flexible four-step pedagogical framework that guides an instructor through the process of designing and implementing a CURE. To quantify students' learning outcomes, we conducted an analysis of the content and delivery of students' research findings through their dissemination of a research poster presentation. This was completed using an internally designed rubric to assess students' intercultural awareness, cultural competence, and global knowledge resulting from their authentic research experiences in Cuba. Furthermore, the rubric also assessed overall comprehension of the complex concepts associated with environmental policy, sustainability, socio-cultural barriers, and of their research projects. In addition, we conducted semi-structured interviews with students a posteriori to obtain a nuanced and comprehensive understanding of students' affective shifts in the domain of research and environmental policy following their participation in the CURE/short-term study abroad experience. Lastly, descriptive interpretive analysis of student artifacts (i.e., students' journals and assignments originating from their time in the course) were coded for converging themes.

Preliminary quantitative and qualitative analyses of student artifacts and feedback indicate that students benefited in their understanding of international environmental policy, with an emphasis on the broader relevance of their research and an overall expansion of knowledge and affect in the domain. Student's semi-structured interview responses coupled with the analysis of their poster presentation indicate that students possess a newfound and explicit awareness of intercultural and socio-political and environmental factors resulting from the experiences students underwent during the CURE. Altogether, these analyses have shown that participation in this short-term study abroad experience/CURE has mediated an overall improvement in students'

research and presentation skills whilst furthering their understanding of the field of conservation biology and informing their future actions as researchers and environmentally-conscious citizens.

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## Audience Segmentation as a tool to improve targeting in tropical forest conservation: a case-study of a bushmeat hunting system in Liberia

(Oral and Poster)

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Techniques from the world of marketing could be applied by conservationists to improve behaviour change outcomes. One example is "audience segmentation", a method to improve targeting of interventions by differentiating groups that exist within a population. Tropical forest conservation typically involves a combination of different tools, requiring managers to make site-specific decisions about which to use and where. To design the most effective interventions, there first needs to be a clear understanding of who the intervention intends to influence. However, this is often not well defined in conservation projects, which are typically aimed at broad groups such as "local communities". This one-size-fits-all approach is inefficient if the population is comprised of heterogeneous groups that respond differently to different interventions. An improvement could be to apply the marketing technique of audience segmentation. Segmentation methods aim to sub-divide populations into groups that are internally homogenous, but differ from each other, in their response to different behaviour change mechanisms. This provides a basis for designing targeted interventions that are optimal for a specific group or groups. We evaluate audience segmentation as a tool in tropical forest conservation, using a case study from the Gola Forest, Liberia. We ask the pragmatic question of whether segmentation would have practical advantages over simpler approaches, given that conservation practitioners rarely have access to large datasets and little is known about the factors linked to successful behaviour change. We apply infinite binomial mixture models to perform cluster analyses of simple datasets describing household and individual livelihoods respectively, then compare the management implications to simpler approaches of using hunting behaviour as the targeting criterion. We found that targeting based only on hunting behaviour did not greatly improve efficiency of decisions relative to one-size-fits-all. The segmentation approach identified a distinct set of priorities for livelihood support tools relative to simpler methods, and provided novel insight for managers. A more nuanced perspective on targeted intervention design was possible by characterising segments across multiple traits. However, this advantage was constrained by the traits used to define segments which represented basic livelihood patterns, rather than psychographic factors associated with behaviour change. Segments captured variation in 3 out of 4 traits taken to be indicators of behavioural response to interventions such as law enforcement and messaging campaigns, whereas simple target group definitions did not. This provides evidence that segments would be a valid basis for designing targeted interventions. We conclude that even under conditions of limited data availability, audience segmentation is a promising tool to guide intervention design for site-based programmes.



## Results-based agri-environment payments: supporting farmers supporting nature

(Oral and Poster)

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There is a growing interest in the conservation potential of linking payments to land managers to ecological outcomes. We drew on the experiences of all schemes paying for biodiversity outcomes on farmland in European countries with the aim of identifying the decisive elements of the schemes' design and implementation as well as the challenges and opportunities of adopting the approach for biodiversity. We used evidence from peer-reviewed literature and technical reports, as well as 20 questionnaire responses and discussions with over 50 key experts in the field of agri-environment-climate policy and results-based schemes (RBS).

We identified 36 payment schemes in nine countries that could be called RBS for biodiversity. The majority are in N and W Europe and half are in Germany. Based on the extent to which the schemes' 'payment' and 'control' mechanisms are dependent on a priori specified biodiversity outcomes, we constructed a RBS typology.

Payments are based solely on results ('pure' RBS) in only five cases. Most RBS include some basic land management requirements. There is a growing body of research focusing on the approach, also with half of it from Germany. Most studies focus exclusively on the development and testing of ecological indicators and ecological performance. A handful of studies look at attitudes of payment recipients to the approach. In two countries research integrated ecological, social and economic assessments.

The evidence to date shows that there are at least 11 unique advantages to the RBS compared to management-based ones with similar objectives. These deal with environmental efficiency, farmer participation, and development of local biodiversity-based projects. Although results-based approaches have specific challenges at every stage of design and implementation, for many of these the existing schemes provide potential solutions. There is some apprehension about trying a results-based approach in Mediterranean, central and eastern EU Member States. We conclude that there is clear potential to expand the approach under the Rural Development programming period for 2021–2028. Evidence is needed about the approach's efficiency in delivering conservation outcomes in the long term, its additionality, impact on the knowledge and attitudes of land managers and society at large, development of ways of rewarding the achievement of actual results, as well as its potential for stimulating innovative grassroots solutions. We illustrate the approach with a Finnish case that explores ecological, social and economic dimensions.

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## Is integrated forest management effective in conserving biodiversity? The inter-disciplinary ConFoBi research programme

(Oral and Poster)

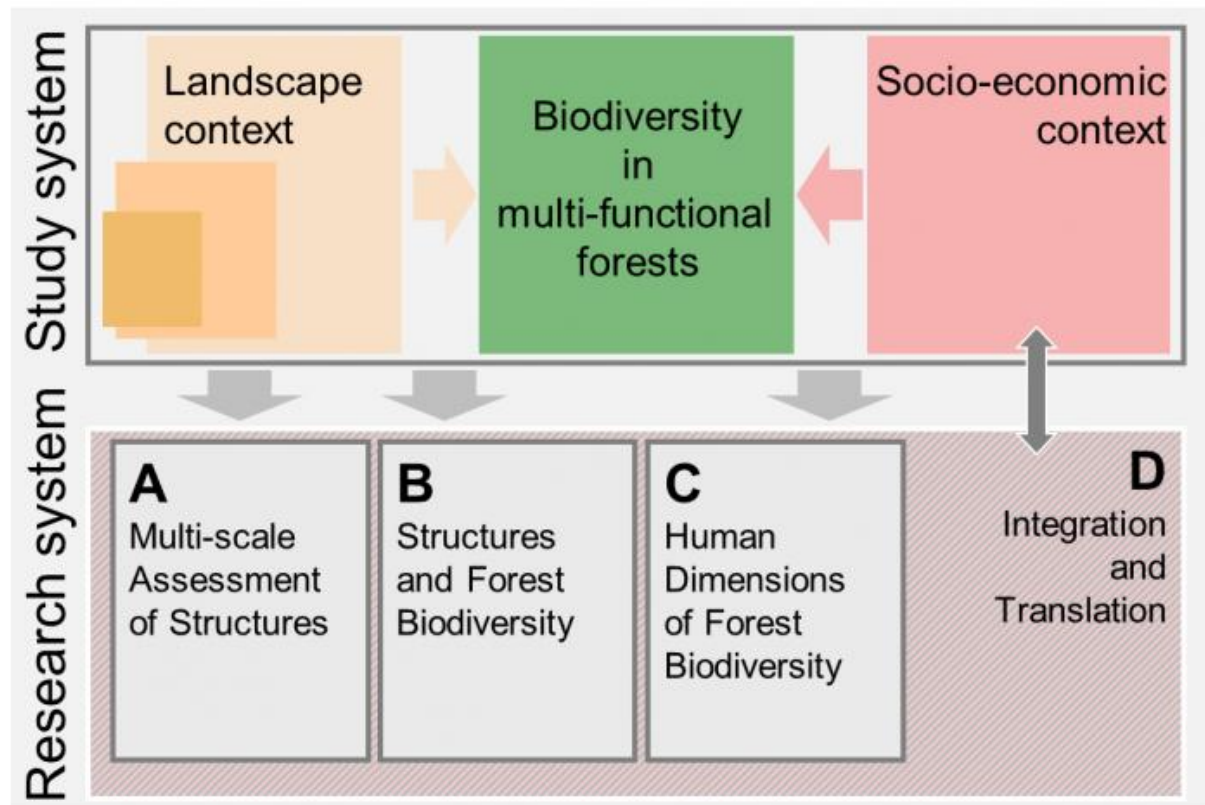
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ConFoBi (Conservation of Forest Biodiversity in Multiple-use Landscapes of Central Europe) is a major research and qualification programme of Freiburg University, Germany. ConFoBi combines multi-scale ecological studies on forest biodiversity with social and economic studies of biodiversity conservation. In addition to this interdisciplinary approach, ConFoBi is maintaining a lively exchange of expertise between scientific research and the demands of forestry and conservation practice throughout all stages of the project. Twelve PhD students supervised by researchers of Freiburg University, as well as the State's Forest Research Institute Freiburg (FVA), focus on the effectiveness of structural retention measures, namely habitat trees and dead wood, for the conservation of biodiversity in managed forests. ConFoBi focusses explicitly on multi-functional forests of Central Europe, using the mixed mountain forests of the Black Forest as a model system. ConFoBi formulates two lead questions: 1) What is the contribution of the landscape context to the effectiveness of retention for conserving biodiversity in multi-functional forests? 2) What is the role of the socio-economic context for the integration of such measures in forest management? The research programme comprises 4 Modules: A will provide tools for Multi-Scale Assessment of Structures ranging from trees to landscapes; B focussed on linkages between Structures and Forest Biodiversity by studying components of biodiversity (mainly epiphytes, vascular plants, insects, bats, and birds) along gradients of forest structure and connectivity; C uses social science and economic approaches to assess Human Dimensions of Forest Biodiversity such as opportunity costs and stakeholder perceptions; D focusses on the interface between science and society in order to study and foster Integration and Translation between ConFoBi and forest management. To maximize synergies, ConFoBi adopted an "all-measurements-on-all-plots" approach. All 12 research projects of ConFoBi work on the same 135 study plots, which were selected along two gradients: 1) forest structure, as indicated by the number of standing dead trees at the plot scale (1 ha), and 2) landscape connectivity, as measured by the proportion of forest with the 25km<sup>2</sup> surroundings of study plots. First results will be presented at this conference.



2018/06/14

16:30

Room: K306 Anton



## Past, present and future of environmental reporting in the Finnish forest industry

(Oral)

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DOI: 10.17011/conference/eccb2018/109071

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## The power of citizen science and big data to advance fungal conservation: setting the scene

(Oral)

Susana C. Gonçalves<sup>1</sup>✉, David Minter<sup>2</sup>, Beatrice Senn-Irlet<sup>3</sup>, Jacob Heilmann-Clausen<sup>4</sup>, Panu Halme<sup>5</sup>

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In recent years, fungal conservation has gained momentum #1. Fungi are increasingly recognized as key players in ecosystem functioning, and the need to consider Fungi in conservation is increasingly accepted. Fungi are a megadiverse Kingdom. Molecular tools are improving our knowledge about fungal biodiversity (in some cases with direct conservation relevance), but to be meaningful for conservation we need accurate biodiversity data across space and time. This is an especially difficult challenge in fungal conservation due to the massive diversity, taxonomic shortcomings and difficult detectability of fungi. In this context, citizen science recording schemes and the integration of databases, e.g. from digitizing natural history collections, provide valuable resources. In Europe, diverse citizen science-based databases are presently being used for advancing fundamental knowledge about fungal biodiversity, e.g. the Danish Fungal Atlas or the Swedish Species Observation Centre. Also, targeted citizen science initiatives are tackling specific questions regarding fungal conservation. For example, the “Lost and Found fungi” project asks if fungi not observed for more than 50 years in the UK are truly extinct or merely overlooked. In parallel, the integration of multi-sources databases from several European countries through the Norwegian-based “ClimFun” project addresses ecological questions pertaining fungal ecology under climate change at various spatiotemporal scales.

We believe the time has come to critically evaluate how these approaches can fill the gap between fundamental knowledge about fungal diversity and conservation action. The invited contributions in our symposium will showcase these and other similar initiatives. A specific objective is to explore tools that overcome encountered difficulties, e.g. to deal with geographical bias or bias related to volunteers’ behaviour. We aim to highlight successes, but also to pinpoint failures to promote debate during the discussions. We will also discuss how to effectively translate these data into information that can be used by decision-makers.

#1 J. Heilmann-Clausen, E. Barron, L. Boddy, A. Dahlberg, G.W. Griffith, J. Nordén, O. Ovaskainen, C. Perini, B. Senn-Irlet, P. Halme 2015. A fungal perspective on conservation biology. *Conservation Biology* 29: 61-68.



## Integrative nature conservation strategies for wood production and biodiversity conservation

(Oral)

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The importance of beta-diversity in European forest requires concepts considering a wide range of set-aside elements ranging from single trees or logs to large strictly protected areas. A successful combination of such elements in a country wide strategy requires knowledge on the importance of spatial scales, mechanisms from a landscape ecology perspective, on population dynamics and on ecological mechanisms responsible for locally diverse communities. Survey data often are blurred by too many confounding variables, which call for experimental approaches. Here I will present results from continental wide survey data and local experiments, answering some key questions how forests habitats can be improved for biodiversity of deadwood organism. Here the survey data cover the full range of European beech forests and provides new insights in the role of biogeography and climate for deadwood communities (1). Based on trait analyses I will show the most urgent targets for deadwood restoration in Central Europe (2). Based on an experimental design I will show that habitat amount is more important in forested landscapes than the spatial arrangement (3). Additionally I will present new results from a landscape wide practitioner experiment to restore a beech forest landscape. Finally I will show on the local level that enrichment of deadwood diversity is more important and at a lower price than focusing on the pure amount.

1. J. Müller et al., Increasing temperature may compensate for lower amounts of dead wood in driving richness of saproxylic beetles. *Ecography* 38, 499-509 (2015).
  2. S. Seibold et al., Association of the extinction risk of saproxylic beetles and the ecological degradation of forests in Europe *Conserv. Biol.* 29, 382-390 (2015).
  3. S. Seibold et al., An experimental test of the habitat-amount hypothesis for saproxylic beetles in a forested region. *Ecology* 98, 1613–1622 (2017).
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## Seven years of follow-up of continuous-cover forestry: responses of saproxylic beetles

(Oral)

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<sup>2</sup> Natural Resources Institute Finland, Finland

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Fennoscandian forest management has since 1950s been characterized by forest regeneration through clear cutting, with subsequent top-soil preparation, seeding or planting with conifers, and removals of legacy elements important for biodiversity, such as dead wood. According to national Red Lists, this structural simplification in most Fennoscandian forests has made hundreds of species threatened. One possible way to support these species is continuous-cover forestry, where at least half of a stand is covered by mature or near-mature trees throughout the logging rotation. Such forestry might secure both economic benefits and support specialized forest species, but empirical evidence is largely lacking. Therefore, we collected beetles in Eastern Finnish Scots pine forests that represent a continuum from clear-cuts to different continuous-cover forestry techniques, combined with large-sized dead-wood increment, and unharvested mature forest ("control"). We used flight-intercept window traps one year before (2010) and seven years after logging (2011-17) to collect beetle data. We will present comparisons of the overall community, and specialized groups of saproxylic beetles, and associate these patterns with structural features of forest stands, particularly volume and diversity of live and dead trees and size of cleared gaps. Our results will shed light on relative merits of continuous-cover forestry and legacy elements from an ecological point of view. Such information is crucial not only for conservation of biodiversity in managed forests but also for guidelines of forestry.

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## Attitudes to Carnivores' Reintroductions in the UK and the role of zoos

(Oral)

Adriana Consorte-McCrea<sup>1</sup>✉, Ana Fernandez<sup>2</sup>✉, Alan Bainbridge<sup>3</sup>✉, Dennis Nigbur<sup>2</sup>

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DOI: 10.17011/conference/eccb2018/108032

Reintroductions may boost ecosystem function and environmental sustainability. However potential conflicts of interest suggest that the restoration of native wild carnivore species benefit from the understanding of its human dimensions. Research suggests that experiences with live animals in zoos may encourage empathy, through personal connection, which in turn facilitates greater concern towards biodiversity. During this talk we will report on phases one and two of a study that investigates attitudes towards native wild carnivores that have been considered for reintroduction in the UK. The project is being developed by a cross-disciplinary team (wildlife conservation, psychology, education). Focus groups and interviews were carried out in Kent (spring 2015) and the Scottish Highlands (spring 2016) to investigate attitudes towards biodiversity and the reintroduction of wild carnivores, with particular focus on two species native to the British Isles and currently considered for reintroduction (the European lynx *Lynx lynx* and the pine marten *Martes martes*) and the role of zoos in promoting support towards their conservation. Thematic analysis of data indicates three overarching themes: concern, motivation, and knowledge, with a fourth theme of zoos that related to all three. Amongst the findings there are suggestions that zoos may help 'breaking down fears', but also disparate views about the role of zoos in 'protecting' species. We will discuss our findings in relation to the context of place of residence and support for reintroduction. Our research aims to contribute to the design and implementation of effective conservation initiatives through an understanding of how people engage with their environment and of what makes people care.



2018/06/14

17:15

Room: C1 Hall



**Landscape context predicts arrival date and settlement of a long distance migratory bird: implications for landscape-scale conservation of mobile species.**

**(Oral)**

**Robin Whytock<sup>1</sup>✉, Elisa Fuentes-Montemayor<sup>1</sup>, Kevin Watts<sup>1</sup>, Nicholas Macgregor<sup>2</sup>, Kirsty Park<sup>1</sup>**

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<sup>2</sup> Durrell Institute of Conservation and Ecology, United Kingdom

Abstract of this presentation is not public



## Identifying priority areas for restoring large mammal populations in the Caucasus Ecoregion

(Oral)

**Tobias Kuemmerle<sup>1</sup>✉, Benjamin Blehyl<sup>1</sup>, Hendrik Bluhm<sup>1</sup>, Arash Ghoddousi<sup>1</sup>, Aurel Heidelberg<sup>2</sup>, Sevinj Sarukhanova<sup>1</sup>, Nugzar Zazanashvili<sup>3</sup>**

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DOI: 10.17011/conference/eccb2018/107944

Large mammals play critical roles in ecosystems, yet their populations are across the globe as a result of habitat loss, overhunting, and human-wildlife conflicts. Some of these threats have lessened considerably in parts of Europe, particularly in mountain regions, and this offers unique opportunities for restoring large mammal populations to ecologically functional levels. However, many species require active conservation planning and management for achieving this goal. We focused on the Caucasus Ecoregion, a global biodiversity hotspot at the crossroads of Europe, Central Asia and the Middle East, with a variety of large carnivore and herbivore species. The collapse of the Soviet Union in 1991 brought about major changes in this region, including armed conflicts, low levels of institutional control, and economic hardship. Altogether this resulted in plummeting populations of many large mammal species that today hold out only in small and fragmented populations. In contrast, the institutional changes in the post-Soviet countries have also led to widespread land-use changes, such as agricultural abandonment and declining livestock numbers, providing opportunities for restoring large mammal populations.

We mapped suitable habitat for Bezoar goat (*Capra aegagrus*), European bison (*Bison bonasus*), Gmelin's mouflon (*Ovis orientalis*) and Goitered gazelle (*Gazella subgutturosa*), all of which are of conservation concern, across the ecoregion. To do so, we used species distribution models, a range of environmental and human-disturbance-related covariates, and extensive datasets of large mammal occurrence. We then identified areas of high and low risk of human-wildlife conflict (e.g., hunting and/or competition with livestock), and assessed the connectivity among core habitat areas using cost-surface and circuit flow analyses in order to identify priority habitat patches for conservation interventions.

Our results highlight widespread areas with suitable habitat for all species, including many areas with potentially low risk for human-wildlife conflicts. Most of these suitable habitat patches, however, are currently unoccupied (e.g., 60 out of 69 for European bison) and are largely outside the current protected area network (e.g., >80% of priority areas for mouflons and Goitered gazelles). Many habitat patches are also fairly isolated in regards to extant populations, highlighting the need for protecting stepping stones and corridors, and for additional reintroductions. All countries contained several candidate sites for reintroductions, particularly in Russia, Azerbaijan and Georgia for European bison, in Armenia and Iran for mouflon, Azerbaijan and Georgia for Goitered gazelle, and all countries in regards to bezoar goat. Finally, our study highlights that habitat networks and key corridors extended across national borders, emphasizing the need for Ecoregion-wide cooperation, conservation planning and enforcement of wildlife protection laws.



## Disturbance based management in eastern Canada: current status and trends.

(Oral)

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DOI: 10.17011/conference/eccb2018/107958

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As in many jurisdiction around the world, forest management in Canada has undergone considerable transformation over the past few decades as a result of a constantly improving knowledge base of forest ecosystem processes and perception of what constitutes socially-acceptable, sustainable forest management. Management that previously focussed almost exclusively on timber production has evolved to incorporate habitat and biodiversity conservation objectives as well as recreational and aesthetic values. Improved scientific understanding of how natural and managed forest dynamics differ along with general public disapproval of clearcutting have led to an increasing interest in the development of alternatives to conventional forest practices at both the stand and forest level. These trends have converged with what is considered a paradigm shift to forest ecosystem management (FEM), in which historical natural disturbance dynamics serve as a reference for forest planning and silviculture.

In eastern Canada, boreal mixedwood and coniferous forests are biologically diverse and economically important forest ecosystems. In the past 20 years, considerable effort has been devoted to the development of silvicultural approaches (e.g. partial cutting) and management strategies (e.g. spatial arrangement of cutover areas), that integrate knowledge of natural stand dynamics.

In this presentation, I will provide a brief history of research on ecosystem management in eastern Canada, discuss how it is integrated in forest planning, and conclude on some challenges facing forest managers and policy makers.

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## Does fire-shaped habitat mosaic support large mammal community in Mediterranean pine forest?

(Oral)

Anil Soyumert<sup>1</sup>, Alper Erturk<sup>1</sup>, Cagatay Tavsanoğlu<sup>1</sup>

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DOI: 10.17011/conference/eccb2018/107586

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Habitat diversity is maintained by fires in fire-prone ecosystems of the Mediterranean Basin, and fire is a significant driver of plant and animal diversity in such ecosystems. We studied large mammal species in a Mediterranean habitat mosaic generated by recent fires. We performed a camera-trapping survey in *Pinus brutia* forests in southwestern Turkey between May 2009 and February 2010. The study area was structured by recently-burned and unburned habitat patches. A total of 2047 camera-trap days were obtained with 33 camera-trap stations which were established in three replicate study sites (each ~12 km<sup>2</sup> in size) comprised both of burned (within the last 15 years) and unburned habitat patches. During the study period, we detected eight large mammal species including brown bear (*Ursus arctos*), caracal (*Caracal caracal*), and wild goat (*Capra aegagrus*), which are of conservation importance. Among these species, six were present both in recently-burned and unburned habitats; except the brown bear (only in burned sites) and the wild goat (only in unburned sites). A permutation test revealed that there is no significant difference in relative abundance of target species except the wild boar (*Sus scrofa*) which was observed in significantly higher abundances in burned sites than unburned ones ( $z = -2.3$ ,  $P = 0.01$ ). Our results suggest that habitat mosaics shaped by fire disturbance in Mediterranean pine forests support large mammal occurrence, and have important implications for the conservation of large mammals in frequently-burned Mediterranean ecosystems.

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## Systemic change challenges traditional business models of forest-based bioeconomy

(Oral)

Jouni Pykäläinen<sup>1</sup>✉, Anu Laakkonen<sup>1</sup>, Ossi Pesälä<sup>1</sup>, Päivi Pelli<sup>1</sup>

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DOI: 10.17011/conference/eccb2018/109036

Systemic change challenges traditional business models of forest-based bioeconomy

In this paper, we introduce the ongoing systemic change among forest-based bioeconomy in Finland and discuss about the effects of this change on sustainable business models. For this purpose, we adopt the multi-level perspective (MLP) framework. On the level of socio-technological landscape, many factors indicate that in the forest sector the forthcoming decades will not be similar to the past. For example, climate, energy, and forest policies are converging because of international attempts to avoid the effects of climate change, and forest and environmental policies are also converging due to the observed decrease in biodiversity. Furthermore, digitalization has decreased the use of paper for printing in Europe and North America, and on the other hand, new digital technology has facilitated interaction among companies and thus increased network collaboration while enabling the transition to a service economy. At the same time, the world's population is still growing, resulting in growing needs for ecosystem services, i.e. energy, nutrition, fiber, and many other products and services that can wholly or at least partly be obtained from forests.

Socio-technical regime of Finnish forest sector has been liberalized. The present forest legislation allows a large variety of forest treatment options, and on the other hand, forest service markets have been genuinely opened up also for SMEs. Furthermore, new technology in forest related information systems, open data and digital service platforms have become increasingly important. Socio-technological niches can be found inside and outside of the traditional forest sector. For example, modern pulp mills have been introduced as biorefinery concepts, developing many kinds of new products and versatile business ecosystems. However, more radical innovation might be found outside of the traditional forest sector. For example, novel solutions related to entertainment, health, recreation and nutrition have been already developed.

Anyway, business models of forest-based bioeconomy have a special requirement of adopting forest resources as a part of them in a sustainable way. Value creation in novel business models – including the ideas of networking, digital platforms, open data etc. - typically operate with abstract and intangible concepts, but in the case of including ecosystem services into business models crucial questions concerning sustainability and externalities arise. These include, among others, biodiversity protection, effects on climate, role of forest owners in the business models and effects of business on citizens' welfare. So far, these questions have been approached in the context of sustainability of fixed value chains in forest-based sector emphasizing linear value adding production

2018/06/14

17:00

Room: C1 Hall



UNIVERSITY OF JYVÄSKYLÄ



## **Tough nuts and low-hanging fruits: integrating cost into conservation priority analysis in China**

**(Oral)**

**Ruocheng Hu<sup>1</sup>✉, Yiyun Gu<sup>1</sup>, Cheng Wen<sup>2</sup>, Ziyun Zhu<sup>2</sup>, Lingdi Tan<sup>1</sup>, Zhi Lu<sup>2</sup>**

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Abstract of this presentation is not public

2018/06/14

17:30

Room: A3 Wolmar



## Panel Discussion: Measuring conservation biology research

(Oral)

**Janne-Tuomas Seppänen<sup>1</sup>**, **Sarah Papworth<sup>2</sup>**, **Claire Wordley<sup>3</sup>**,  
**Corey Bradshaw<sup>4</sup>**

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DOI: 10.17011/conference/eccb2018/108046

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## The relationship between zoo visits and the understanding and support for biodiversity

(Oral)

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DOI: 10.17011/conference/eccb2018/107310

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Zoos and aquariums are some of the most-visited institutions, with around 700 million visits made to them globally each year. They are, in a basic sense, simply repositories of living biodiversity. However, the justifications for the continued existence of zoos have evolved since their inception in the late 18th and early 19th centuries, and nearly all now position themselves as organisations focussed on the conservation of the world's remaining biodiversity. Public education of visitors is seen as, and is claimed to be, a central role in achieving this mission. Until relatively recently though, very little was known about the impacts of zoo-based education on zoo visitors. Here, I present the main findings from two global surveys of more than 10,000 visitors to around 30 zoos and aquariums. Most notably, we found that people tend to end their visit with a significantly greater understanding of what biodiversity is, as well as the ways that they personally can help protect it (1). The links between these two knowledge strands were, however, found to be weaker than predicted, which leads us to question the significance of the role of knowledge in catalysing human behaviour change (2). Aside from demonstrating their own positive educational impact, the wider implication of this research is that zoos and aquariums can also show that they are helping to achieve global biodiversity targets; namely, UN Aichi Biodiversity Target 1. From this, I will argue that the educational role of zoos should be considered as a more influential contributor to biodiversity conservation, and society more generally, than has previously been accepted.

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1. Moss, A., E. Jensen, and M. Gusset, Evaluating the Contribution of Zoos and Aquariums to Aichi Biodiversity Target 1. *Conservation Biology*, 2015. 29(2): p. 537-544.
  2. Moss, A., E. Jensen, and M. Gusset, Probing the Link between Biodiversity-related Knowledge and Self-reported Pro-conservation Behaviour in a Global Survey of Zoo Visitors. *Conservation Letters*, 2017. 10(1): p. 33-40.
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## Who and where: predicting road mortality risks using trait models

(Oral)

**Manuela Gonzalez-Suarez<sup>1</sup>✉, Flavio Zanchetta Ferreira<sup>1</sup>, Clara Grilo<sup>1</sup>**

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Wildlife-vehicle collisions are a major cause of mortality for many species. Empirical estimates of road mortality show that some species are more likely to be killed than others but to what extent this variation can be explained and predicted using intrinsic characteristics remains poorly understood. This study aims to identify general patterns associated to road mortality and generate spatial and species-level predictions of risks. We fitted trait-based random forest regression models (controlling for survey characteristics) to explain 783 empirical road mortality rates from Brazil, representing 170 bird and 73 mammalian species. Fitted models were then used to make spatial and species-level prediction of road mortality risk in Brazil considering all 1831 birds and 623 mammals which occur within the country's continental boundaries. Survey frequency and geographic location were key predictors of observed rates, but mortality was also explained by species' traits including body size, reproductive speed, and ecological specialization. Spatial predictions revealed high potential road mortality risk in Amazonia for both birds and mammals, and additionally high risk in Southern Brazil for mammals. Predicted rates for all Brazilian endotherm uncovered potential vulnerability to road mortality of several understudied species which are currently listed as threatened by the IUCN. With a fast expanding global road network, there is an urgent need to develop improved approaches to assess and predict road-related impacts. This study illustrates the potential of trait-based models as assessment tools to better understand correlates of vulnerability to road mortality across species, and as predictive tools for difficult to sample or understudied species and areas.

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## Is salvage logging a proper tool for restoration of forest ecosystems affected by bark beetle outbreak?

(Oral)

Anna Orczewska<sup>1</sup>✉, Patryk Czortek<sup>2</sup>, Bogdan Jaroszewicz<sup>2</sup>, Agnieszka Kantor<sup>1</sup>

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### Is salvage logging on deciduous forest habitats essential in restoration of forest ecosystems affected by bark beetle outbreak?

Biotic and abiotic disturbances are part of the life cycle of natural forests. They increase the structural and biotic diversity of forests ecosystems. Norway-spruce dominated stands of Central Europe are often affected by outbreaks of *Ips typographus*, which initiate "stand replacement" pathways of forest regeneration (*sensu* Veblen 1992). Such processes are difficult to accept from the point of view of forestry. Thus, in forest stands disturbed by the insect outbreaks, salvage logging and tree replanting are usually implemented, while natural processes leading to forest regeneration play the minor role.

We studied two different aspects of forest ecosystem recovery in salvage logged and in unmanaged (not logged) spruce-dominated forests affected by spruce bark beetle: (1) tree regeneration dynamics in the lower mountain zone of the Beskidy Mts. (Silesian Beskids, S Poland), and (2) changes in herb layer composition in the lowlands, in the Białowieża Forest (N-E Poland). Both, in mountains and lowlands, the ratio of spruce in the studied stands was artificially high (50-90% and 20-80%, respectively) due to former rejuvenation planting on sites of broadleaved forests. Otherwise, deciduous trees would naturally dominate in these forest habitats: beech in the mountains and oak, lime and hornbeam in the lowlands.

In the mountainous zone we investigated the sites where all dead trees were removed with no successive tree replanting (the reference stands where no trees were logged were not available). Natural tree regeneration process was very dynamic and led to re-establishment of beech-dominated stands. In the lowlands the total species richness of the herb layer was significantly higher in sites with removed dead trees and trees replanted. However, an increase was mainly due to appearance of species characteristic of non-forest, open habitats. Such trends were not observed in sites with untreated sites with standing dead spruce. In contrast, compared to salvage-logged sites, ancient woodland species, typical to mixed deciduous forest maintained higher abundance in unmanaged stands, where salvage logging did not take place.

Both forest types studied revealed great potential for natural reestablishment of species composition typical to deciduous forests. Thus, from the conservation point of view post-disturbance salvage logging is needed neither for recovery of beech in the mountain deciduous forests nor for recovery of herb layer of mixed-deciduous forests in the lowlands. Furthermore, in the case of lowland forests investigated such treatments inhibit the spontaneous recovery of herb layer species composition typical to broadleaved forests.

Veblen T.T. 1992. Regeneration dynamics, in: Plant succession: theory and prediction (eds. D.C. Glenn-Lewin, R.K. Peet, T.T. Veblen). Chapman and Hall, London, 152-187.



## Conservation from the bottom up: drawing inspiration from human-nature connections

(Oral)

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Increasing exploitation and commodification of the world's species and natural systems threaten biological diversity as well as human cultural diversity. Approximately 1000 known species and an estimated half of the world's languages have gone extinct over the last 500 years. Increasing human populations and impacts may threaten 30-50% of remaining species within the next several decades, and many extant languages are in danger of extinction, illustrating how the fates of both biological and human cultural diversity may be entwined. We explore challenges and opportunities to stem this tide of homogenization using cultural traditions that have conservation implications. We highlight case studies with birds in Europe, Africa, Amazonia, and Asia, including examples from Latvia, Ghana, Peru, and Taiwan. We present examples of successful conservation collaborations inspired by cultural beliefs and practices, and ask workshop participants to come with their own stories to share. One example is indigenous Amazonian communities who are working with scientists to protect and sustainably manage a large area of primary forest and its birds in northern Peru, and whose cultural heritage includes a large number of traditional stories of birds as messengers to and helpers of people. How can we take inspiration from cultural traditions celebrating biodiversity and use these for conservation innovation, propelling the conservation movement forward and protecting unique species, areas, and cultures into the future? Our goal is to bring together and build a network of people advancing conservation through innovative initiatives that incorporate or transform cultural traditions and practices. We will use group discussion and brainstorming to create new collaborations, bringing together salient experiences we can use to advance conservation. We will document the experiences shared during the workshop and use these to make the basis of an article on conservation innovation that we will offer for consideration in the special issue on planetary wellbeing in Conservation Biology. This article will include case studies from around the world (Europe, Africa, Asia-Pacific, the Americas) that use cultural traditions as a basis for conservation, both historically, currently, and those proposed for the future.

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## Developing connection and care for nature in the zoo

(Oral)

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Support for the conservation of large carnivores and for biodiversity is more likely when people have not merely understanding, but also an emotional appreciation for diverse species. These are likely to be enhanced by direct experiences, such as the visits to zoos and aquariums that provide many people an increasingly important opportunity for contact with other species. The direct experiences of nonhuman animals provided by zoos have two psychologically important characteristics: they are vivid and emotionally rich, and they are typically shared with others. Vivid, emotional experiences not only attract more attention, they are also better remembered, contributing to understanding. Social interactions surrounding zoo animals are opportunities to create and communicate shared emotional experiences and values.

This presentation reviews several studies describing the experience of a zoo visit, to show the complexity of such a visit, beyond the presumed connection among captive wild animals, visitors, and wildlife conservation issues. Indeed, a single visit does not always increase visitors' concern for wildlife conservation (1), and participating in a zoo-based animal adoption program is motivated more by animal charisma than by concern about endangered species (2). Although people are attracted to the zoo to see wild animals, the zoo visit appears much richer than a single contact with captive animals. We showed for instance that visitors express the feeling of "being away" when visiting the zoo, and that they become more receptive to other components of biodiversity (e.g. common urban birds) in addition to the presented wildlife (3). More, visitors declared having felt more positive than negative emotions when exiting the zoo, and visitors who felt more positively said they had learned more (1).

Zoos are important places for conservation, but their impact may be primarily indirect: more than transferring direct messages for wildlife conservation, zoos are places where complex and shared experiences of nature can be promoted, in order to increase the sense of being connected to the natural world. Because zoos attract a large diversity of people, we encourage them to demonstrate respect, and encourage empathy and connection toward the nature presented at their sites.

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2. Colléony A., Clayton S., Couvet D., Saint Jalme M., Prévot A.C. 2016. Human preferences for species conservation: Animal charisma trumps endangered status *Biological conservation* <http://dx.doi.org/10.1016/j.biocon.2>
3. Colléony A., Martin L., Misdariis N., Clayton S., Saint-Jalme M., Prévot A.C. 2017. Exoticism as a Mediator of Everyday Experiences of Nature: an Anthropological Exploration of Soundscape in Zoos. *Human Ecology*. DOI 10.1007/s10745-017-9937



## Can natural enemy diversity ensure stable biological control in the future?

(Oral)

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Natural enemy diversity generally strengthens biological control, but individual studies have found anything from positive to negative effects. However, most studies investigating the impacts of natural enemy diversity on pest suppression have focused on short term effects, while ignoring the stability in pest suppression across time and space. Theory predicts that a high diversity of redundant species (i.e., species currently doing the same job) should stabilize ecosystem functioning, since different species are likely to be important during different environmental conditions. This implies that a high natural enemy diversity should provide an insurance against global environmental change. We will here present how generalist predators contribute to stability of aphid biological control in Swedish barley fields under varying landscape complexity and climate change. We have found that ground dwelling predators such as spiders and carabids can reduce aphid pest damage with 50% in such fields, and that the level of aphid biological control is higher in more complex landscapes (Rusch et al. 2013). In recent work, exploring feeding preferences of the most common carabid and spider species on over ten prey types with molecular gut content analysis we have confirmed that these species are highly generalistic and that a high diversity of predators contribute to aphid biological control (Roubinet et al. 2017). Our preliminary analyses suggest that the level of redundancy in aphid predation increases with landscape complexity, suggesting that barley fields in complex landscapes not only currently has more effective aphid biological control but that the stability of aphid control is likely to be higher in such landscapes. We are currently investigating the climate niches of different predators in relation to temperature and rainfall. These niches will be combined into climate niches for predator communities in different types of landscapes and we will test if the level of climate resilience (Kühnel and Blüthgen 2015) in predator communities is higher in complex landscapes. Finally, we will conduct mesocosm experiments under different climate scenarios to test if predator communities with different levels of redundancy and climate resilience really contribute to more stable biological control of aphids.

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## Rare or ignored? Working with the citizen science community to survey potentially endangered fungi in the UK

(Oral)

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We know that there are many species of fungi in the UK (around 15000 at the last count), but for most we have little idea about where they are or even whether they still exist. Over 2000 fungal species are known only from a very small number of sites. Others have been very infrequently recorded over the past 50 years, and have either significantly declined or been forgotten about. Some species are only recently described or potentially invasive recent arrivals. But how can we determine if these species are genuinely rare, or if they're overlooked? The only way is to go out and look, and to encourage as many people as possible to go out and do the same.

The Lost and Found Fungi (LAFF) project is a five year (2014-2019) fungal conservation project aiming to address some of these problems. Based at the Royal Botanic Gardens Kew, LAFF is funded by the Esmée Fairbairn Foundation and supported by the British Mycological Society, the British Lichen Society, and fungus recording groups and individuals throughout the UK. Working with volunteers, LAFF aims to establish baseline distribution data for 100 target species of current or potential conservation concern, by discovering new sites, undertaking surveillance of current sites, and rediscovering populations at historically known sites. Curated datasets supported by vouchered specimens at Kew will be used to formally Red List assess the target species towards the latter part of the project, and to establish baseline distribution datasets to help conserve populations and assess trends in the future.

In parallel, LAFF has been working to increase the capacity of fungus enthusiasts to meet the challenges of fungal conservation, providing outreach to amateur fungus enthusiasts and recorders via the LAFF website, social media, email, fieldwork, and group visits. Assistance and mentoring have been provided in the forms of identifications, taxonomic advice, workshops, and encouraging amateur taxonomic and survey work. The LAFF project is also addressing some taxonomic issues surrounding species of current conservation concern, volunteer-submitted rarities, and taxonomic novelties.

Outcomes to date include ~900 new records of 59 target species (>20% of all records and sites for these species in Britain), >170 vouchered specimens, and >250 "bycatch" specimens of rarely recorded or poorly understood fungi. Some species appear to be much more widespread than previously thought; some apparently extinct or "lost" species have turned out to have been overlooked; and others appear elusive and may genuinely be rare. Volunteer submissions have allowed taxonomic and distribution reassessment of some species, e.g. *Entoloma bloxamii* s.l. By engaging with fungus enthusiasts, and demonstrating the effectiveness of co-operation between volunteers and supporting institutions such as Kew, LAFF provides a model for future fungal conservation work in the UK and further afield.





## Land use changes could modify future negative effects of climate change on old-growth forest indicator species

(Oral)

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Climate change is expected to have major impacts on terrestrial biodiversity at all ecosystem levels, including reductions in species-level distribution and abundance. We aim to test the extent to which land use management, such as setting-aside forest from production, could reduce climate-induced biodiversity impacts for specialist species over large geographical gradients. We applied ensembles of different kind of species distribution models based on Citizen Science Data (CSD) for six red-listed old-forest indicator species of wood-inhabiting fungi. We tested the effect on species habitat suitabilities of alternative climate change scenarios and varying amounts of forest set-aside from production over the coming century. With the current allocation of 3.6% of forest area set-aside from production in Sweden, habitat suitabilities in set-aside forest initially increased over the first one-two decades in response to maturing forest, before the negative impact of climate change became evident. Overall habitat suitabilities for all six species were projected to decline under climate change scenario RCP4.5 (intermediate-low emissions), with even greater declines projected under RCP 8.5 (high emissions). Increasing the amount of forest set-aside to close to the Aichi Biodiversity Target 11 aim of  $\geq 17\%$  resulted in significant increases in overall habitat suitability, with one species showing an increase. A further increase to 32% forest set-aside resulted in considerably more positive trends, with three out of six species increasing. There is inter-specific variation in the importance of future macro-climate and resource availability on species occurrence. However, large-scale conservation measures, such as increasing resource availability through setting aside forest from production, could reduce future negative effects from climate change, and early investment in conservation is likely to reduce the future negative impacts of climate change on specialist species.

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## Ecological intensification: using wildlife-friendly farming to increase crop yield

(Oral)

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Ecologically intensifying arable agricultural systems by manipulating underlying ecosystem services represents a fundamental requirement to reducing the environmental footprint of agriculture. While there is considerable evidence for the role played by service providing taxa (e.g. insect pollinators and natural pest control), there is little direct evidence of yield benefits at scales that have direct relevance to farms growing commercial important globally foodstuffs, e.g. grains, oilseeds, pulses. Using a semi-landscape scale replicated experimental design (50-60 ha plots), we tested the value of two treatments that removed 3% or 8% of land at the field edge from production to create wildlife friendly habitats. This was undertaken on a 900 ha commercial UK arable farm. This was compared to a business as usual control representing normal agricultural management where no land was removed from production. By taking 3% or 8% of land out of production to create wildlife friendly habitat we were able to demonstrate yield increases in the cropped areas of the fields which became more pronounced over a six year period. The tendency of yields to increase over time suggested that populations of beneficial invertebrates need time to become established on wildlife friendly habitats before they can provide ecosystem services at economically important levels. Despite the loss of cropland yields were either maintained or enhanced depending on crop. Importantly, over a 5 year crop rotation there would be no negative impact on overall yield in terms of either monetary value or nutritional energy resulting from the loss of land for wildlife friendly habitats, while in some cases there are yield gains. This study provides a demonstration that wildlife friendly management supporting ecosystem services is compatible with conventional arable systems.

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## Beyond describing threats: Rigorous analysis of conservation interventions

(Oral)

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Conservation science as a discipline spends a lot of effort describing threats. While this is important, relatively little attention is paid to rigorously testing conservation interventions. Conservation Evidence is one project working to collate the evidence for how well conservation interventions actually work. This is an ongoing project which attempts to keep evidence synthesis ‘live’ and updated, and to facilitate use by a diverse community of people. However we run into problems in collating, interpreting, and encouraging people to use the science due to i) a scarcity of studies for many interventions, ii) poor methodological design hampering interpretation, iii) a poor understanding of how generalizable conservation interventions are, partly due to i and ii, and iv) a reluctance or lack of confidence in using evidence from some quarters.

I will describe our theory of change for improving evidence availability and increasing use. I will describe some of the work we are doing as a group to map evidence gaps, to assess the benefits and drawbacks of different study designs for testing interventions, to assist conservation practitioners in properly evaluating the impact of their actions, and to encourage evidence use among NGOs, ecological consultants and governments.

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## Enabling ecological intensification of agriculture through policy

(Oral)

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Ecological intensification is an innovative, knowledge-based approach to agriculture. It combines emerging understanding of how agro-ecosystems function with agronomic knowledge, to manage agricultural ecosystems in a way that secures high yields with reduced environmental impacts.

Policy makers have an interest in ecological intensification, as it can help them respond to multiple international targets and strategies implemented this decade to improve sustainability. It can deliver elements of the second Sustainable Development Goal, ‘Zero Hunger’, which includes a target to ‘ensure sustainable food production systems ... that increase productivity and production, help maintain ecosystems ..... and progressively improve land and soil quality’. In contrast to more technological, production-focused views of sustainable agriculture sometimes called ‘sustainable intensification’ [1], it represents a set of ‘nature-based solutions’ for agriculture. Nature-based solutions are prominent in the European Union’s Research and Innovation policy agenda. Ecological intensification is also recommended as a policy option to mitigate declines in wild pollinators globally [2].

Several available routes to promote or enable ecological intensification in agriculture are much discussed. They include voluntary financial incentives for farmers (e.g. agri-environment schemes in Europe or conservation measures financed by the Farm Bill in the US); obligations for farmers, such as compulsory greening measures in the European Common Agricultural Policy; and market-based instruments such as certification schemes or ‘Payments for Ecosystem Services (PES)’.

However, none of these options gets to the essence of ecological intensification. The underlying idea is that farmers themselves manage ecosystem services actively and knowingly, to support their own productive systems. Ecological intensification should not have a cost, which requires compensation or additional income from market prices. It should pay for itself, in reduced inputs and enhanced productivity, and indeed it has been shown to do so, albeit in only a small number of studies so far [3]. What is actually needed to enable ecological intensification are policies to support farmer education and training, provision of ecological advice and trans-disciplinary agricultural research to investigate what measures are feasible and provide reliable returns on farm.

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 [2] Dicks, L. V., et al. (2016). Ten policies for pollinators. *Science*, 354(6315), 975-976.  
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## Not all information is equal: Understanding the data drivers behind spatial conservation priorities

(Oral)

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Spatial prioritization, where priority areas for conservation actions are identified from a set of candidate locations, is a critical step in many conservation planning problems. How priorities are formed depend on multiple factors, including: i) the attributes of candidate locations, such as the species and other biodiversity values present, cost of acting, current condition and risk of loss; ii) how information of different types are combined across species and habitats, costs etc., and; iii) what is the general objective against which priority of a site is evaluated.

Uncertainties in input data and how these affect conservation solutions have long been of central interest to both conservation scientists and practitioners. Particularly, gaps and uncertainties in ecological data, but increasingly also in the economic and socio-political data, have been studied. Yet, there remains notably ambiguity on how these data gaps influence solutions that are optimized across multiple biodiversity features and locations, and what is the relative importance of gaps in different data.

In this presentation, I will explain how basic mathematical restrictions can be used to understand the ways different data types, and hence uncertainties in them, influence outcomes in common conservation prioritization approaches. I will also show how, when looking for a solution that maximizes benefits for all included species (maximum-coverage problem), the spatial characteristics of species distributions play a role in the way priorities are distributed in space.

These studies show that in simple scoring based approaches, information on costs, threats, and habitat condition quickly dominate prioritization solutions, particularly when done for large number of species and other biodiversity features. When more sophisticated, complementarity based prioritization approaches are used, the solutions become more sensitive to the number and type of included species [1]. When only few species are used, the location of priority areas are driven by the distribution patterns of intermediately rare species that occupy species poor areas. The most important and least important areas also behave differently to changes in ecological data.

Understanding how spatial priorities are driven by different data types is useful as it improves the transparency of prioritization results, provides clarity to species weighting in multi-species prioritization problems, and helps to focus our efforts in improving data.

[1] Kujala et al. (in press) Spatial characteristics of species distributions as drivers in conservation prioritization. *Methods in Ecology and Evolution*. DOI: 10.1111/2041-210X.12939



## From policy to pollination: using mechanistic models to assess policy alternatives and management interventions on insect-mediated ecosystem services

(Oral)

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Increasing pressure on land to deliver more food and fibre with less environmental impact has dramatically increased the demand for assessing effects of present and future agri-environmental policies on ecosystem services including pollination and pest control. If we are to make clever use of these ecosystem services, it is critical to understand how they respond to our actions, which benefits we are to expect, and at which cost. This is not trivial. First, the beneficial organisms underpinning pollination and natural biological control often use multiple resources across the landscape and respond at individual, population and community level to land-use changes. Patterns emerge through complex spatiotemporal processes, with feedback loops and delayed effects that are difficult to capture using traditional regression-based models. Second, policy is filtered into changes on the ground by human decision-making processes. Both ecological and human decision-making processes can result in unexpected patterns and shortfalls compared to anticipated benefits.

Here, I present ecological models for pollination and natural pest control that integrate multiple processes in a way not possible with simpler models [1]. Drawing on past and ongoing collaborative work, I present several examples of applications including the impact of flowers strips in spaces and time [1], the impact of the greening of the CAP [2], and the effects of increasing arable field sizes. On the one hand, I highlight the importance of taking into account processes such as foraging and population dynamics, on the other, show-casing applications of ecological ecosystem services models coupled with economic models, I show how farmer behaviour and costs related to interventions, can be more important for decisions and policy outcomes than ecological responses to a local management intervention. Finally, I outline remaining challenges such as handling species interactions, assessing transferability of models in space and time and handling multiple models.

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## Coexistence: looking at the glass half full

(Oral)

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For some, the discussion of conflict or coexistence may be a matter of semantics. In terms of working toward solutions, concentrating on mechanisms of coexistence is more positive than mitigating conflicts. However, shifting from conflict to coexistence may not be enough. There is a need to consider conflict and coexistence as they relate to each other. We discuss the conflict-to-coexistence continuum concept, which spans from negative to positive attitudes and/or behaviors. On the extreme end of the conflict side of the continuum, negative attitudes/ behaviours can result in retaliatory killing of wildlife, or support for eradication policies. Moving away from this end position, people might still disagreeing and opposing species management and conservation, but likely not taking direct actions against wildlife. The continuum moves then toward neutral or mixed attitudes/ behaviours, where people may not be interested in wildlife and thus remain indifferent toward wildlife issues. Passive tolerance characterizes this section, which is followed by the positive end of the continuum. In this last section, humans favouring the needs of wildlife - as in the case of supporting strict nature reserves, or donating for wildlife conservation, represent some examples of the end point on the positive side of the continuum. Examples from different worldwide studies extracted from the upcoming book "Human-wildlife interactions: turning conflict into coexistence" will be presented to illustrate how the continuum helps in comparing and categorizing the relative strength of negative to positive attitudes/behaviors, and may help to clarify how a specific context influences human-wildlife interactions.

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2018/06/14

17:15

Room: K306 Anton



## Microbusinesses reconciling monetary and nature values in forestry

(Oral)

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Finland is a country with hundreds of thousands of small-scale entrepreneurs in forestry. These non-industrial private forest owners reconcile their timber production with other motives of forest ownership. Conservation of nature values, carbon sequestration, community values, different types of recreation and timber production are often but not always joint produced even in the same hectare. The increasing demand of timber challenges the balance in the future. The higher demand affects the timber prices making the timber production more profitable. To enhance other forest values, new business models for forest owners are called for.

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2018/06/14

18:00

Room:



## Panel discussion: Large carnivores and zoos as catalysts for biodiversity conservation

(Oral)

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Abstract of this presentation is not public



UNIVERSITY OF JYVÄSKYLÄ



## Spinnova - The most sustainable textile fibre in the world

(Oral)

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The global challenges that drive the currently emerging sustainable businesses are growing, as the world population grows on a steep curve. Climate change, marine resource pollution and water shortage and waste issues are among the most urgent ones that also drive the forest industry's new innovation.

This is also the foundation that Spinnova's innovation is built on. It is directly related to several of the United Nation's Sustainability Goals for 2030. Spinnova's cellulose-based fibre is a solution that solves many sustainability issues in the textile industry, also with other materials than cotton: polluting microplastics from man-made fibres and manufacturing processes contributing to climate change to mention a few.

Production methods of new innovations are also significant from an environmental point of view. Spinnova produces the fibre in a simple, ecological process, without harmful chemicals and minimum emissions. Once commercialized, the Spinnova fibre is the most sustainable fibre in the world, both from a raw material and manufacturing process aspect.

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2018/06/14

17:00

Room: A1 Wilhelm



## Do flower strips and hedgerows enhance crop pollination and pest control services? A quantitative synthesis of drivers, effects and impacts on crop yield

(Oral)

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Abstract of this presentation is not public



## Identifying Large Ecological Networks with Spatial Conservation Prioritization Methods to Benefit Regional Land-use Planning

(Oral)

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The current biodiversity crisis is a major environmental problem to be solved. Land-use planning should respond to the near-ubiquitous decline in habitats and their ecological quality, which derives from e.g. urban expansion and natural resource use. Connectivity is one crucial thing to consider in biodiversity-friendly land-use planning. In human-modified landscapes, it is important to identify and preserve not only the remaining small sites of high biodiversity value, but also the larger-scale mosaics of good-quality sites.

Spatial conservation prioritization is a group of methods that has been successfully used to steer resource-efficient conservation. Complementarity-based prioritization methods have been used to identify places that enable maximal biodiversity retention, i.e. to locate places that are "critical" for conservation. Connectivity has often been used as a factor to increase sites' value if they are located next to similar areas (e.g. forest patches close to other ones) or e.g. protected areas, but not to identify large agglomerations of good-quality sites per se. A strict focus on small "critical" sites might lead to a neglect of general ecological quality in land-use planning, especially in fragmented landscapes.

We used a spatial conservation prioritization software called Zonation to identify regional-scale ecological networks in the Uusimaa region (Southern Finland, 9,600 km<sup>2</sup>) which is a heavily human-dominated landscape with extensive urban areas (e.g. the Finnish capital region), as well as intensive agriculture and forestry. We had 59 GIS layers describing different biotopes (forest quality, peatlands, etc.) and species (rare species observations, deer densities, regionally important bird areas, etc.) as input features for Zonation analysis. Focusing not only on the prioritization result ("the critical sites") but also to the relative density of the input features ("the overall diversity") allowed us to identify large ecological networks that emerge from the surrounding landscape, form well-connected mosaics of ecologically good-quality environments, and harbor a great portion of the regional biodiversity. Furthermore, we used the corridor building function of Zonation to identify ecological corridors between valuable nature sites inside and between the large networks. We then compared the identified networks and corridors to modelled urban growth in Uusimaa to identify future conflict areas between urban expansion and nature conservation. The results are used in the ongoing Uusimaa Regional Plan 2050 initiative.



## SIZE ISN'T EVERYTHING: THE IMPORTANCE OF SMALL HABITAT PATCHES WHEN PLANNING THE CONSERVATION OF SPECIES IN FRAGMENTED LANDSCAPES

(Oral)

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Metapopulation theory and landscape ecology indicate that larger patches of habitat are more likely to support self-sustaining populations of more species. In spatial conservation planning, it makes sense that if all else is equal; one would prefer to conserve a large patch of habitat over a small patch. However, simplistic and selective application of these theories is having perverse impacts on the viability of rare and threatened species in fragmented landscapes. Preference toward conserving large patches and ambivalence toward protecting small patches is manifest in many land management policies and regulations. However, due to historical patterns of land-use and habitat loss, it is seldom the case that all else is equal in a choice between large and small patches. In many instances, small patches and large patches have different species composition. We hypothesized that the distribution of species most rare in the landscape will tend to be biased toward smaller patches. We analysed the relationships between species composition, rarity, irreplaceability and habitat fragment size in fragmented landscapes with contrasting histories of land-use and habitat change in Australia, Europe, Africa, and North America. We find that small habitat patches are inordinately important in the bulk of landscapes simply on the basis of their species compliment. We found a surprisingly clear and strong negative relationship between irreplaceability and most habitat fragmentation indices. This is driven by the fact that rare species distributions are biased toward small patches, while common species exist across all patch sizes. This result has strong implications for land-clearing regulations and offsetting policies. Selective application of ecological theory that downplays importance of small patches in fragmented landscapes will lead to catastrophic outcomes for rare and threatened species. Priority should be given to improving integrity of small patches through management of threats and restoration



## EFFECTS OF FARMLAND AND FOREST PRACTICES ON BIODIVERSITY CONSERVATION IN NORTH-WEST SPAIN

(Oral)

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The main changes in land use during the last 50 years have been agricultural intensification and forestry plantations with exotic species, and North-West Spain is not an exception. Traditionally, local people used to give value to native forests and sustainable agriculture, but several generations of rural abandonment and changes on the rural economy have led to a system in which farmers feel that they have to intensify their production. At the same time, they seem to have forgotten the values and services that native deciduous forests have always given to their ancestors. Nowadays, both fertile agricultural lands and mature native forests are rapidly being replaced by Eucalyptus plantations, which in less than 15 years can be cut down for paper production. It is known that Eucalyptus plantations affect biodiversity, but there are surprisingly few studies that analyse how these plantations affect biodiversity.

In addition, during the last 18 years, there has been a 33% increase of organic farming in the area. This change has been mainly produced due to economical constraints in conventional farming, and most local farmers thought of it as the only way to continue living from farming. Many studies have documented how organic farming can counteract farmland intensification regarding the conservation of biodiversity, but few studies have considered how the effect of organic farming works in a heterogeneous landscape and how it varies between seasons. North-West Spain is an important wintering and breeding ground for many bird species, therefore, it is important to understand whether organic farming can enhance agricultural biodiversity conservation, as its effect in this area can affect biodiversity not only locally, but in a bigger scale.

We analysed the effect of both farming and forest practices on biodiversity during an entire year by means of transects in paired organic and conventional farms and native and Eucalyptus patches. Bird, flying insect and plant species richness and abundance were compared. Bird species richness was higher in winter in organic than conventional farms. Bird abundance increased in organic squares with increasing surrounding native forest. Both species richness and abundance of plants and flying insects were higher in organic than conventional farms. Regarding forest and Eucalyptus patches, all species richness and abundance of birds, plants and flying insects were higher in native forests. Therefore, our results suggest that both organic agriculture and native forests have a key role in biodiversity conservation in the area, and that policies enhancing these two approaches will have positive effects on biodiversity conservation. Conserving traditional forest uses, such as chestnut production, or oak and chestnut wood use, at the same time as promoting an organic agriculture, will have a positive effect on biodiversity. Biodiversity conservation in the area cannot be separated from conservation of traditional land uses.





## Armageddon scribes: only transdisciplinarity will rescue conservation biology from irrelevancy

(Oral)

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I argue that our discipline is caught in a rut of irrelevancy on the grander scale. Much of our research is focussed on refining the basics of what we essentially already know well. While there will always be processes to understand, species to describe, and relationships to measure, our discipline can no longer afford to avoid the biggest sustainability issues, including inter alia increasing agricultural production without further destruction of ecosystem integrity, low-impact energy provision for electricity and fuels, human overpopulation and how to reduce it ethically and fairly, and massive ecosystem restoration at meaningful scales. While we argue about the best ways to conserve species, we are still losing our forests, coral reefs, climate regulation, and food-production efficiency with increasing speed. Most of us become comfortable with what we know, and therefore spend most of our time refining our area of expertise. Instead, more of us should jump out of our comfort zones and learn some physics, engineering, climatology, economics, and political science to expand our limited world view. This means that we must do more than just 'engage with stakeholders' post-publication; instead, we need to generate and test hypotheses that explicitly attempt to solve complex problems that transcend mere biological processes. Multidisciplinary teams can assist, but more relevant progress will require biologists themselves to adopt data, approaches, and communication strategies from other fields (many of them not residing within the sciences). Including policy implementers from the outset will potentially increase the probability of uptake in government and industry provided we examine the questions they deem most pertinent. This approach will probably require compromises, but tangible changes in policy arising from dedicated research will be more easily measured and demonstrated following this approach. With a little more effort, I think conservation biologists would be far more relevant and successful in turning some of the threatening unsustainability tide back towards more acceptable outcomes.

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## Finnish fungal atlas as a conservation and education tool

(Oral)

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Fungi are a challenging organism group to study and often amateurs need extensive help to be able to correctly identify their fungal collections. Fungi could be used for an example as indicators of environmental changes and as a tool to evaluate the conservation value of endangered biotopes. However, all this requires reliable and extensive observation databases on fungi. If citizen scientists are not well enough educated, their contribution may be even harmful due to decreased data quality. To achieve more reliable information of habitat requirements, distribution and risk status of fungi in Finland we started a citizen science project called SieniAtlas (Finnish Fungal Atlas) in 2016, and opened a new databased fieldtrip form for the season 2017. Our aim is to inspire amateurs to report their observations and to deposit better specimens to the natural history museums and their databases. We organize short courses (e.g. how to collect a specimen or use a microscope) and survey trips for amateurs to inspire them and increase their skill level. Observations are reported through a form in the internet. We also conduct analyses on the data already during the project to further prove to amateurs the value of their efforts. Moreover, we organize thematic events, for example focusing on the mycobiota of a certain threatened habitat or on a certain threatened species. The first year of active data collection was an immense success. We had for example a thematic call on one globally red-listed species, Witches Cauldron (*Sarcosoma globosum*) and received about seven times more observations than the recent yearly average. Another call on Macrolepiota and Lepiota species yielded very similar results. Finnish fungal atlas has already now changed the culture of collecting fungal observation data in Finland. In the presentation we will show our first results and outline our most important plans for the future.



## Human dimensions approach to gaining support for biodiversity and large carnivores

(Oral)

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Our human dimensions in wildlife resource management field has grown from its beginnings studying motivations of hunters and describing behaviors to applying theories and predicting behaviors. In fact, our research has become academically recognized and we could be criticized, like we use to say about biologists who studied only animals, that many HD researchers study people, and perhaps have forgotten that conservation is only achieved through working with people. HD research provides insights on wildlife issues to managers but managers require mechanisms to solve issues. In those rare cases where we choose to "engage" the public, our traditional tools often fail to get diverse interest groups to consensus and conflicts resolved. Perhaps "engaging the public" is not what we really need if we wish to achieve solutions, we in fact must build strong relationships and teams to solve today's wildlife challenges.

The applied human dimensions facilitated workshop approach (AHDFWA) continues to provide examples of success stories getting diverse interest groups to agree on controversial national large carnivore management plans in various parts of Europe. The AHDFWA builds relationships with all groups, encourages feedback from individual team members back to their constituencies and where employed for the last 25 years worldwide, 100% consensus has been reached by the author. I discuss the power of drawing images to illustrate a vision and taking the time to effectively move beyond "engagement" to a "committed relationship" of trust to achieve consensus and conservation successes. Other key components of the AHDFWA include strong feedback, clear, defined roles, discussions rules and a visual style of facilitation that inspires participants to work hard and find solutions.

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## Where is Road Ecology going?

(Oral)

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The building of new roads is a recognized agent of landscape transformation with several conservation implications for almost all species worldwide, threatening them with a huge variety of impacts (including some little studied, like pollution or trophic cascades). Road Ecology as an independent discipline was born twenty years ago, and since then the number of studies has not stopped growing every year. However, we wonder whether this growth has been accompanied by a diversification in scales, topics and study regions. We systematically reviewed a total of 707 studies, from journals and proceedings (ICOET, IENE, AENET, CIBIV) combined, dealing with Road Ecology. We classified the studies on the basis of: i) scale, as large (population, community or landscape levels) or local; ii) topic; and iii) country where it was carried out. Local-scale studies are roughly twice as common as those focused on large scales. Furthermore, most large-scale studies were based on methods (e.g., GIS) lacking empirical data to support their findings. Our review reveals that road ecologists have studied to date a limited range of topics, with only three of them (road-kills, barrier effects and mitigation effectiveness) monopolizing 74% of the works. Finally, 85% of studies were carried out in high-income countries. Our review suggests that Road Ecology needs to innovate in research topics, as several impacts remain understudied (long-term effectiveness of mitigation, population impacts of road-kills and barrier effects, trophic cascades). Also, focusing on others than high-income countries is of paramount importance because 90% of new roads projected for the next decades will be built in developing nations, including regions that harbor some of the last surviving wildernesses.

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## Measuring the silent science in conservation biology

(Oral)

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There is increasing interest in measuring the scientific and societal impacts of research. This increasing interest can be demonstrated by the increased weighting of "impact case studies" in the latest UK Research Excellence Framework, which ranks UK universities based on their research. Conservation research is often considered intrinsically applied, but I argue that understanding how conservation research impacts conservation practice is essential to a discussion on the scientific and societal impacts of conservation biology research. Although there are numerous methods to quantify research impact of published peer-reviewed papers (e.g. using Altmetric.com to measure the online impact of research<sup>1</sup>), these metrics may fail to capture direct impacts where conservation research results in improved conservation practice or success. For example, a newspaper article on peer-reviewed conservation research might be considered 'research impact' does not necessarily lead to quantifiable changes in conservation practice. This "silent science", which does not lead to direct impacts in conservation practice, is mirrored by the silent science which does impact conservation science but is not captured by these metrics. Examples of this is conservation practice informed by research published in grey literature, or the unpublished work by research teams at conservation NGOs. I do not focus on the relative accuracy or value of these different information sources, instead on highlighting how this silent science is used, but not captured in metrics of research impact.

I present qualitative and quantitative research on the information sources used to support decision-making in biodiversity conservation to identify potential sources of "silent science" in conservation practice. The qualitative research is based on the semi-structured interviews with conservation professionals, and revealed a variety of ways in which conservation research can impact decision-making in conservation practice. An example of "silent science" identified using this method is consulting academics for their expertise. This leads to email exchanges and discussions based on conservation research, and decisions which impact conservation practice, but which are not directly informed by specific peer-reviewed publications. The quantitative research builds on these interviews and uses an online questionnaire to identify how often different information sources are used, and their perceived importance and reliability by conservation professionals. Although the quantitative research can identify the types of information used, and the relative importance of these sources for decision-making, I argue that the impact of silent science on conservation practice may be best measured using qualitative evaluations by research users.

1. Papworth et al. (2015) Quantifying the role of online news in linking conservation research to Facebook and Twitter. *Conservation Biology* 29: 825-833

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## Citizens may boost primary biodiversity knowledge - insights from the Danish fungal Atlas

(Oral)

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The Danish Fungal Atlas ran from 2009-13 and contributed with almost 250.000 records of fruit-body forming Basidiomycota (macrofungi) mainly submitted by volunteer citizen scientists. The data has been utilized in several research and conservation projects, but here we explore how the project contributed to the primary understanding of fungal biodiversity in Denmark. During the project, 197 species were recorded as new to Denmark, extending the national species list considerably. At least 15 of these appeared to be new to science. An even higher number of species previously recorded in Denmark, were however not reported in the project period, indicating a potential significant species turnover. Species with a mainly northern distribution were significantly overrepresented among the new Danish species, in marked contrast to climate change predictions. Species groups with inconspicuous or subterranean fruit-bodies were overrepresented both among the new Danish species and those only recorded before the project period. The same was the case for recently described taxa. Hence, we identified the species turnover to reflect factors relating to recording rather than actual biological changes in Danish nature. More specifically, improved taxonomic knowledge combined with an intensive sampling effort by citizen scientists guided by professional mycologists was concluded to be the main drivers of novel biodiversity discoveries in the project. Summarizing over the last 100 years an exponential increase in known macrofungal diversity in Denmark is evident, suggesting that even with the new knowledge generated in the project we are still far from a complete understanding of macrofungal diversity in Denmark. Denmark is one of the best studied countries for macrofungi globally, and at the same time one of the most heavily exploited, with nature under massive threat. Our research show that even under such conditions citizen scientists have potential to boost primary biodiversity knowledge.



## Understanding animal-road interactions for proper mitigation: stopping the recurrent roadkill of Giant Anteaters

(Oral)

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The Brazil's Cerrado support the largest remaining populations of Giant anteaters. However, today this biome is being heavily fragmented by an ever-increasing road network, and Giant anteaters are one of the most frequently road-killed species.

To address this threat, data on why, when, and how anteaters interact with roadways is urgently needed. We have recently initiated a four-year research project in Mato Grosso do Sul, aiming to assess the impact of roads on Giant anteater populations in the Brazilian Cerrado in order to understand how roads in the Cerrado are affecting anteater population persistence.

A total of 19 individuals have already been fitted with GPS loggers and their data allowed us to verify that anteaters have highly variable behaviors toward roads, ranging from complete avoidance to crossing movements on a daily basis. Alongside, we are performing systematic roadkill surveys every two weeks on 1,300 km of highways; and the numbers have confirmed a high roadkill rate for this species (150 individuals in less than one year). Interestingly, structured interviews on truck drivers and other citizens allowed to discredit an old myth that truckers run over animals on purpose. Finally, remote sensing information allowed us to quantify the deforestation amount and rates since 1970's in the study area. Based of movement data, the giant anteaters seem to favor forest-open areas edges, which have been increasing with increasing deforestation. Along with the disappearance of Jaguar, its natural predator, we questioned whether the high number of road killings may be due, at least in part, to a population increase of this species. Nevertheless, the effects of increasing traffic volumes and new roads being opened and/or paved, are certainly main causes of such mortality.

Altogether, our project will provide important information on effect of roads on animal movement behavior, population structure and health condition. Research findings will then be used to develop landscape and road management guidelines to mitigate the impact of road mortality on anteater populations.





## Both organic farming and flower strips support biodiversity, but organic farming is more profitable at field scale

(Oral)

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Agri-environment schemes (AES) have been introduced to counteract the negative environmental effects caused by increased agricultural intensification in Europe (1). AES approaches can be also classified according to whether they prescribe management in non-productive areas, such as field boundaries and wildflower strips, or in productive areas, such as arable crops or grasslands. Here we test the ecological and economic effectiveness of the two most popular AESs in Lower Saxony, Germany: wildflower strips next to winter wheat fields as off-field practice and organic farming on winter wheat fields as on-field practice. For doing this we selected ten landscapes along a field size gradient with three wheat fields, one conventional field with flower strip, one organic field and one conventional field without flower strip as a common control (the two conventional fields were owned by the same farmer per landscape). During two consecutive years we surveyed plants in field margins, field edges and field interiors; we sampled carabids, spiders and rove beetle by pitfall traps in field edges and field interiors; we sampled bees and hoverflies by transect walks and sweepnetting in field margins. Additionally, we performed detailed economic interviews with our organic and conventional farmers to get revenue, cost and profit data per study field. Plants benefitted far the most from organic farming, whereas flowering strips had only a positive effect on plant richness in field margins, but no effect in the fields compared to the control. As expected due to the high flower cover, flower strips supported three times more bee species and only about 25% more hoverfly species than organic farming, with both AESs being more effective than the control. Finally, both AESs supported equally well carabids and spiders with about 20-30% higher species numbers than the control with exception of rove beetles, which rather avoided fields with flower strips in contrast to control and organic fields. Field size showed only a slight negative trend on the biodiversity of study taxa probably owing to the relatively short gradient in the small-scale agroecosystem of the study area (see also 2). Economic analyses showed the highest costs in control conventional fields and the highest revenues in organic fields leading to more than two times higher profit in the latter one, whereas fields with flower strips compromised a bit lower profit than the control. Wheat yield was about 90% higher in both types of conventional fields than in organic fields. In summary, both AES support farmland biodiversity depending on the taxonomic group at the field scale. The next question is how the effectiveness changes, when scaling up to farm scale or higher scale, or correcting for yield loss between the two AES. References (1) Batáry et al. 2015. *Conserv. Biol.* 29: 1006–1016. (2) Batáry et al. 2017. *Nature Ecol. Evol.* 1: 1279–1284.



## Importance of scale and process in forest disturbance legacies

(Oral)

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Ecological memory is the information and material legacies—the adaptations, individuals, and materials that persist after disturbance—that guide ecosystem response to disturbances. Resilience is directly related to ecological memory, and because resilience is desired in forest management, it is important to consider how ecological memory works. We propose that six spatial scales are needed to characterize ecological memory and its interactions with disturbance. These scales are: micro, tree, neighborhood, stand, meso and landscape. The nested hierarchy of microsites-tree-stand-landscape is well known, with widespread recognition of the need for diverse microsites, tree species and ages, and stand ages to create a managed landscape that harbors biodiversity. However, roles of the neighborhood and meso scales have been considered less often and have not been well integrated into overall legacy theory and its application to forest management. Here we show the key role of processes at these scales and their interactions with disturbance to maintain ecological memory, using cold-temperate and boreal forests from Minnesota, USA as a case study.

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2018/06/14

16:30

Room:



## Introduction: Large carnivores and zoos as catalysts for biodiversity conservation

(Oral)

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Abstract of this presentation is not public



## The effects of flower-rich fields on biodiversity-based ecosystem services in the agricultural landscape.

(Oral)

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The rising demand of agricultural products has led to agricultural intensification based on external inputs. Therefore, biodiversity and semi-natural habitats in agricultural landscapes have decreased in the last decades. Biodiversity-dependent ecosystem services like pollination and natural pest control are negatively affected by this development. Pollination provided by animals is of major importance to a wide variety of crops as well as the majority of wild plants. Furthermore, natural pest control gains importance due to increasingly frequent pesticide resistances. In Germany, Agri-environmental schemes (AES) aim to restore biodiversity in the agricultural landscape and to compensate at least partly for the lack of perennial semi-natural habitats by providing key resources for wild animals. For example, sown flower-rich fields are implemented to provide nectar, pollen and nesting sites to insects. The optimal management, composition and distribution of these flowering fields are still matters of ongoing discussion, especially concerning their interaction with the surrounding landscape in terms of maximizing ecosystem services. In addition, knowledge gaps exist about trade-offs and synergies among pollination and pest control services in response to AES and landscape context. Experiments were carried out in Lower Franconia, Germany in 2016 to address these questions. A total of 31 oilseed rape fields with adjacent flowering fields differing in age/continuity, size and management or with adjacent oilseed rape controls located in 1km radius landscapes along a semi-natural habitat gradient were selected for this study. In the oilseed rape fields, transects leading away from the flowering fields were established to examine distance decay effects of the AES by conducting pollinator observations, pest density and yield measurements. We present results on pollinator visitation rates, pollinator richness, pest control efficiency and crop yields. In doing so, we consider interactive effects of landscape context, different types of AES and within field distance-decay functions.

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## Modelled habitat suitability of fungi in floodplains

(Oral)

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To maximize restoration efforts, knowledge on habitat key structures and potential for species occurrence is crucial for conservation. Contemporary protected areas such as national parks and nature reserves can provide refugia for fungal species. Still, the relative importance of single areas might vary across species, especially as they might have been chosen according to other criteria (e.g. endemism vs species richness). Despite the knowledge on the important role of fungi in floodplains e.g. for decay processes, little is known about fungal species distribution and important factors for species conservation in this dynamic habitat. The national database on Swiss fungi with 615'000 records is to date mainly based on citizen science data, i.e. biased in many ways with a strong focus on macrofungi. Nevertheless we show that species with more than 100 observations can form a robust set for modelling. In this study, we focus on modelling the ecological niche along rivers in Switzerland for 17 riparian fungal species in a 25 x 25 m grid representing various functional groups (ectomycorrhiza, saprobic soil fungi, dead wood species). We predict areas of suitable habitat based on environmental predictors which cannot be influenced by management (e.g. soil characteristics, temperature and precipitation) and contrast it with models additionally including forest structures. Our results show that the two modelling approaches differ considerably in their predicted habitat suitability for the fungal species. While a majority of individuals of all species is currently reported to occur in protected landscape, areas with high habitat suitability varies considerably among species and does not overlap with key areas for conservation. The modelling approaches allow to detect potential habitat for individual species. Moreover, candidate regions for new key areas for conservation for a maximum number of fungal species can be defined in order to optimize conservation efforts under space constraints along rivers.

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## Natural disturbance regime as the basis of forest conservation and ecosystem management

(Oral)

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Forest disturbance regime, i.e. the spatio-temporal occurrence pattern of varied disturbances in a given area, is a key factor shaping forest ecosystem structure, species assemblages and processes. Over the past decades, natural disturbance emulation (NDE), based on adapted silviculture for maintaining habitat diversity, has been proposed as a comprehensive approach to forest conservation and ecosystem management. The logic here is that by restoring and maintaining forest structures that are sufficiently similar to those occurring in natural forests, it would be possible to reduce the adverse effects of timber harvesting on biodiversity and key ecological processes. Despite the NDE initiatives, boreal forestry continues to favor clear cut harvesting and even-aged management, an approach that is known to match poorly with natural forest structure and dynamics. Due to intensifying forest utilization, and in some areas due to increasing natural disturbances with warming climate, boreal forest age class structures have changed, and continue to change, rapidly so that the proportion of old forest has substantially declined, while that of young post-harvest and/or post-natural-disturbance forests have increased. To mitigate the risks to boreal forest biodiversity and ecosystem functioning, and to safeguard the multiple services forests provide to societies, more attention is required on maintaining an adequate share and ecological qualities of young post-disturbance stages, as well as mature forest stages with old-growth characteristics. This can be accomplished by following natural disturbance emulation principles, i.e. managing for natural post-disturbance legacy structures in forest harvesting, and by innovative use of mixtures of silvicultural approaches to maintain variability and critical proportions of late-successional forest in landscapes.

1) Kuuluvainen, T. 2016. Ecosystem management of the boreal forest. Oxford Research Encyclopedia of Environmental Sciences. Oxford University Press

2) Kuuluvainen, T. & Grenfell, R. 2012. Natural disturbance emulation in boreal forest ecosystem management: theories, strategies and a comparison with conventional even-aged management. Canadian Journal of Forest Research 42: 1185–1203.

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## Future bioeconomy pathways: case fibre-based packaging sector in Finland

(Oral)

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According to the Finnish bioeconomy strategy, competitive and sustainable bioeconomy solutions for global problems can be created via new business creation both in the domestic and international markets. Forest sector contributes to roughly one half of the bioeconomy sector in Finland with main growth areas being packaging, industrial wood construction and production of renewable biofuels. Demand for renewable materials based packaging solutions is driven by growing environmental consciousness, technological development and the rise in online purchasing.

The aim of the research is to investigate how fiber-based packaging value network actors in Finland perceive the role of sustainability and sustainability related innovations shaping the transitioning toward future bioeconomy. First, we wish to clarify how the value network actors understand the concept of bioeconomy, and second, empirically analyse the two possible bioeconomy evolution pathways. In the technology based pathway, sustainability is viewed as an implicit result of the bioeconomy and most emphasis is in the technological development, resource efficiency and diffusion large scale solutions promoted by strong partnerships between policy, science and industry. In contrast, according to the socio-ecological pathway, higher emphasis is in promoting circularity, inclusive regional value chain development and sustainable consumption practices.

Our qualitative analysis is based on a futures workshop and 14 expert and industry interviews with different actor organizations of the Finnish fiber-based packaging sector. These results are also analyzed against the Nordic bioeconomy strategy to depict enabling factors and barriers in achieving the set goals regarding sustainability and economic competitiveness from the packaging business perspective. Based on the results, bioeconomy is seen as a bringing concept but without one clear definition. The study also found that although all actors have importance for the future development of more sustainable packaging concept, the brand owners are perceived to carry the most influential power. We conclude that the bioeconomy concept may contribute toward gaining societal benefits from sustainability, but to do this it needs to break free from business as usual thinking and silos between different packaging sectors.

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17:30

Room: K306 Anton



## UPM Raflatac: Labeling a smarter future with forest based products

(Oral)

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With a continuous increase in the global demand for all kind of products environmental sustainability is more important than ever. To do good business we have to be environmentally responsible and optimize our use of natural resources, focus on renewable raw materials, eliminate waste and reduce environmental emissions. Every choice can make a difference. UPM Raflatac has taken up the task of labeling a smarter future. We are using innovation to develop solutions that were previously thought unviable. Today we are making steps in the right direction, creating resource efficient, recyclable and biobased products that are the blueprint for a circular future. However, we see a bio-future as the ultimate solution for a circular society but it requires us to rethink the system and to create partnerships to get us there.

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## Occurrence of fire among boreal forest site types and climates can guide natural disturbance emulation for biodiversity conservation: a case study of uptake of evidence-based knowledge

(Oral)

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Since 1993 Swedish forest policy states that production and environmental objectives are equally important. This triggered knowledge production about how to diversify forest management systems. For the dominating boreal forests evidence show that knowledge about the relative incidence of forest fire can be used to estimate the relative amount of different forest disturbance regimes that ought to be emulated in a particular landscape. Those regimes range from gap-phase dynamic on wet rich sites and humid climates where fire is absent or occurs seldom, via succession after infrequent stand-replacing fires to multiple cohorts of Scots pine where fire occurs often. The conceptual ASIO-model, after the words Absent, Seldom, Infrequent and Often, indicating different forest fire return intervals was developed in 1993 to introduce the natural disturbance regime paradigm into forest planning and management (1, 2). Combining this with evidence-based knowledge about how much habitat can be lost without losing species allows formulation of area targets for conservation, management and restoration of different forest habitats (3).

I report on the uptake of evidence-based knowledge about the role of fire and forest disturbance regimes for biodiversity conservation, and how this was used in forest planning and management. Retired and active forest managers in private forest industrial companies and forest planners procuring wood from non-industrial private forest owners were interviewed, and popular, grey and peer-review papers was reviewed.

The ASIO-model was introduced into forest management planning systems of several large Swedish forest enterprises, and was also used as an educational tool. The model was also used to formulate strategic long-term area targets for protected areas among Swedish regions. The most enduring management action was prescribed burning. However, in spite rapid accumulation of evidence stressing the need for diversification of forest management systems, actual emulation of the three main forest disturbance regions is rare. Instead, under the auspices of bio-economy and climate change mitigation, forestry intensification, including lowered final felling ages, is encouraged. Biodiversity conservation remains a wicked problem for actors aiming at implementation of sustainable forest management policy.

1. Angelstam, P., Rosenberg, P. och Rülcker, C. 1993. Aldrig, sällan, ibland, ofta. [Absent, seldom, infrequent, often] Skog och Forskning 93(1): 34-41. (In Swedish)
2. Angelstam, P. 1998. Maintaining and restoring biodiversity by developing natural disturbance regimes in European boreal forest. *Journal of Vegetation Science* 9(4): 593-602.
3. Angelstam, P., Andersson, K., Axelsson, R., Elbakidze, M., Jonsson, B.-G., Roberge, J.-M. 2011. Protecting forest areas for biodiversity in Sweden 1991-2010: policy implementation process and outcomes on the ground. *Silva Fennica* 45(5): 1111-1133.



## Conservation Biology is not a single field of science: how to judge citation impact properly

(Oral)

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Conservation Biology is not a single field of science. It is a multitude of very different fields of science. It ranges from continental-scale distribution change simulations using planetary-scale climate data, to understanding how a frog responds to calls, to economic optimization models for society's resource extraction, to teasing apart molecules or atomic isotope ratios to infer past and present, and much more.

Yet, items of research - and individual scientists - in all these fields are published in the same platforms, compete for the same scarce attention of peers and of society at large, and the same but even more scarce funding, and the same but mythologically scarce tenures. Somehow, we need ways to compare science of frog calls to science of forestry offset policies, science of bear population genetics, and to everything else.

Citation metrics based on co-citation networks are very promising ways to achieve impact comparison between items and people in different fields of science. The first implementation of this [1] is fatally flawed, as it allowed the diseased concept of "a journal" to be included in the algorithm, but the co-citation network comparison can be implemented on a pure basis of just the research items. I will briefly introduce my Co-citation Percentile Ratio (CPR) algorithm and examples how it ranks research items from different corners of Conservation Biology.

Citation analysis at the article and individual level is slowly but certainly delivering the welcome death of the journal impact factor, and promises to be a better way to judge academic importance. However, we need to be careful in adopting the new tools, and not let them grow to monsters worse than the one we just killed.

In particular, we need to recognize what "a citation" is, and ideally develop ways to give it more nuanced, richer, but still machine-readable meaning. At present, every citation is considered a source that contributed to the science that was done, when in reality most citations are tools to build the author's narrative [2]. But that does not mean citation analysis is useless, it just means that the inference we draw from it needs to take into account what "a citation" really is.

[1] Hutchins BI, Yuan X, Anderson JM, Santangelo GM (2016) Relative Citation Ratio (RCR): A New Metric That Uses Citation Rates to Measure Influence at the Article Level. PLoS Biology. <https://doi.org/10.1371/journal.pbio.1002541>

[2] MacRoberts MH, MacRoberts BR (2017) The mismeasure of science: Citation analysis. Journal of the Association for Information Science and Technology. <https://doi.org/10.1002/asi.23970>



## Cons and prons of metabarcode analysis of fungi for fungal conservation: implications from a large scale monitoring of soil fungi in Swedish forests 2014-16.

(Oral)

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A challenge for getting adequate information of the identity and composition of soil fungal diversity, hence for fungal conservation, is the largely cryptic life of fungi. Several years' lack of sporocarps does not necessarily imply absence of fungal species as mycelial activity may poorly correlate to the irregular and strongly weather dependent production of sporocarps. Furthermore, sporocarps are short-lived, morphological identification of many taxa require specialist competence and several species have inconspicuous, or may even lack, sporocarps.

One approach to circumvent these difficulties, and to complement sporocarp monitoring, is to use metabarcode analysis of e.g. soil and wood to identify fungal communities based on the presence of fungal mycelia. The appealing power of using this methodology is that all fungal taxa present, will in principal be detected and identified at any time of the year. On the other hand, a significant limitation is that only fungi present in the minute samples can be detected. Fungal species richness and diversity is typically very high. Few species are frequent and abundant while red-listed and of conservation interest typically are rare.

Annually since 2014, forest soil fungi are identified and monitored nationally throughout Sweden by metabarcode analysis of soil samples collected in permanent forest plots by the Swedish Forest Soil Inventory (SFSI) and the Swedish National Forest Inventory (SNFI). Hereby, fungal communities from all types and ages of forest with varying histories and management are efficiently collected and identified with a high resolution and precision. Importantly, the fungal communities can be analysed with all associated environmental metadata collected by SFSI and SNFI.

This talk will present the results of fungi identified from the about 900 stands analysed during 2014-2016 with a focus on red-listed species. A comparison will be made with sporocarp records of the corresponding species reported in the Swedish Species Gateway. The results will be discussed in the perspective of red-list assessments and the value and implementation of this type of metabarcode data in fungal conservation.



## Revelations for global change and conservation: determining European fungal species' patterns via a large-scale fruit body 'meta-database'

(Oral and Poster)

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**PRESENTATION:** The driving forces to the geographical structuring of fungi remain notably irresolute, despite well documented trends for a variety of plant and animal groups. This information is critical to planning and mitigating potentially negative consequences of global change, and especially related to conservation. We identified the major geographical and environmental gradients structuring fungal assemblages for two main nutritional modes, saprotrophic and ectomycorrhizal fungi, through the use of 4.9 million European fungal fruit body observations. For both fungal nutritional modes, mean annual temperature correlated most with the first gradient identified that structured assemblages. Soil organic carbon was the highest correlate of the second compositional gradient for ectomycorrhizal fungi, likely an indicator of vegetative- and pH-related covariance. In contrast, a pollution gradient was of secondary importance for saprotrophic fungi, reflected in a high correlation with nitrogen deposition. Compositional gradients and environmental conditions correlated similarly when the data were divided into two time intervals of 1970–1990 and 1991–2010. Indicator species analyses (based on temporal changes in assemblages along the main gradient) did not identify site-specific species, but many species which reflected a high sensitivity in the number of sites they occurred at within a given grouping. The highest rates of compositional change by time suggest targeting higher latitudes and altitudes for a better understanding of fungal dynamics, especially related to climate change. Given the patterns presented here, we suggest further examination of the ranges and dispersal abilities of fungi to assess responses to global change and to aid fungal conservation.

**POSTER:** Species occurrences are increasingly available through citizen science and museum records digitization, creating major ecological resources. Combined with open-source data, our ability to understand the

ecology of organisms is unparalleled. Here we describe a European mycological ‘meta-database’ (ClimFun) that has been integrated with open-source environmental and species traits data. Unique fungal species fruit body records, from nine countries, were assembled into 6 million records of 10,000+ species. We, also, explain phenology patterns related to climate variability and the seasonality of fungal fruiting. Mean annual temperature is ubiquitously important, and especially for autumnal fruiting fungi, while spring fruiting fungi are more responsive to primary production. There is significant likelihood that further climatic change, especially in temperature, will impact species’ fruiting patterns at large spatial scales. The ecological implications are diverse, potentially affecting biodiversity, leading to trophic asynchrony, and impacting dispersal. Against a backdrop of global change, these results all demonstrate how big data are advancing the fields of conservation and mycology.

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## Impact of Anatolian Motorway on Large Mammals: Quantifying the Permeability and Impact Zones

(Oral and Poster)

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Roads are one of the major structures that cause habitat fragmentation all over the world. Motorways and highways especially create a greater disturbance due to their size and extent, not only by increasing the fragmentation but also by resulting in edge effect. Large mammals, due to their need for extensive areas for resources, have large home-ranges, which are more easily fragmented by roads acting as barriers. Motorways and highways may further act as total barriers for certain species, dividing their populations.

Turkey is home, still, to a great diversity of large mammals. However, being a developing country, an extensive amount of infrastructure projects have been under way in an increasing fashion during the last two decades. Roads have been built in excessive amounts, serving as the main infrastructural elements to connect new and enlarged settlements and resource extraction sites such as mines and dams. A total of 17,000 kms of highways were built in Turkey during the last decade. Unfortunately, the effects of roads on wildlife have not been assessed. This study is the first one evaluating the road's effects on wildlife in Turkey.

In order to evaluate the effects of roads on wildlife, a 100 km. segment of the Anatolian motorway, connecting Ankara and İstanbul, is monitored for two years, using 200+ camera traps located at every underpass. The surrounding forest areas were monitored using additional 55 camera traps utilizing systematic grids at 1,5 x 1,5 kms.

A total of 2068 red fox, 1926 golden jackal, 934 wolf, 692 wild boar, 168 brown bear, 32 lynx, 10 red deer and 3 roe deer passing events recorded (filtered by hour). Out of three types of underpasses - culvert, multi-use underpass, viaduct - herbivores used only the viaducts. The heights of underpasses - but not the length or width - significantly affect the preference of all carnivores except red fox. An additional effect of the road on the use of large mammals at varying distances from the road is determined: the use of roadside areas were lower than average use in the 0-500 m. zone while it peaked in 500-1500 m. zone, and undulating around average use at 1500-5000 m. zone on both sides of the road. Such a pattern, caused by the effect of road was also determined in several other studies.





## Age and season-related habitat selection patterns of the bearded vulture (*Gypaetus barbatus*) in the Swiss Alps: a basis for predicting conflict-zones with wind energy construction

(Oral and Poster)

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The recent increase of wind energy use in Central Europe incurs potential impacts on wildlife. Large soaring raptors, like the bearded vulture, are particularly exposed to collision risk with wind turbines as they sometimes converge in selecting fairly similar combinations of landscape and wind conditions. Considerable efforts and resources have been invested to re-instate the species in the European Alps. There exists a risk, however, that this success will be jeopardized by the sprawl of the wind parks across the alpine massif.

We used a maximum entropy modelling approach to predict the potential distribution of the bearded vulture across the Swiss Alpine range using presence-only data. We adopted a stepwise fashion to tune model complexity by varying feature combinations and regularization intensity, selecting the settings that provided the most parsimonious model. We identified and ranked the environmental variables most relevant for the species and tested for differences in ecological requirements between two different age classes (adults and juveniles) in both the cold and the warm season separately.

The resulting models had a high accuracy in predicting habitat suitability (mean AUC across 5-folds cross validation  $\geq 0.81$ ) in each season for both age classes. Adults and juveniles showed different seasonal habitat selection patterns: whereas for juveniles the most important environmental variable was food availability, particularly ibex density (relative contribution: 40.9% in summer and 25.9% in winter), for adults climatic conditions were more important (altitude with 24.9% contribution in summer and average precipitation with 30.6% contribution in winter). When considering both age classes 67% of the Swiss Alpine range offered suitable habitat for the species, with range shifts between the cold and warm season.

This analysis provides a first, broad-scale overview of the species distribution across the Swiss Alps and thus areas of potential conflict with wind energy construction. We will now further investigate flight altitudes and movement patterns at a fine spatial scale in order to identify the sites bearded vultures use most intensively at risky flight heights, i.e. within the rotor-swept area. The results will be integrated into a planning tool that will help avoiding conflicts between wind energy construction and vulture conservation.



## Landscape changes associated to wind farm implementation increase predation on artificial ground-nests

(Oral and Poster)

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The effect of wind farms on birds has received considerable attention. Potential indirect impacts associated to these infrastructures include the attraction of predators that may increase nest predation rate, especially in ground-nesting species. In this work, we investigated artificial ground-nest predation at shrub-steppes in the presence and in the absence of wind farms. For that, we placed 18 sampling stations (11 in the absence and 7 in the presence of wind farms), comprising 9 artificial nests each. Artificial nests were placed in the same location at the beginning and at the end of the breeding season (April and June 2016). Nest predation events were recorded after twelve days exposure, average incubation period of small ground-nesting species inhabiting in the study area. We fitted a Generalized Mixed Effect model (1- predated, 0- non-predated; log link function) and nested effects were analysed incorporating sampling station and nest identifier as random factors, the latter in order to account for repeated-measures design. In addition, we incorporated the following fixed factors: i) month (April/June); ii) the covariate ‘wind farm’ (presence/absence); iii) landscape features in a 500 metres buffer around each sampling station (crop, tree and road surface); and iv) four Principal Components summarizing the microhabitat around each artificial nest, which was measured in a 1x1 metres quadrat. Predation rate was higher at the end than at the beginning of the breeding season (22.5% and 13.6%, respectively). The likelihood of predation was positively related to crop and road surface, being the latter linked to wind farms occurrence. Microhabitat variables around each artificial nest and the presence of wind farms did not influence predation rate. We conclude that roads, a landscape alteration mainly associated with wind farm implementation, increase predation rate on artificial nests since they ease the movement of terrestrial generalist predators. These results highlight the indirect impact that wind farms may have on ground-nesting species, which could compromise their breeding success and, therefore, population viability. An increase on predation rates in the vicinity of wind farms, could be partially explaining the negative impact of these infrastructures on the abundance, occurrence and population trends of small passerine birds[1].

[1] Gómez-Catasús, J., Garza, V. & Traba, J. (2018) Effect of wind farms on small passerine birds: occurrence, abundance and population trends of a threatened species, the Dupont’s lark *Chersophilus duponti*. *Journal of Applied Ecology*.



## Effective conservation planning: The perception of high level stakeholders in Australia

(Oral and Poster)

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The discipline of systematic conservation planning began gaining popularity in the 2000s [1] and is now widely used to assess trade-offs between potential conservation actions. Almost two decades on it is now possible to observe the longer-term impacts of the discipline. The Great Barrier Reef Representative Areas Program and the North East New South Wales Regional Forest Agreements in Australia are considered test cases of systematic conservation planning, but their success is often taken for granted. What made these plans talking points, how transferrable are the lessons learned, and how do the perspectives of key stakeholders differ when it comes to reported outcomes?

As far as we are aware, this is the first time that evaluations of conservation plans have extended beyond the perspectives of scientists and planning personnel. We interviewed senior representatives of major stakeholder groups involved in planning negotiations, including scientists, public servants, politicians, environmental and industry representatives. 32 semi-structured interviews were undertaken, accompanied by questionnaires to query the types of outcomes interviewees had observed during and after the planning processes. We employed a framework of reporting outcomes by five types of capital (natural, social, human, institutional and financial), originally developed by Bottrill and Pressey [2]. Qualitative coding and document analysis were used to explore themes relating to the temporality of different outcomes, the availability of monitoring and reporting evidence, and the relative role of systematic conservation planning in the broader context of natural resource planning. We found that natural capital outcomes were less frequently reported than outcomes relating to social, financial, institutional and human capital, but were more likely to be reported in the longer term. There was broad agreement amongst stakeholders in both case studies about the importance of systematic conservation planning principles and tools in shaping the outcomes of the planning processes, but perspectives on the relative importance of the science as compared with other political, procedural or contextual factors varied widely. Interviewees reported that barriers to conducting evaluations included the loss of personnel, expertise and political will once the plan was completed, an important lesson about the narrow window of opportunity to design and implement high profile conservation programs.

These case studies offer valuable insights into the range of outcomes of highly complex conservation interventions, and why impact evaluations are so challenging to conduct in conservation.

1. Margules, C. R., and R. L. Pressey. 2000. Systematic conservation planning. *Nature* 405(6783):243–253.

2. Bottrill, M. C., and R. L. Pressey. 2012. The effectiveness and evaluation of conservation planning. *Conservation Letters* 5(6):407–420.



## Analysing the road verges as ecological assets - Biodiversity as company

(Oral and Poster)

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Using GIS-analysis in identifying valuable habitats on slopes of Finnish traffic network

Certain built up or otherwise strongly modified environments may be significant for preserving species in endangered natural habitats. These habitats may serve as refuges for endangered species – spaces where they can spread back to their natural environments. These compensatory habitats may serve as a complement to natural habitat protection. Road and railway verges, normally being open, well-lighted and regularly mown areas are potential habitats for grassland species adapted to continuous disturbance. Semi-natural grasslands as well as dry exposed esker habitats constitute a threatened, declining habitat type in Northern, and suitable alternative habitats are needed for survival of these populations. In fact, several grassland species do occur in Finnish road and railway corridors.

In this study we analyzed habitats along the Finnish highway and railroad system to find the most valuable habitats resembling the endangered esker habitats. Different approaches were used for road and railways and this presentation focuses on the analysis of road slopes. We used geographic information methods to first find the road slopes with ideal exposure, soil quality and slope. Then we used Google Street View to classify the patches identified by the initial GIS-analysis. The classification was done based on vegetation cover, coverage of different vegetation types, and proximity to conservation areas. Method was first tested in pilot areas, of the provinces of Pirkanmaa, Kanta-Häme and Päijät-Häme and then the analysis was then expanded to include the whole Finnish highway (main roads) and railway system.

The analysis resulted in 386 sites along road slopes. The total length of the sites were 66 km and the length of the sites varied from 8 to 1 171 m (average 171). The rough estimate of their total area is on average 13,2 hectares which is 1,1 % of the total estimated area of the whole network of known endangered exposed sunny meadow and esker habitats in Finland.

There total area of these sites is small in relation to the total area of their natural endangered counterpart habitats. However, these sites may have importance for the survival of the endangered species in dry exposed habitats as a part of their habitat network when:

1. they form a network with valuable natural habitats
2. they form a network of stepping stones or a corridor between valuable natural habitats
3. the compensatory sites themselves form a connected network or a corridor along

The results of the analyses give an opportunity to the owner of these land assets the to develop the management of road slopes to promote their biodiversity value.

2018/06/15

11:00

Room: C1 Hall



UNIVERSITY OF JYVÄSKYLÄ



## Biodiversity and ecosystem services in Europe and Central Asia – status, trends and future scenarios

(Oral)

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The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), a science-policy platform administered by the United Nations Environment Programme, at its third plenary in January 2015, in Bonn, requested the undertaking of a set of regional and sub-regional assessments of biodiversity and ecosystem services.

These assessments aim to synthesize the body of scientific, indigenous and local knowledge on status and trends of biodiversity and ecosystem services, direct and indirect drivers of change, alternative future scenarios, and key challenges and opportunities for achieving Sustainable Development Goals in each region.

The Europe and Central Asia assessment (ECA) is expected to inform several international environmental agreements by providing the science-base underpinning all environmental policies in the region in the near-future.

In this talk I will illustrate the main trends across taxa, habitats and regions and the main past drivers of biodiversity change. We found strong evidence for long-term and ongoing declines in extent and condition of habitats and species conservation status across all realms, with exceptionally high rates in the freshwater realm where wetlands across Europe and Central Asia have declined by 60% from 1970, and 71% of fish and 60% of amphibians with known population trends are declining. However, conservation efforts have shown the potential to reverse negative species trends, for instance the bird taxa breeding in the EU and in Annex I of the European Union Birds Directive have in have better population trends than the average and several species that attracted conservation interests have improved their prognosis.

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## Introduction: the IPBES, Intergovernmental Platform on Biodiversity and Ecosystem Services

(Oral)

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Conservation biology is to save the diversity of life on our Planet. This diversity contributes to the functioning of ecosystems, thus also to the well-being of the human societies. The decline of biodiversity has long been recognised by the scientific community, and was widely publicized. Unfortunately, these voices and actions (e.g., Millennium Ecosystem Assessment) initiated by the scientific and NGO communities did not effectively bridge the gap between science and policy. IPBES is different from previous efforts, as it originates from the governments and not the scientific community. More than hundred and twenty governments are members of this intergovernmental platform. Nevertheless, the accomplishment of the platform's work programme involves over 1000 researchers and experts, thus the mutual cooperation of both sides of the bridge of the science – policy gap now actively participates. One of the objectives of IPBES is to assess the interactions between the living world and human societies. Probably the most important for Europe is the regional assessment of biodiversity and ecosystem services for Europe and Central Asia, covering Europe, whole Russia, Turkey, and five Central Asian countries. The assessment contributes also to the identification of needs for capacity-building, generation of new knowledge and development of policy support tools. Compared to previous works, the assessment has higher level of involvement of experts from the post-soviet countries, and brings in knowledge from non-academic knowledge systems (e.g. Indigenous and Local Knowledge), as well. This symposium will provide an introduction to IPBES, with special emphasis on its novelties and on the Europe and Central Asia Regional Assessment. The following workshop will provide forum for discussing how to use the results of the assessment to guide research, research funding, and other activities of the European conservation biologists' community.

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## A systematic map of biodiversity impacts of active forest management relevant to protected areas

(Oral)

**Claes Bernes<sup>1</sup>✉, Bengt-Gunnar Jonsson<sup>2</sup>, Kaisa Junninen<sup>3</sup>, Asko Löhmus<sup>2</sup>, Ellen Macdonald<sup>4</sup>, Jörg Müller<sup>5</sup>, Jennie Sandström<sup>2</sup>**

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The biodiversity of forests set aside from forestry is often considered best preserved by non-intervention. In many protected forests, however, remaining biodiversity values are legacies of past disturbances, e.g. recurring fires, grazing or small-scale felling. These forests may need active management to keep the characteristics that were the reason for setting them aside.

As a first step towards a more complete synthesis, we compiled a systematic map of impacts of interventions that could be useful for conserving or restoring biodiversity in boreal and temperate forests (1). Such a map gives an overview of the evidence base by providing a database with descriptions of relevant studies, but it does not synthesise reported results (2).

Searches for literature were made using online publication databases, search engines, specialist websites and literature reviews. We searched not only for studies of interventions in actual forest set-asides, but also for appropriate evidence from commercially managed forests, since some practices applied there may be useful for conservation or restoration purposes too.

The 798 articles found to be relevant included 812 individual studies, all of which were described in an interactive GIS application. Almost two thirds of the studies were conducted in North America, whereas most of the rest were performed in Europe. Of the European studies, 58% were conducted in Finland or Sweden. The interventions most commonly studied were partial harvesting, prescribed burning, thinning, and manipulation of grazing. The impacts most frequently reported were effects on trees, other vascular plants, dead wood, vertical stand structure and birds. Outcomes included e.g. abundance, species richness, diversity indices, and community composition based on ordinations.

The systematic map identified a wealth of evidence on impacts of active management practices that could be utilised to conserve or restore biodiversity in forest set-asides. As such, it should be of value to e.g. conservation managers, researchers and policymakers. Moreover, since the map also highlighted important knowledge gaps, it could inspire new primary research on topics that have so far not been well covered. Finally, it provided a foundation for systematic reviews on specific subtopics. Based on our map of the evidence, we identified four subtopics that were sufficiently covered by existing studies to allow full systematic reviewing. Three of the subtopics have now been subject to such reviews.

(1) Bernes, C., et al. 2015: "What is the impact of active management on biodiversity in boreal and temperate forests set aside for conservation or restoration? A systematic map." *Environmental Evidence* 4:25



(2) Haddaway, N.R., et al. 2016: "The benefits of systematic mapping to evidence-based environmental management." *Ambio* 45, 613-620

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## The use of biological traps for water treatment in Recirculating Aquaculture Systems

(Oral)

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Increasing global demand for fish and the depletion of natural fish stocks has stimulated the development of aquaculture all over the world. One of the main restrictions for future growth and sustainability of the aquaculture lies in its waste discharge. The main concern includes dissolved or particulate organics, nitrogen and phosphorus, which may lead to eutrophication of aquatic ecosystems receiving the wastewaters. Therefore, nutrient removal is essential for aquaculture wastewater treatment for protection of the surrounding environment.

Recirculating aquaculture systems (RAS), enable fish production in relative isolation from the surrounding environment, and they offer advantages in terms of reduced water consumption, improved opportunities for waste management and nutrient recycling. In RAS a microbial biofilter is used for converting the ammonia excreted by fish into nitrate, and due to the high recirculation of water, the RAS's wastewater is concentrated with nutrients that can be used for microalgae cultivation.

This project will test the hypothesis that by the combination of microalgae and filter feeder cultivation in RAS's effluent, the nutrient release into the environment can be significantly reduced. The objectives are to evaluate (1) the effectiveness of microalgae to remove dissolved nutrients from the RAS's wastewater; (2) the effects of environmental conditions on the algal biomass production. As harvesting of microalgae is a challenging and expensive process, this project will evaluate (3) the potential of *Daphnia magna* & lake mussel *Anodonta anatina* to filter the algae from the water. This project will produce new knowledge on nutrient recycling and thus supports the concept of circular economy, and conservational and sustainable management.

Our preliminary results are promising: the tested green microalgae can remove more than 90% of dissolved nitrogen and phosphorus from laboratory-scale RAS's wastewater effluent after 4 days, while still in the exponential growth phase; and more than 99% after 9 days while they are in the saturation growth phase.

RAS production is growing worldwide but also in Finland, thus the potential for re-using valuable nutrients in RAS's wastewater should be investigated to improve the sustainability of aquaculture.

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## Commercial farming threatens Chinese Giant Salamander conservation through disease, introgression and overexploitation.

(Oral)

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The Chinese giant salamander (*Andrias davidianus*; CGS), endemic to China and Critically Endangered, has been identified as the amphibian species most in need of conservation action<sup>1</sup>. Since 2004, a rapidly growing industry to farm CGS for food, subsidised in order to diversify and bolster the rural economy and employment opportunities, has developed throughout much of China, centred on Shaanxi Province.

By mid-2012 at least 141 CGS farms had been licensed in the province, with many more farms unrecorded. In 2011, 2.6 million farmed CGS were documented in Shaanxi Province alone. Wild-caught CGS continue to be in demand for breeding farms even though their capture is illegal. This is partly due to problems in getting > F1 animals to breed and partly due to huge (up to 100%) losses of farm stock from disease epidemics and the consequent requirement to restock affected farms<sup>2</sup>. This demand for breeding stock, which can command very high prices, has driven recent overexploitation and near-depletion from the wild.

We visited CGS farms during outbreaks of fatal disease and, using PCR, we identified Ranavirus infection as the cause<sup>2</sup>. Thirty-nine of 43 additional farms surveyed reported that they had suffered disease outbreaks consistent with ranaviral disease. Three of the four farms that did not report disease held stock of  $\leq 3,000$  animals, lower than the mean number of 8,354 CGS per surveyed farm. The industrial-scale farming, high stocking densities, and trade in animals across China in the absence of biosecurity measures has led to a system that has fostered the propagation and spread of infectious disease.

Genetic screening of wild and farmed CGS has identified geographic structuring of wild salamanders but genetic mixing and hybridisation of farmed animals<sup>3</sup>. The current structure and management of the CGS farming industry presents conservation threats to extant wild CGS (and possibly other wild fauna) through the discharge of contaminated farm wastewater or the escape of infected individuals to the wild. Additional disease and genetic threats to CGS conservation are posed by the Chinese government-sponsored conservation action of purchasing farmed animals for release into the wild without adherence to IUCN guidelines, such as pathogen or genetic screening, identification of suitable habitat or post-release monitoring.

Complete separation of farmed and wild CGS populations and improved CGS farm management, including the quarantining of new stock and the disinfection of waste-water, is recommended in order to reduce disease risks to both farmed and wild animals. The number and native locations of CGS evolutionary significant units should be identified and in situ protection measures put in place and enforced. A CGS conservation action plan should be developed and, if conservation breeding and release is an identified requirement, this should be conducted separately from commercial farming and should follow IUCN guidelines.

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## Shared threats to endemic Yangtze finless porpoises, fisheries, and community livelihoods in the middle-lower Yangtze River and Poyang Lake, China.

(Oral)

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Understanding causes of population decline is essential to inform effective conservation of endangered species, but attention must also be given to the social and economic context of the system in which the species exists to ensure successful, integrated interventions. In many rapidly developing countries however, awareness lags behind development and sufficient data to inform effective conservation is not available, causing problems and delays in implementation. This can be made even more difficult by the typical involvement of multiple stakeholders, who can hold differing objectives or conservation values.

Asian freshwater cetaceans are amongst the most threatened large mammal taxa(1). The Critically Endangered Yangtze finless porpoise (*Neophocaena asiaeorientalis* ssp. *asiaeorientalis*) is a unique freshwater cetacean endemic to the middle-lower reaches of the Yangtze River, eastern China. As their range is restricted to the heavily industrialised Yangtze River, their habitat is concurrent with a high level of anthropogenic habitat modification and direct and indirect environmental threats. Heavy extraction from this system has led to severe fish stock decline; this has reduced prey availability for the porpoise but also threatened livelihoods and sustainability of food resources for local communities, some of whom have been severely restricted by government-led fishing limitations. There's very little understanding of how to effectively mitigate the local fishing industry whilst also conserving livelihoods and protecting communities reliant on the Yangtze as a source of income and food.

To address this issue, an extensive interview survey of fishing communities aimed to detail local fishing habits, quantify porpoise bycatch, and assess the success of mitigation schemes around the key habitat of Poyang Lake and an adjacent section of Yangtze mainstem. The comprehensive interview was designed to gain better understanding of the factors needed for successful livelihood replacement, effective reimbursement schemes, and other factors that may affect the success of conservation measures. By incorporating the socio-economic implications noted in this study, current and possible future interventions to conserve both the porpoise and other local species will be more likely to result in long-term sustainability through community support whilst also ensuring the future of local livelihoods.

(1) Reeves, R. R., Smith, B. D. and Kasuya, T. (2000) *Biology and Conservation of Freshwater Cetaceans in Asia*. IUCN, Gland, Switzerland and Cambridge, UK.



## Applying Systematic Reviews and Systematic Maps for devising management recommendations

(Oral)

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Systematic reviews and maps are becoming a golden standard for evidence synthesis in conservation and environmental management. Building upon previous studies, these research methods for collating research evidence are based on key principles of transparency, comprehensiveness and repeatability [1]. While aiming at minimizing bias and subjectivity at all stages of the review process, they can provide the best available evidence to decision makers in environmental policy and practice [2]. Systematic reviews are conducted in several consecutive steps: 1) review question formulation with stakeholder engagement; 2) peer-reviewed and published protocol outlining the review methods; 3) comprehensive search for relevant grey and academic literature; 4) careful screening and inclusion of relevant evidence using pre-determined criteria; 5) critical appraisal of internal and external validity of each included study; 5) transparent synthesis and reporting of review results; 6) communication of review results. Whilst systematic reviews address questions about effectiveness of interventions or impact of an activity, systematic maps are used to describe and catalogue the evidence base on a broad subject of interest. They can highlight knowledge clusters, knowledge gaps, and methodological patterns in the primary research.

To guarantee high standards of systematic reviews and maps, Collaboration for Environmental Evidence (CEE) was established as a coordinating body for the promotion, conduct and registration of environmental systematic reviews. Mistra EviEM is the Swedish centre of the CEE network [3]. Since 2012, Mistra EviEM has been conducting systematic reviews and maps relevant (but not restricted) to Swedish environmental policy and management, focusing on several key areas such as forestry, agriculture, biodiversity conservation, etc. These reviews are conducted in attempt to fill synthesis gaps identified by Swedish environmental stakeholders. They address questions on e.g. if and how management measures achieve desired effects, or what are the environmental consequences of anthropogenic activities. This presentation will give an overview of synthesis approaches used by Mistra EviEM to transparently, comprehensively and objectively describe and summarise scientific evidence and inform environmental policy and management. Importance of stakeholder engagement in prioritisation and planning of a review conduct and communication of review results will be highlighted. Finally, some common (methodological) flaws in the primary studies that can limit use of these studies in systematic reviews and maps will be described.

Ref.

[1] Collaboration for Environmental Evidence (2013) Guidelines for Systematic Review and Evidence Synthesis in Environmental Management. Version 4.2.

[2] Haddaway NR, Pullin AS (2014) The Policy Role of Systematic Reviews: Past, Present and Future. Springer Sci. Rev 14:179–183.

[3] EviEM (2017) About Us. <http://www.eviem.se/en>



## Indigenous and Local Knowledge: a Major Novelty of IPBES

(Oral)

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Indigenous peoples and local communities (IPLCs) are the main users and caretakers of nature and its contributions to people over large areas of Europe and Central Asia. Their understanding of nature, drivers, futures and policies can help developing more relevant actions and policies and acknowledging indigenous rights. While national or global stakeholders might have a particular interest in the conservation of nature, indigenous and local communities may be more concerned by long-term sustainable use, and the enhancement of the cultural heritage, and the ‘health’ of their living environment.

IPBES has developed and applied a conceptual framework, an integrated valuation approach and a strategy and guidance that integrates information from different knowledge systems (cf. Tengö et al. 2014), including indigenous and local knowledge (ILK). As IPLCs retain within their knowledge systems an inter-generational memory of fluctuations, trends and exceptional events in relation to the local environment, they can contribute importantly to understanding ecological processes of change and their drivers.

Gathering of ILK and integrating it within the assessment was a major challenge. Therefore we organized a dialogue workshop between ILK holders and assessment authors to help this integration (Roué, Molnár 2017). We also prepared a content analysis of ILK-holders narratives on biodiversity and ecosystem services which allowed to (i) identify some beneficial nature’s contributions to people that were not assessed as an ecosystem service in former National Ecosystem Assessments and to (ii) gain confidence about the status and trends of specific nature’s contributions to people when the evidence based on available published literature was low (Díaz et al. 2018).

Regardless the final output of the assessment, the consideration of ILK can contribute to overcome the existing power asymmetries between scientific knowledge and ILK in science-policy interface. In fact, the consideration of ILK as equally useful as scientific knowledge can foster procedural justice in decision-making regarding management of nature and nature’s contributions to people. We hope that taking ILK into account will help increase also the efficiency of nature conservation and the long-term sustainable use of biodiversity.

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2018/06/15

10:15


Room: A2 Wivi



## Tracing key adaptive-pathways of conservation-concerned mammal species in Europe under climate change - where conservation priorities meet human development

(Oral)

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Abstract of this presentation is not public



## Drivers of change in the status and trends of biodiversity and nature's contributions to people

(Oral)

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The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) combines the state-of-the-art knowledge about the status and trends of our ecosystems, biodiversity and nature's contributions to people (NCP). In the IPBES regional assessment focusing on Europe and Central Asia (ECA), Chapter 4 assesses the drivers that contribute to change in biodiversity and related nature's contributions to people. In my talk, I will provide overview of the main findings and policy implications related to drivers of change in the IPBES ECA assessment, and discuss the challenges that Chapter 4 authors had when identifying and quantifying driver trends and their effects.

For assessing the drivers of biodiversity change, IPBES adopted the same approach already used in the Millennium Ecosystem Assessment, differentiating between direct drivers and indirect drivers. Direct drivers are those with direct impact on biodiversity and NCP, while indirect drivers influence biodiversity through their impact on direct drivers. While different categorizations of direct and indirect drivers have been proposed over past decade, IPBES assessment distinguished following direct drivers: 1) natural resource extraction; 2) land use change; 3) pollution; 4) climate change, and 5) invasive alien species. Considered indirect drivers were 1) institutional; 2) demographic; 3) scientific & technological; 4) economic, and 5) cultural & religious. Although also natural processes and factors can have impact on biodiversity and NCP, IPBES ECA assessment targets only the anthropogenic drivers, i.e. those that are directly linked to human impact. For example, climate per se is not considered as a driver, but human-induced climate change is assessed as a driver. Where possible and justified, IPBES ECA assessment focused on assessing the trends and effects of anthropogenic drivers during post-industrial time.

Concept of drivers is complicated by the fact that different drivers rarely act in isolation. Not only indirect drivers influence direct drivers, they can have impact other indirect drivers, leading to altered outcome for the direct drivers. Similarly, direct drivers interact with each other and magnify or mitigate both their individual trends as well as their individual and combined effects on biodiversity and NCP. As few of many examples, trends of climate change and land-use change influence the alien species invasions, and effects of climate change are further magnified by land use change. We assessed this complexity by developing causal loop diagrams that indicate the interactions and effects between drivers. However, interactions between drivers and their possible mitigating and enforcing effects are still among the topics that have not received enough attention in the ecological literature and more research is needed to unravel the effects of different drivers acting in concert.



## Projecting impacts of global land-use scenarios on biodiversity change across scales and species groups.

(Oral)

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Habitat destruction via land-use change is considered to be a primary driver for both biodiversity and ecosystems changes. As the pressure on land use is expected to increase in the future, there is an urgent need to develop the ability to assess in more detail the full range of responses of biodiversity to future land use change. Scenario analysis of alternative plausible futures is often used as a tool to explore and evaluate the extensive uncertainties associated with such possible future developments. Here, we use the countryside species-area relationship (cSAR) model to project future (2015-2100) changes in both alpha and gamma diversity of birds species and assess the dynamics between two bird functional species groups resulting from land use changes following three distinct scenarios of land use change and climate mitigation (i.e. the land use harmonization (LUH) database that represent alternative representative concentration and shared socio-economic pathways (RCP-SSP). We then compared future and current (1900-2015) rates of biodiversity loss. Across the different scenarios, we observe minimal losses to small increases in mean local species diversity (alpha diversity), although with significant declines of forest specialists, which are compensated by increases in generalist and open-habitat species. While global species loss (gamma diversity) seems to decrease around two percent, across the three scenarios, with significant losses of generalist and open-habitat species, rendering the tree scenarios similar when all bird species are taken together. Our results highlight the importance of assessing how different patterns of land-use affect biodiversity and how different choices will affect different components of biodiversity. We discuss how these considerations can help integrate human development and nature stewardship in a more sustainable way.



## Introduction – Does nature best manage itself or do protected areas need active conservation?

(Oral)

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A traditional approach to limit impacts of forestry on biodiversity is to set aside forests of conservation value. Many set-asides are relatively untouched, but some have a history of disturbances; wildfires, forest grazing, coppicing or small-scale felling. Such areas may gradually lose their value for biodiversity conservation unless the disturbances are re-introduced or managed otherwise. On the other hand, many currently protected forests have a history of commercial management, and may lack important characteristics of natural forests. Some of these lost features, can be brought back by active management faster than they would recover naturally. Recently, interest in active management of forest set-asides has increased, but opinions differ among conservationists on how such management should be balanced against non-intervention [1].

In many protected forests remaining biodiversity values are legacies of past disturbance regimes that are nowadays suppressed. This is common e.g. in the boreal pine forest, which in its natural state is shaped by recurring fires creating dead wood and keeping the stands relatively sparse and with a significant broadleaf component. In northern Europe, forest fires are now rare, and pine forests have therefore become denser, with an increasing dominance of spruce; calling for reintroduction of fire.

In other forest set-asides, conservation values is a result of earlier forest grazing, coppicing, small-scale felling or similar human influences. Since these activities were often discontinued several decades ago, the forest has become denser and more shaded, negatively influencing associated species. Such reserves may need active management to conserve the characteristics that were the reason for setting them aside.

Finally, active management designed to achieve a favorable conservation status can be particularly relevant in regions where forests have been extensively degraded by human land-use. In such areas, the creation of a network of forest reserves with high-quality habitats may require some level of stand-scale restoration.

Until quite recently, few well-designed experiments have been conducted to investigate how forest set-asides are affected by various kinds of interventions. Management have mainly been based on historical data or palaeoecological land-use studies, natural disturbance regimes and past environmental qualities. We have performed a set of Systematic Reviews of primary field studies of how active management affect biodiversity in boreal or temperate forests.

The studies are from both protected areas as well as studies of interventions in commercially managed forests. These studies provide a starting point for evidence-based management of protected forest areas. However, the reviews also highlight significant knowledge gaps for further experimental research.

[1] Halme, P. et al. 2013. Challenges of ecological restoration: Lessons from forests in northern Europe. *Biol. Conserv.* 167:248-256

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## Exposure to a widespread agricultural pollutant alters ecologically important behaviours in fish

(Oral)

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The capacity of pharmaceutical pollution to alter behaviour in wildlife is of increasing concern to the scientific community. A major pathway of these contaminants into the environment is the treatment of livestock with hormonal growth promotants (HGP), highly potent veterinary pharmaceuticals that can enter aquatic ecosystems via effluent runoff. Hormonal growth promotants are designed to have biological effects at low doses, often act on physiological pathways that are evolutionarily conserved across taxa, and have repeatedly been detected in ecosystems worldwide. However, despite being shown to cause altered development, reproduction and morphology in various non-target species, relatively little is known about the potential of HGPs to alter ecologically important behaviours, especially across multiple contexts. Here, we investigated the effects of short-term (21-day) exposure to field-detected levels (average measured concentration: 16 ng/L) of 17 $\beta$ -trenbolone—a potent growth-promoting veterinary pharmaceutical repeatedly detected in freshwater systems—on a suite of ecologically important behaviours in female eastern mosquitofish (*Gambusia holbrooki*). We found that fish exposed to 17 $\beta$ -trenbolone were more active and exploratory in a novel environment (i.e. maze arena), while boldness was not significantly affected. Further, when tested for sociability, exposed fish were again more active and exploratory, and spent less time associating with a shoal of stimulus (i.e. unexposed) conspecific females. Lastly, when assayed for foraging behaviour, exposed fish spent a greater total amount of time within a foraging zone containing an array of prey items (chironomid larvae) than did unexposed fish, entered this zone more frequently, and were more likely to feed. Further, a significant effect of exposure was detected on the total number of prey items consumed, although treatment-induced increases in foraging behaviour were dependent on female size. Taken together, these findings highlight the potential for sub-lethal levels of veterinary pharmaceuticals detected in the environment to alter sensitive behavioural processes in wildlife across multiple contexts, with possible ecological and evolutionary implications for exposed populations.

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## In beech forest landscapes composed of different management systems biodiversity increases with the share of even-aged forests.

(Oral)

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The composition of forest landscapes in terms of tree age, developmental phases and the share of unmanaged forests is substantial for protecting biodiversity. However, the optimal composition in temperate forests is still under debate. Forest conservationists and policy nevertheless advocate increasing the share of unmanaged and uneven-aged forests at the expense of traditionally managed even-aged forests to preserve biodiversity.

We studied the biodiversity of forest landscapes composed of even-aged, uneven-aged and unmanaged (formerly managed) European beech forests for 14 organism groups from bacteria to vertebrates sampled in the largest contiguous beech forest in Germany [1]. Hypothetical forest landscapes were generated by resampling plots of the three management systems so that all compositional combinations were represented in steps of 10% with 1000 replications. We asked how gamma-diversity - single taxa diversity and multidiversity - responds to differently composed forest landscapes.

Species richness of all groups responded non-linearly and convexly to landscape composition. Strongest responses were found for beetles ( $R^2 = 0.599$ ), spiders ( $R^2 = 0.588$ ) and vascular plants ( $R^2 = 0.521$ ) with the biodiversity maximum in pure even-aged and the minimum in pure unmanaged forest landscapes. The response pattern was similar for Shannon diversity and for forest specialists. Birds ( $R^2 = 0.454$ ) and saproxylic beetles ( $R^2 = 0.275$ ) benefited from a high share of even-aged complemented by unmanaged forests. Different response patterns were observed for deadwood fungi ( $R^2 = 0.367$ ) and bacteria ( $R^2 = 0.358$ ) with the maximum in unmanaged and uneven-aged forests, respectively. Multidiversity cumulated in pure even-aged landscapes preserving 97.5% of total diversity across all 14 taxa. By increasing the share of uneven-aged forests, multidiversity declined to 87.0%. Its minimum was found in pure unmanaged forest landscapes (86.2%).

We conclude that biodiversity of most taxa is largely preserved in even-aged forests. This indicates that a mosaic of different age-classes better promotes biodiversity than high within-stand heterogeneity and management abandonment for the investigated forest landscape under current conditions. Specific features of uneven-aged and unmanaged forests can provide important habitats for certain species, in particular those depending on high deadwood amount. These habitats may even increase in the future, considering the relatively short time span of management abandonment in the investigated secondary natural forests (20 to 70 y) that functioned as an unmanaged reference. Nevertheless, the even-aged forests should be acknowledged as the backbone of forest biodiversity in a landscape that was shaped by humans for centuries.

1. Schall P, Gossner M M, et al. (2018). The impact of even-aged and uneven-aged forest management on regional biodiversity of multiple taxa in European beech forests. *J Appl Ecol* 55, 267-278





## How can we save pangolins? A case study from a market perspective in China

(Oral)

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Pangolins are threatened by intense poaching activities, and are now the most trafficked animal group in the world. Frequent large international seizures of pangolins and their body parts indicate that international market demand is a primary driver of poaching. China is a major end-market for pangolin products, necessitating study of pangolin use in China to inform management as an important conservation priority. According to the market reduction approach, reducing illegal behaviour (i.e., poaching of pangolins) requires an understanding of the whole trading chain in order to permit identification of potential easy-to-disrupt joints or nodes along this chain (1). Using the framework of the market reduction approach, I present new socio-economic data derived from interviewing trade participants to describe the supply and demand of pangolin products in China. Trade participants are identified as four groups of people: hunters, sellers, consumers, and nature reserve rangers or forestry department officials. Representatives of each of these participant groups were interviewed about their understanding and attitudes towards pangolins and pangolin products. Relevant demographic data were gathered and questions were designed according to the theory of planned behaviour, to characterize pangolin users and to understand the behaviours involved in pangolin trading (2). This approach provides a relatively comprehensive understanding of the whole trading chain and can answer important questions that are necessary to address for pangolin conservation, such as “who are the consumers?” and “why do doctors prescribe pangolin scales?” The results of this study reveal that in China the demand on pangolin products is huge, while enforcement to regulate the market and public awareness on pangolin conservation is limited. Raising public awareness, collaborating with the traditional medicine community, and strengthening law enforcement should be the focuses for pangolin conservation in China. Findings from this project highlight the importance of understanding trading chains in order to identify focal points to conserve species threatened by illegal trade.

1. Schneider JL. Reducing the Illicit Trade in Endangered Wildlife: The Market Reduction Approach. *Journal of Contemporary Criminal Justice*. 2008;24(3):274-95.

2. Ajzen I. Constructing a theory of planned behavior questionnaire. 2006.



## Can manipulation of ungulate herbivory facilitate biodiversity conservation for forest vegetation and invertebrates?

(Oral)

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Livestock grazing and ‘overabundance’ of large wild herbivores in forests have long been perceived as conflicting with the aims of both silviculture and forest conservation; however, herbivory can also help to maintain certain forest habitat values. Management of mammalian herbivory in protected forests can, therefore, be an important tool for biodiversity conservation and restoration. We conducted a full systematic review with meta-analyses to examine how manipulation of the grazing/browsing pressure affects forest vegetation and invertebrates. Our systematic review included studies of experimental manipulation of ungulate herbivory in boreal and temperate forests. Non-intervention or alternative levels of intervention were used as comparators. Relevant outcomes included abundance, diversity and composition of plants and invertebrates, tree regeneration, and performance of target species. 144 studies were included in the review, most from a recent systematic map (1) but with updates based on searches online and bibliographies of existing reviews. Most studies had been conducted in North America, Europe or Australia/New Zealand. The intervention most commonly studied was experimental exclusion (or enclosure) of wild and/or domestic ungulates by fencing. Other studies examined culling of wild ungulates or compared forests grazed by livestock to ungrazed forests. We found negative effects of herbivory on the abundance (cover) of understorey vegetation as a whole, woody understorey and bryophytes, and also on the species richness of woody understorey vegetation. In contrast, herbivory had a positive effect on the richness of forbs and bryophytes. Ungulate origin was a significant effect modifier: Understorey abundance responded negatively to livestock and to ungulates introduced into the wild, but not to native ones. In contrast, understorey species richness responded positively to livestock but not to wild ungulates. The effects on woody understorey abundance and richness became increasingly negative with increasing duration and intensity of herbivory, respectively. Despite a paucity of studies reporting on invertebrates we detected a significant negative effect of herbivory on lepidopteran and spider abundance, but not richness. Our review confirmed that, if used carefully, manipulation of ungulate herbivory can be an effective tool for the management of tree regeneration, understorey vegetation or certain invertebrate groups. Important knowledge gaps included few studies of: boreal areas, long-term herbivory effects, impacts on bryophytes, lichens and invertebrates, and effects of manipulation less radical than total exclusion of ungulates.

1Bernes, C., B.G. Jonsson, K. Junninen, A. Lõhmus, S.E. Macdonald, J. Müller, J. Sandström. 2015. What is the impact of active management on biodiversity in boreal and temperate forests set aside for conservation or restoration? A systematic map. *Environmental Evidence* 4:25 DOI 10.1186/s13750-015-0050-7



## Rethinking common assumptions on linkages between protected areas and human well-being

(Oral)

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International policies on conservation and protected areas now emphasise a pro-poor approach and equitable management with participation by local communities. Many protected areas are now established and managed based on the premise that there are synergistic relationships between human well-being and environmental outcomes. Through a review of the academic literature and expert interviews, we investigate five common assumptions in protected area conservation pertaining to these synergies: (1) Conservation is pro-poor; (2) Poverty reduction benefits conservation; (3) Compensation neutralizes conservation costs; (4) Participation is good for conservation; (5) Resource tenure underpins long-term conservation. We identify the circumstances under which synergies and trade-offs emerge within and between social and ecological outcomes of protected areas, and highlight the role of power, governance processes and scale in shaping outcomes.

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## The role of snow leopard predation in determine prey recruitment: a synthetic study of abiotic, bottom-up and top-down influences on the Tibetan Plateau

(Oral)

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Ungulate populations could either be limited by resources (bottom-up control) or be regulated by predation (top-down control). Consequently, for ungulates and their predators, conservation strategies may need to differ depending on the predominance of either of these forces at any given time period. Livestock competition, snow leopard *Panthera uncia* predation, and snow disaster in winter are three main forces affecting recruitment of blue sheep *Pseudois nayaur*, the major wild prey of snow leopards on the Tibetan Plateau. To answer the question which of them is the dominant force regulating blue sheep population, we selected seven study sites representing a gradient of livestock grazing pressure on the Tibetan Plateau. Population structure of blue sheep after birth and after winter, livestock density, snow leopard density and other environmental variables were recorded. We used Generalized Linear Model to examine the potential roles of the three forces on blue sheep recruitment. Our results did not find any evidence of resource limitation/livestock competition. Snow leopard predation appeared to significantly decrease the young : female ratios both in summer and after winter. Low winter temperature decreased young : female ratio after winter. These results indicated that blue sheep populations in our study area were more predation-regulated than resource-limited. Conservation actions should be more targeted on maintaining the ecological function of snow leopards, rather than controlling livestock density.



## Fishing restrictions is the essential protection method of the Saimaa ringed seal

(Oral)

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The Saimaa ringed seal (*Pusa hispida saimensis*) is an endemic relict of the last ice age that inhabits a fragmented freshwater Lake Saimaa in Finland. This small seal population (current population size ca. 370-380 individuals) is one of the most endangered seals in the world. The high mortality rate of young seals due to by-catch mortality of fishing and insufficient snow conditions during breeding season are the most serious threats to the population. The fishing restrictions are the main short-term conservation measures of the Saimaa ringed seal. Springtime fishing restrictions have been set to reduce by-catch mortality of weaned pups. Certain fishing methods which can kill also adult seals, are totally forbidden in the main parts of the Saimaa ringed seal's distribution area. The fishing restriction areas that covered about 13% of the Lake Saimaa in 2007, increased covering 61% of the lake in 2016. At the same time the seal population size has increased from around 260 to 360 individuals, and the annual pup production from ca. 50 pups to over 80 pups. Altogether, the fishing restrictions is the effective method to diminish mortality of especially juvenile Saimaa ringed seals. However, the pre-weaning pup mortality of the ringed seal has increased in 21st century due to poor snow conditions induced by climate change. Although the new methods to decrease the pre-weaning mortality are being developed and implemented in the current LIFE Saimaa seal project, global warming is a growing threat to the juvenile survival of the seal. Therefore, the fishing restrictions is the essential conservation method also in the future.

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## Landscape simplification weakens the association between terrestrial producer and consumer diversity in Europe

(Oral)

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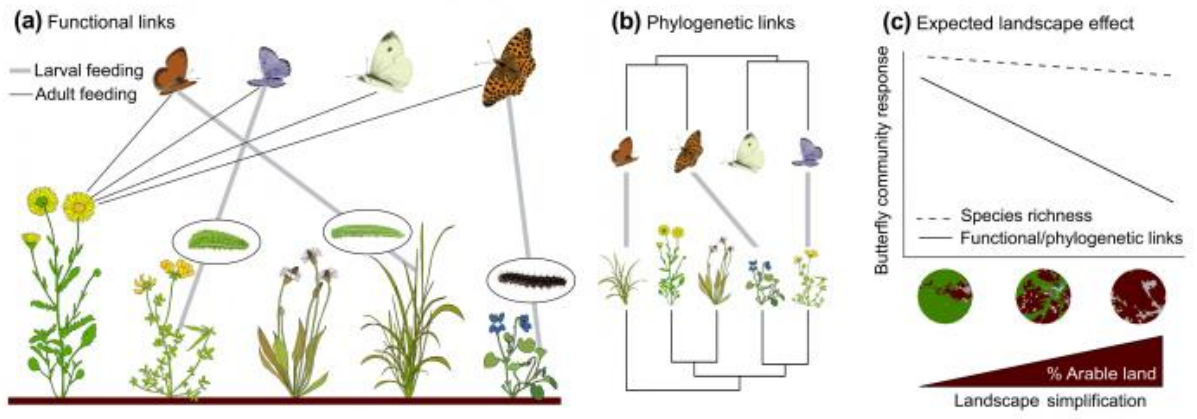
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Land-use change is one of the primary drivers of species loss (1), yet little is known about its effect on other components of biodiversity that may be at risk (2). Here, we ask whether, and to what extent, landscape simplification, measured as the percentage of arable land in the landscape, disrupts the functional and phylogenetic association between primary producers and consumers. Across seven European regions, we inferred the potential associations (functional and phylogenetic) between host plants and butterflies in 561 seminatural grasslands. Local plant diversity showed a strong bottom-up effect on butterfly diversity in the most complex landscapes, but this effect disappeared in simple landscapes. The functional associations between plant and butterflies are, therefore, the results of processes that act not only locally but are also dependent on the surrounding landscape context. Similarly, landscape simplification reduced the phylogenetic congruence among host plants and butterflies indicating that closely related butterflies become more generalist in the resources used. These processes occurred without any detectable change in species richness of plants or butterflies along the gradient of arable land. The structural properties of ecosystems are experiencing substantial erosion, with potentially pervasive effects on ecosystem functions and future evolutionary trajectories. Loss of interacting species might trigger cascading extinction events and reduce the stability of trophic interactions, as well as influence the longer term resilience of ecosystem functions. From an applied perspective, conservation efforts might fail if we do not consider how landscape simplification affects the cross-trophic-level diversity associations in a local community (3). Conservation interventions aimed at restoring consumer diversity by enhancing local plant resources is likely to be more effective in regions where landscape simplification has been less marked. Therefore, we suggest that monitoring of the relationships between the diversities of these taxa can serve as an early warning signal of ecosystem health and conservation status (2). In conclusion, our novel approach reveals that other components of biodiversity are lost well before the species richness variation. Our measures of functional and phylogenetic associations across trophic levels, and how they change in response to landscape simplification, contribute to a growing understanding of the properties that determine ecosystem resilience.

(1) Newbold, T. et al. Global effects of land use on local terrestrial biodiversity. *Nature* 520, 45-50 (2015).

(2) Valiente-Banuet, A. et al. Beyond species loss: the extinction of ecological interactions in a changing world. *Funct. Ecol.* 29, 299-307 (2015).

(3) Harvey, E. et al. Bridging ecology and conservation: from ecological networks to ecosystem function. *J. Appl. Ecol.* 54, 371-379 (2017).







## A multidisciplinary approach to identify multispecies hotspots of intra-specific diversity

(Oral)

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Conservation efforts are traditionally focused on species diversity, without any explicit consideration of the underlying processes that generated (and maintained in time) that same diversity. In a global change context, conservation efforts should focus on conserving evolutionary patterns that generate the biodiversity we observe today. Focusing on the identification (and protection) of the intraspecific genetic diversity hotspots is one of the few options available to ensure the evolvability of species in a rapidly changing world.

Focusing on terrestrial vertebrates (amphibians, reptiles and mammals) endemic to the Italian peninsula, for 23 different evolutionary lineages, we (1) modeled the current and future distribution using an ensemble forecasting approach; (2) calculated intra-specific genetic diversity using different genetic markers (mitochondrial and nuclear DNA) and modeled its spatial explicit distribution; (3) identified multispecies diversity hotspots; (4) evaluated the extent to which the existing network of Protected Areas (PAs) covers these hotspots now and in the near future (2100), considering different emission scenarios (one optimistic and one pessimistic).

The main hotspots of genetic diversity are all located in the southern part of the Italian peninsula. Many of these hotspots are not covered by any existing PA, even though they are often nearby. Our results clearly show that the existing PAs network does not provide an effective protection of genetic diversity, and the situation will be even worse considering future scenarios of climate change. Currently around 20% of the genetic diversity hotspots are protected by existing PAs; in the near future this percentage decreases both in the optimistic and pessimistic scenario.

Due to climate change, the decreasing of genetic hotspots and the decreasing of their protection by PAs in the near future could cause the loss of the evolutionary potential of these lineages. This could increase their rate of extinction with the loss of important evolutionary processes. Both climate change and human impact are modifying different levels of biodiversity (genetic, species and ecosystem) with the consequences not only on species and habitats but even on human well-being.



## European beech controls biodiversity in mixed forests – Mixed versus pure forests of beech and conifers

(Oral)

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Monocultures of Scots pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*) have been promoted in Central Europe since the early 19th century due to economical, ecological and management constraints on sites naturally dominated by broadleaved species. Catastrophic damages and the call for multifunctional forest ecosystems with a high degree of naturalness initiated a large-scale conversion of these monocultures into mixed forests often with the naturally dominant European beech (*Fagus sylvatica*). Beside an increased stability, mixed forests are assumed to facilitate forest biodiversity conservation due to an increased habitat heterogeneity compared to the respective monocultures. Scientific evidence for this assumption is, however, scarce [1]. Here we investigated data on 15 organismic groups from plants to bacteria sampled in two regions of Germany to reveal the effect of mixed versus pure forests of beech and conifers on biodiversity.

Although species composition of mixed stands was intermediate between beech and conifer stands for most organismic groups, they never exceeded gamma-diversity of either pure stand. To identify a landscape composition of pure and mixed stands that maximizes biodiversity, we generated virtual forest landscapes by resampling plots of pure and mixed stands in a way that all compositional combinations were represented in steps of 10 % with 1000 replications. Landscapes were created containing beech and pine stands and its mixtures for 15 taxonomic groups and containing beech and spruce stands and its mixtures for three groups. Most groups as well as multidiversity benefited from mixing different pure stands at the landscape scale and not from local within-stand mixtures. Except deadwood fungi that prefer a high percentage of pure beech stands, most species groups need a share of at least 30 % of conifer stands for a maximum biodiversity. For a landscape with beech, pine and its mixtures, 97 % of multidiversity was achieved with a combination of 70 % pure pine and 30 % pure beech stands. Within-stand mixtures supported only 77 % of multidiversity as the competitive beech determined resource availability. Thus, the habitat heterogeneity provided by different pure stands at the landscape scale is more effective for biodiversity than the heterogeneity by mixing species at the stand scale.

Our findings indicate that the ongoing large-scale conversion of pure conifer into mixed stands with beech will lead to biodiversity loss. An optimized forest landscape for regional biodiversity contains pure beech and pure conifer stands that show complementarity in species composition. We can, however, not yet say if pure forest stands should be larger than the here investigated 1 ha to be effective.

[1] Cavard X et al. (2011) Importance of mixedwoods for biodiversity conservation: Evidence for understory plants, songbirds, soil fauna, and ectomycorrhizae in northern forests. *Environ Rev* 19: 142-161



## Experiences in sharing research data and methods in conservation science

(Oral)

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Openness, transparency, and reproducibility are hallmarks of scientific methods as they enable the peer-evaluation of the quality and accuracy of research. In practice, however, most research carried out still today cannot be reproduced or replicated by others and thus evaluated in detail. This is due to limitations in access to original data, vague or insufficient method descriptions or simply difficulties in accessing the publications that describe the research work. In fields like conservation, where real-life decisions may be based on scientific work, this is a challenge also for transparent decision-making.

During the past years, the Open Science movement has gained popularity among scientists, research, national science policies and everyday practice of many journals. Despite the advancements, a lot of work is still needed to make scientific publications, research data and methods openly available for others to evaluate and develop further. The scientific merit system is gradually changing to support openness, and technological advancements are making it easier in practice. Ultimately, however, it is still up to individual researchers or research groups to decide if and how to share and open the outputs of their research. Hence, personal level experiences are important determinants of the adoption of open science practices.

In our Digital Geography Lab, we have attempted to follow the practices of open science for the past years. We have aimed to use open data sources whenever possible as the source of our research, publish our methods online, share the output data and apply storytelling to make our research more approachable and accessible.

In my short presentation, I will share some of the practical experiences we have gained while doing so: What has worked, has it been worth the effort and where we have failed and why.

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## How does prescribed burning in temperate and boreal forests affect biodiversity?

(Oral)

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Image credit: Dmytro Gilitukha, from iStockphoto

Forests set aside from productive forestry are often considered best conserved by non-intervention. However, biodiversity can be maintained in natural forests by a background level of disturbance, which, in some forests, takes the form of forest fires.

While the effects of prescribed burning on tree regeneration and on pyrophilous and/or saproxylic species in some regions are well known, effects on other organisms are less clear and/or consistent. The primary aim of this systematic review was to clarify how biodiversity is affected by prescribed burning in temperate and boreal forests, and how it may be useful as a means of conserving or restoring biodiversity, beyond that of pyrophilous and saproxylic species. A separate review, almost complete at the time of writing, focuses on the impacts of dead wood (e.g. by prescribed burning or addition of dead wood) on forest biodiversity. This review avoids overlap by excluding saproxylic species; those most impacted by dead wood changes.

Relevant studies were taken from a recent systematic map of the evidence on biodiversity impacts of active management in forests. Additional searches and a search update were undertaken using a search string targeted to identify studies focused on prescribed burning interventions. Studies were assessed for internal and external validity and data was extracted, using critical appraisal and data extraction tools, specifically developed for this review. Studies were presented in a narrative synthesis and interactive map, and those which were suitable were combined in meta-analyses.

After screening for relevance, 244 studies were included in this review, 82 were included in the quantitative synthesis. We describe the geographical spread, study characteristics and heterogeneity of the evidence base. We find no evidence for a general trade-off between improving conditions for fire dependent species and the biodiversity of non-target species groups. We discuss the knowledge gaps in study scope identified by this review. We also identify evidence needs, such as appropriate and consistently applied study designs, long-term data sets and more detailed reporting by authors.

Image credit: Dmytro Gilitukha, from iStockphoto

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## Threatened grassland butterflies as indicators of microclimatic niches along an elevational gradient – Implications for conservation in times of climate change

(Oral)

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Among the factors that determine habitat quality for butterflies, an adequate microclimate has crucial importance, especially for the less mobile immature stages. Therefore, stenotopic butterflies are precise indicators of specific microclimatic niches. However, the thermal and hygric requirements of butterflies are usually inferred from habitat structure or regional climate instead of being exactly measured. Here, we present the results of year-round measurements of temperature and relative air humidity at typical oviposition microhabitats of three threatened grassland butterflies (*Erebia medusa*, *Melitaea aurelia* and *Satyrrium spini*) inhabiting different zones along a climatic gradient in the Diemel Valley (Germany, Central Europe). Furthermore, we analysed how the climate in the study area has changed since the middle of the 20th century.

The interspecific differences in annual and seasonal averages of temperature and humidity at the oviposition sites roughly reflected the overall distribution of the three species along the climatic gradient in the Diemel Valley. Interestingly, the differences in mean spring, summer and autumn temperatures were mainly due to differences in nighttime temperatures. During the day, radiative heating of the near-ground air layer apparently compensated for the mesoclimatic differences in the study area. In contrast, the interspecific differences in relative humidity were stronger during the day when the air at the oviposition microhabitats of *E. medusa* remained more humid than in the case of *M. aurelia* and *S. spini*, probably due to the higher vegetation and the deeper soils in the larval habitats of *E. medusa*. Since the 1950s, the climate in the Diemel valley has become significantly warmer. The magnitude of the observed increase in mean temperature was similar or even greater than the interspecific differences recorded by the microclimatic measurements. This implies that thermophilous species may expand their ranges within the Diemel Valley if climate warming continues. Species living in the relatively cool Upper Diemel Valley such as *E. medusa*, however, may incur population declines because there are few grasslands available at higher elevations or at microclimatically cooler sites such as north-facing slopes.

2018/06/15

11:30

Room: K301 Felix



## **Traditional knowledge and practices contribute to the survival of an endangered small ape**

**(Oral)**

**Lu Zhang<sup>1</sup>✉, Zhenhua Guan<sup>2</sup>, Hanlan Fei<sup>1</sup>, Lu Yan<sup>3</sup>, Pengfei Fan<sup>1</sup>**

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Abstract of this presentation is not public





## How does manipulation of dead wood affect forest biodiversity? - A systematic review

(Oral)

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Dead wood (DW) provides a critical habitat for thousands of wood-dependent (saproxylic) species in forests. However, intensification of forest management has heavily reduced the amount and diversity of DW. This has resulted in many saproxylic species being threatened and has caused a situation where interventions aiming at increasing DW might be necessary to support its associated biodiversity. Examples of such interventions include felling, girdling, creation of high stumps, leaving of crowns, logs and trees during harvest operations, and restoration burnings. Although the evidence base on how effective different interventions aiming at increasing DW volumes grows, there is a lack of reviews on the topic. We have therefore conducted a full systematic review with meta-analysis, where we have synthesized the current state of knowledge drawn from replicated experimental studies into solid quantitative evidence of the effects of DW manipulation on forest biodiversity. Our review included three interventions, all compared against sites with no intervention: creation of DW, addition of DW, and prescribed burning; we used studies conducted in set-asides and production forests in boreal or temperate regions. Relevant outcomes included abundance and richness of saproxylic insects, beetles, ground insects, wood-inhabiting fungi, and cavity-nesting birds. Studies were mainly selected from a recent systematic map<sup>1</sup> but additional studies were identified through updated searches. 91 studies were included in our systematic review, 58 conducted in northern Europe, a majority in coniferous forests and the dominant species group was beetles. A subset of stand-scale studies (37) were used in meta-analysis and, although this evidence base was heterogeneous, it revealed that DW amount had a significant positive effect on the abundance and richness of saproxylic insects and fungi. No negative effects were found for any of the species groups. All three intervention methods revealed a positive effect on saproxylic insect abundance, burning showing a tendency for the strongest effect; this was despite the fact that DW volume was, in general, twice as high where DW had been added or created, as compared to burning. Weighted meta-regression revealed only one significant covariate: the positive response of saproxylic insect richness to DW enrichment decreased with increasing amounts of DW, indicating a  $\log(\text{Species}) \sim \log(\text{DW})$  relationship similar to the Species Area Relationship. Overall, our results support that it is beneficial to create DW, regardless of method, to increase biodiversity for DW-dependent species. However, there is a need for more long-term studies, studies in more regions (e.g. Russia and Asia) and more species groups (e.g. lichens, vascular plants and bryophytes).

<sup>1</sup>Bernes C, Jonsson B, et al. What is the impact of active management on biodiversity in forests set aside for conservation or restoration? A systematic map. *Environmental Evidence*. 2015;4:25.

2018/06/15

10:30

Room: C1 Hall



UNIVERSITY OF JYVÄSKYLÄ



## Important Insights of the IPBES Regional Assessment on Biodiversity and Ecosystem Services for Europe and Central Asia

(Oral)

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DOI: 10.17011/conference/eccb2018/109102

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Based on requests of IPBES member governments this assessment was elaborated by a team of more than 120 authors from 2015 to 2018. It shows, based on about 4000 sources, that nature provides broader contributions to people than acknowledged earlier. Further it shows that, while food production and energy biomass have increased, most other contributions decreased over recent decades. While high biodiversity would be required to provide multiple contributions of nature to people, the biodiversity of marine, inland surface water and terrestrial habitats and taxa also declined largely. Most of these trends were due to land and water use, and climate change, pollution and invasive species also played important roles. The assessment report further shows that most scenario studies of future development suggest further declines in biodiversity and nature's contributions to people and they suggest that climate change will become an even more important driver of change. These scenario studies also suggest that the contributions of the Europe and Central Asia region to the Aichi Targets and to the Sustainable Development Goals relevant for the scope of the assessment are unlikely to be met. The assessment concludes by providing information on potential pathways and opportunities for decision makers toward a sustainable future. These opportunities include mainstreaming biodiversity, integration among sectors, and participation of multiple actors in governance.

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## Reconciling community natural resource use and local livelihoods with biodiversity conservation in Chinese protected areas

(Oral)

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Local informant data, including local ecological knowledge, is now increasingly used by conservation biologists to obtain information on extremely rare and threatened species (1). It can uncover patterns of biodiversity status and decline, help understand the role of humans in ecosystems by directly targeting communities that extract natural resources, and is argued to be a cost-effective tool for complementing traditional field ecological methods, especially in study systems where long-term monitoring datasets are absent. China is one such country with high species richness and endemism; however, similar to many emerging economies, its ecosystems are under extreme threat from human exploitation and development. Using Bawangling National Nature Reserve (BNNR) in Hainan Province, China as a case study, I assess the extent to which low-income local communities rely on biodiversity in and around Chinese protected areas for their livelihoods. BNNR is home to the world's last population of about 26 Hainan gibbons (*Nomascus hainanus*), the world's rarest ape (3). Until recently, local people have relied on subsistence agriculture and hunting for their livelihoods. While governmental, non-profit, and research organizations have conducted awareness-raising campaigns primarily focused on protecting the Hainan gibbon, it is unclear what changes have occurred as a result of these efforts. Using local ecological knowledge and other quantitative social science methods, this study examines various aspects of social-ecological system dynamics including 1) how communities perceive the causes of decline and extinction of wildlife and whether they accept responsibility; 2) patterns and drivers of local people's natural resource use behaviours at different scales, and to what extent their livelihoods depend upon the ecosystem goods and services supported by the reserve; 3) the effectiveness of conservation awareness-raising campaigns in promoting conservation behaviours among local communities; and 4) the applications of using local ecological knowledge for conservation research, and factors that underlie its variation and limit its usefulness. Based on the results of this study, potential solutions to maximize conservation effectiveness and improve human well-being simultaneously in heavily degraded ecosystems could then be designed. Conclusions from this study present further opportunities and key data gaps relevant to wider conservation contexts involving communities beyond this study system.

1) Berkes, F., Colding, J., & Folke, C. (2009). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications*, 10 (5), 1251-1262 .

2) Turvey, S.T., Traylor-Holzer, K., Wong, M.H.G., Bryant, J.V., Zeng, X.Y., Hong, X.J., Long, Y.C., (2015). International Conservation Planning Workshop for the Hainan Gibbon: Final Report. Zoological Society of London, London/IUCN SSC Conservation Breeding Specialist Group, Apple Valley, MN.



## Maximising carbon stock and multi-taxa diversity in European temperate forests: can we fill two needs with one deed?

(Oral)

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Understanding how forest biodiversity and carbon stocks can be simultaneously maintained or enhanced is crucial for the development of effective forest management strategies and policies aimed at halting biodiversity loss under climate and land use change. Many existing policies and strategies assume that forests hosting high carbon stocks provide co-benefits in terms of high biodiversity. While this relationship has been demonstrated in tropical forests, it has not been rigorously assessed in temperate forests, and further research is needed to understand how carbon stock and biodiversity covary, and whether non-linearities, community thresholds and variability across taxa exist.

We built a comprehensive biodiversity dataset including six taxonomical groups (beetles, birds, bryophytes, fungi, lichens, and vascular plants) distributed over 352 plots representing three forest types, in 22 distinct study areas across three European countries (France, Hungary and Italy). We used Boosted Regression Trees and Threshold Indicator Taxa ANALysis (TITAN) to address three questions: (1) is there a positive relationship between overall multi-taxa diversity (multidiversity) and aboveground carbon stocks in European temperate forests? (2) Are there nonlinearities or thresholds (e.g. synchronous change-points in species composition) along the carbon stock gradient we considered, and are they consistent across taxonomical groups and forest types? (3) How do individual species respond to increasing aboveground carbon and how does the proportion of species with positive (win-win species) or negative (trade-off species) relationships vary across taxonomical groups?

We found neither higher multidiversity, nor a consistently higher number of species across the six taxonomical groups in forests storing higher aboveground carbon. We found evidence for synchronous change-points in community composition along the carbon gradient, although these were neither consistent, nor equally abrupt across taxonomical groups and forest types. For all taxonomical groups except lichens, trade-off species markedly decreased at carbon stocks between 80 and 110 Mg/ha, roughly corresponding to the canopy closure phase of the forest stand development. The turnover between trade-off and win-win species was gradual along the carbon gradient, and the proportion of these two groups of species varied across taxonomical groups, and forest types.

Maximizing forest carbon storage may not benefit all facets of biodiversity at the same time, although it may enhance some specific taxa and functional groups. Explicitly distinguishing between win-win and trade-off

species, and considering taxon-specific community change-points along the carbon gradient could provide a conceptual basis for forest managers to operatively reconcile biodiversity conservation and carbon stock retention.

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## Land system regime shifts and their impacts on human well-being in forest frontier landscapes of Madagascar and Myanmar

(Oral)

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Landscapes on forest frontiers in the humid tropics provide powerful examples of the challenge to reconcile human development with increasingly evident planetary boundaries. These social-ecological systems (SES) not only have to meet the immediate livelihood needs and the broader development aspirations of their local populations. They are also expected to ensure the complex mix of ecosystem service (ES) flows that support human well-being locally and provide environmental benefits worldwide. Driven by demands for commercial agricultural production, carbon sequestration or biodiversity conservation among others, distant socio-economic and environmental influences are becoming increasingly entangled, triggering not only rapid land use change processes at the local scale, but also unchaining multi-directional spill-over and feedback effects affecting other SES. Land science experts refer to these socio-economic and environmental interactions between distant SES as "telecoupling". In such contexts, managing land use to ensure both desired ES flows and human well-being - i.e. sustainability transformation - is often seen as a "wicked problem"

The forest frontier contexts of Madagascar and Myanmar illustrate the abovementioned sustainable development challenges. Both countries have experienced a transformation of their subsistence based small-holder shifting cultivation systems towards commercial agriculture. Spatially distant actors and their claims on land have contributed to highly dynamic local land use changes and overall land system regime shifts. To date, however, there is little understanding of their impacts on ES and human well-being in local SES. Yet this understanding is crucial to the negotiation of trade-offs between economic development and maintaining bundles of ES between actors at different scales. We have therefore collected empirical data on the impact of land use changes on human well-being via a methodological approach including gender-separated focus group discussions and individual semi-structured interviews in the two countries. Here, we propose to present first results of a comparative analysis regarding 1) the most important aspects of human well-being in each context; 2) interviewees' capabilities to achieve different well-being aspects; 3) the contribution of ES to different well-being aspects; 4) and how the capabilities and contribution of ES have changed over the last 20 years. Although both countries have experienced similar land use change trajectories, the impacts on well-being differ, which highlights the importance of context specificity in well-being assessments.



## Human Wellbeing – Nature relationships in rural Sub-Saharan Africa – developing a protocol for the consideration of the natural environmental in multi-dimensional poverty indices

(Oral)

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The natural environment is included in several Sustainable Development Goals (SDGs), including the first SDG of eradicating poverty. In countries like Rwanda and Malawi, despite repeated emphasis of the dependence on natural resources of the rural poor, the wellbeing-nature links have not been detailed or quantified. One step towards quantification of these links would be to integrate environmental indicators into multidimensional poverty indices. However, social legitimacy of such indicators is a prerequisite.

Building on [1], who demonstrate that in some places there is a conceptual grounding for including the environment as a constituent element in wellbeing measures, we aimed to determine whether the people whose wellbeing is measured deem this to be legitimate.

We developed a focus group discussion protocol to elicit perceptions of nature-wellbeing relationships. The methodology includes (a) a wellbeing free-listing exercise, (b) a matching exercise relating the items listed under (a) to a list of predefined wellbeing dimensions based on existing frameworks (see [1]), (c) questions to discuss the relationships between the local environment and wellbeing, and to explore whether these were perceived as instrumental or constituent [1]. We tested this protocol in 15 focus group discussions in rural Rwanda and Malawi in Sep-Nov 2017.

The participants described a wide range of environment-wellbeing relationships and recognised the environment as a major wellbeing component and visible in most of the (a priori) dimensions. Environmental problems mentioned included deforestation, declining soil fertility, droughts, floods, declining water quality and quantity, tenuous land tenure, restricted forest access, and crop raiding animals. These issues lead to a loss of income, livelihoods, crops, assets, and even lives; stress; and constrained freedom of choice (e.g. self-confidence, place attachment, self-sufficiency).

Low levels of environmental degradation have mostly instrumental impacts, and act as drivers of existing wellbeing dimensions of food, health, water availability and living standards. However, beyond certain thresholds, persistent degradation and natural hazards become disastrous, leading to prolonged stress and psychological health problems. Safety from natural hazards and severe environmental degradation and safe resource access were often mentioned as constituent elements of wellbeing. Having access to and control over environmental and natural resources contributes to freedom of choice.

Our results suggest that the inclusion of these constituent wellbeing dimensions in poverty statistics is socially legitimate – at least according to the respondents at the locations we studied - and would reflect a more nuanced picture of ‘poverty’. Operationalisation of such an indicator, however, would require further investigation of threshold levels and pragmatic choices due to data availability.

1. Schleicher, J. et al. 2017. DOI: 10.1002/sd.16



2018/06/15

11:15

Room: A1 Wilhelm



## Drivers of diversity of dead-wood dependent insects and fungi

(Oral)

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Abstract of this presentation is not public



## How do stand characteristics and crown heterogeneity influence bat activity in forests?

(Oral)

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In forest ecosystems, changes in three-dimensional structure that may be induced by forest management influence the presence and abundance of plant and animal species. This is particularly true for bats as they make extensive use of the three-dimensional habitat space in forests for foraging and commuting purposes. Bats show different responses to vegetation structure depending on their foraging strategies and ecomorphological and acoustic traits such as wing morphology and echolocation call design. For instance, species with low wing loading and short-range echolocation are more likely to be found foraging within the forest where the vegetation is relatively dense whereas species with high wing loading and long-range echolocation will be found flying above the canopy. Despite the extensive literature on the effects of different forest structural characteristics on bat activity at the stand scale, the influence of canopy architecture has received very little attention. This may be principally due to difficulties associated with both bat sampling and vegetation survey at the canopy level. Using passive acoustic sampling to record bats coupled with airborne Light Detection and Ranging (LiDAR) and terrestrial field surveys for measuring vegetation structure, the aim of the study was to determine key structural forest variables that influence bat activity in managed forests. We deployed bat detectors both at ground and canopy levels in 32 mixed and deciduous forest stands located in Switzerland. Each stand was surveyed between 6 to 12 nights. Bat echolocation calls were identified using a semi-automatic approach. Bats were grouped into different guilds reflecting their echolocation range (namely, short-, mid-, and long-range echolocators; SRE, MRE, LRE). From the LiDAR point clouds, we computed nine variables that describe forest vegetation structure such as mean canopy height, outer canopy ruggedness, and foliage height diversity. Seven variables were measured during field surveys including tree density, shrub vegetation cover, and leaf area index. We tested the effects of forest structure on bat guild activity by fitting a series of generalized linear mixed models. Our results suggest that the activity of the MRE and LRE guilds were clearly associated with canopy characteristics. LRE activity increased with increasing mean canopy height while MRE bats responded positively to increasing outer canopy ruggedness. Species that constitute the MRE guild are edge specialists and may therefore use the external canopy surface as a surrogate of edges. SRE activity was mainly determined by vegetation clutter as we found that foliage height diversity and tree density had a negative influence on activity. We highlight that (i) crown heterogeneity alongside other stand characteristics strongly influence bat guild activity; and (ii) airborne LiDAR brings a top-down perspective that enables accurate characterisation of the forest canopy architecture.



## Metapopulation dynamics in a changing climate: Increasing spatial synchrony in weather conditions drives metapopulation synchrony of a butterfly inhabiting a fragmented landscape

(Oral)

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Habitat fragmentation and climate change are both prominent manifestations of global change, but there is little knowledge on the specific mechanisms of how climate change may modify the effects of habitat fragmentation, e.g. by altering dynamics of spatially structured populations. The long-term viability of metapopulations is dependent on independent dynamics of local populations, because it mitigates fluctuations in the size of the metapopulation as a whole. Metapopulation viability will be compromised if climate change alters the extent of spatial synchrony in weather conditions associated with population growth rates. We studied if a recently reported increase in metapopulation synchrony of the Glanville fritillary butterfly (*Melitaea cinxia*) in the Finnish archipelago could be explained by climate change induced change in synchrony of weather conditions. For this, we used 23 years of butterfly survey data together with monthly weather records for the same period. We first examined the associations between population growth rates within different regions of the metapopulation and weather conditions during different life-history stages of the butterfly. We then examined the association between the spatiotemporal trends in the synchrony of these weather conditions and the synchrony of the metapopulation dynamics. We found that both temperature and precipitation conditions from spring to late summer are associated with the *M. cinxia* per capita growth rate, with spring and early summer conditions being most important. We further found that the spatiotemporal increase in metapopulation synchrony is paralleled by an increase in the spatiotemporal synchrony of weather conditions. Alternative explanations for spatial synchrony, such as increased dispersal or trophic interactions with a specialist parasitoid, did not show paralleled trends and are not supported. The climate driven increase in *M. cinxia* metapopulation synchrony suggests that climate change can increase extinction risk of spatially structured populations living in fragmented landscapes by altering their dynamics.



## Poverty-environmental relationships in the context of the Sustainable Development Goals

(Oral)

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The interconnected relationships between the natural environment and human wellbeing and poverty have been a central theme in the environmental and development literatures. However, this has been less influential in mainstream international development policies, which often neglect the natural environment. This can have negative implications for the environment and for addressing poverty adequately in all its forms. Based on a literature review, stakeholder consultation workshops and secondary datasets, this paper (1) examines how the Sustainable Development Goals (SDGs) might influence the framing of the environment-poverty relationships and (2) present the results of integrating environmental and socio-economic datasets to assess poverty in Brazil. We argue that the SDGs' comprehensive nature could provide an opportunity for a better environment-poverty integration. We show how environmental aspects can be taken into account in poverty measures in the case of Brazil, and that doing so influences the distribution and levels of poverty. This has important policy implications for addressing poverty and taking environmental considerations more seriously. Furthermore, achieving the SDGs will need to stay clear of maintaining the status quo and realise more radical transformations that address uneven power dynamics, both in how we measure and understand development, and in the interventions that are designed to positively impact human wellbeing and the natural environment.

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## Current and future interactions between the natural world and human society in Europe and Central Asia.

(Oral)

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Nature and human society interact in complex ways with biodiversity underpinning the benefits that nature contributes to people (NCP) and human development often leading to significant losses in biodiversity through overexploitation and other drivers of change. These complex interactions result in large uncertainties that make it difficult for societies to resolve an appropriate course of collective action to adapt to or to mitigate change and to pursue sustainable livelihoods. Despite these uncertainties and complex interactions, it is important to understand the key interrelationships to develop effective management and policy strategies. However, social, economic and political conditions in the future may be very different from today. Scenarios and models provide means for exploring uncertainties about how different drivers of change might develop in the future and for considering how those changes might alter society's vulnerability and ability to take action. This improves understanding of the range of plausible futures in a region, alerts decision-makers to undesirable future impacts, and enables exploration of the effectiveness of policy options and management strategies.

Here we develop an assessment of the range of plausible futures for Europe and Central Asia (ECA region) based on a review of exploratory scenarios. The consequences of these futures for nature, NCP and a good quality of life, as simulated by models taking account of uncertainties in projections of different drivers of change. We provide the foundation for understanding the key challenges that may be faced by society in moving towards a more sustainable future. In the assessment, we also describe what a sustainable future might look like by reviewing different visions of sustainable development and how these relate to the United Nations (UN), the Convention on Biological Diversity (CBD) and the long-term EU agendas and sustainability objectives. Possible pathways for achieving such visions are then appraised based on a review of pathways and normative scenarios. This analysis provides an assessment of the alternative policy choices or management interventions that can be used by decision-makers to move towards meeting sustainability goals and thereby support a good quality of life for the people of ECA by mitigating biodiversity loss and promoting a balanced supply of NCP.

The ECA assessment takes an integrated approach to assessing the relationship between nature and society and how they are influenced by natural and anthropogenic direct drivers as well as institutions and governance and other indirect drivers. Furthermore, it builds on the analysis presented in the previous chapters of the ECA report by finally forming the foundation to further develop options for governance, institutional arrangements, and private and public decision-making for implementing the future policy responses analysed in the scenario and modelling studies.



## Cultural eutrophication, tourism and societal disconnect- Potential factors harming the wellness of high altitude Kashmir Himalayan lake- The Dal

(Oral)

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Intensive farming practiced in the surrounding area of Dal Lake and its floating gardens leads to an enhanced vulnerability of crops to pests and indiscriminate use of pesticides. Possible transfer of these hazardous molecules from vegetable fields to the aquatic environment of the lake, poses a potential threat to the aquatic species and human health as well. The myriad ways in which people use the lake along with the numerous pollutant-generating activities have stressed the lake ecosystem in diverse ways. In the present investigation conducted from 2009 to 2012, 135 samples of fish including 81 samples of *Schizothorax niger*, *Schizothorax esocinus* (Ale Gaad / Churuu Gaad) and 54 samples of *Cyprinus carpio* Spp (var: *communis* & *specularis* {Punjab Gaad}) were collected from three basins of Dal. The samples were analyzed for seven commonly used pesticides with GC-MS/MS. It was found that 73 samples (54.07%) out of 135 were contaminated with chlorpyrifos with mean concentration of  $(0.0009 \pm 0.0010 \text{ ng/kg})$  with concentration ranging from undetected to 0.003ng/kg. Level of pesticide was higher in pesticide use season than non use season except in 2009 when levels were same. Presence of sub acute exposure of chlorpyrifos in a locally consumed *Schizothorax niger*, *Schizothorax esocinus* species and not in *Cyprinus carpio* spp. The low dose exposure to pesticides through food chain like fish can be a major contributor for presence of pesticide residual levels in human blood. *Schizothoracids* being more susceptible to the pesticide than carps. Water of the lake is continuously being fed with human excreta through sewage dumping, although some partial treatment of the sewage is done via treatment plants. The lake is thus a contributing vehicle to the presence of various gastrointestinal viruses like rotavirus, which has been detected at various locations of lake. The lake is in a serious state of eutrophication mostly cultural and ways and means for lake restoration have not proved to be fruit full till date. Sewage from the settlements around the lake and the large population (estimated 50,000-70,000) living on hamlets within the lake on floating islands and houseboats enters the lake without treatment. More than 111 tons of Phosphorus and 380 tons of nitrogen are estimated to flow into the lake from point sources and 4.5 tons of P and 18.1 tons of N from non-point sources. The "Dal" is used for major economic activities relating to tourism, site seeing, recreational activities, fisheries, harvesting of food and fodder plants. The floating gardens of the lake that have originated with time have now assumed a status of biggest biggest vegetable producing bowl of Kashmir. The state of disconnect between lake dwellers, catchment population and general public with the lake seems to be a worrying factor.

1. <http://www.ijppsjournal.com/Vol4Suppl5/6004.pdf>

2. <http://wldb.ilec.or.jp/data/ilec/wlc12/P%20-%20World%20Case%20Studies/P-17.pdf>

2018/06/15

11:30


Room: K308 Cabinet



## Life after tree death: Does restored dead wood host different fungal communities to natural woody substrates?

(Oral)

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Abstract of this presentation is not public






## Nature's contributions to people and good quality of life in Europe and Central Asia

(Oral)

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The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has recently released its first set of regional assessments, including the Regional Assessment of biodiversity and ecosystem services for Europe and Central Asia. Comprising six chapters, the assessment summarizes the available knowledge on the status and trends of nature and its contributions to people in Europe and Central Asia, as well as direct and indirect drivers affecting them and options for decision-making. Chapter 2 of the assessment focuses specifically on nature's contributions to people (NCP) and their relationships with values and good quality of life, thus covering two elements of the conceptual framework of IPBES. Nature's contributions to people are defined in the assessment as "all the contributions of nature, both positive and negative, to the quality of life of humans as individuals and societies" and include regulating, material and non-material NCP, with a total of 18 NCP. Chapter 2 strives to represent the multiple values of nature's contributions to people and is based on an assessment of both existing scientific body of knowledge and indigenous and local knowledge (ILK) linked to nature and its contributions to people.

In this talk we will provide some key findings of Chapter 2, as well as some insights into how the Chapter was developed and has evolved over time. One of the key conclusions related to the trends in NCP in Europe and Central Asia is that declining trends have been observed in the majority of regulating NCP and some non-material NCP. The increasing trends observed in the delivery of some material NCP have come at the expense of this decline in nature's capacity to provide some regulating NCP. Non-material NCP show contrasting trends. Declining trends have been established for some, particularly learning derived from indigenous and local knowledge.

Following an assessment of status and trends of regulating, material and non-material NCP in Europe and Central Asia, the Chapter discusses their relation with food and water security, linkages between nature and health and cultural heritage, identity and stewardship. It also discusses integrated valuation approaches that demonstrate that NCP have multiple values, including both monetary and non-monetary values.

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## Declining populations of European mountain birds

(Oral)

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Fredrik Haas<sup>8</sup>, Sarah Harris<sup>9</sup>, Sergi Herrando<sup>10</sup>, Magne Husby<sup>11</sup>, Frédéric Jiguet<sup>12</sup>,  
John-Atle Kålås<sup>13</sup>, Åke Lindström<sup>8</sup>, Romain Lorrilliere<sup>12</sup>, Clara Pladevall<sup>14</sup>,  
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Mountain areas often hold special species communities and are thus in the high priority list of conservation. Changes in human land use, such as grazing pressure and afforestation, and especially in climate have been suggested as major threats for biodiversity in the mountain areas, because species have difficulties to find new suitable habitats in circumstances. Despite the special species communities very little is known about the population trends of species in mountain areas [1,2]. Here we studied population trends of 44 bird species in four major European mountain regions: Fennoscandia, UK upland, south-western (including Pyrenees) and south-central mountains (including Alps), covering 12 countries. We predicted that more species should show negative trends due to unfavourable environmental conditions. We also predicted the declines to be more severe in mountain specialists compared to mountain generalists, which are also found in the lowlands. We found in accordance with our predictions that mountain bird species have experienced significant declines (c. -7%) during 2002–2014. Mountain specialists showed a significant c. -10% decline in population numbers, and the slope for generalists was also negative but not significantly so. The slopes of specialists and generalists did not differ from each other. Fennoscandian and south-western populations were on average declining, but UK or south-central mountain birds showed on average stable situations. Our findings support the hypothesis that mountain species are declining. Thus more efforts should be undertaken to identify the causes of decline in order to protect these populations.

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## Spatial patterns of tree-related microhabitats: key factors and ecological significance for the conservation of the associated biodiversity

(Oral)

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Tree-related microhabitats (TreMs) are specific, well delineated above-ground tree morphological singularities occurring on living or standing dead trees. TreMs are key features for many taxa and contribute in the complex network of forest resources for biodiversity (1). Large and broadleaved trees bear most of the TreMs within a forest stand (2). The spatial pattern of TreMs is however not only influenced by the spatial distribution of these noteworthy trees, but also by a wide range of natural stochastic, abiotic and biotic processes as well as forestry operations (3).

A better knowledge of spatial patterns of TreMs in contrasted forest conditions would help us to promote more biodiversity-friendly forest management practices. First we explored spatial patterns of two TreM types, pivotal for saproxylic beetles, i.e. cavities and polypores, in temperate old-growth forests and compared them with patterns in stands in managed forests, analyzing a compiled European database focusing on beech and oak trees. Secondly, we analyzed the response of TreM-associated saproxylic beetle assemblages, sampled by emergence traps set up on targeted TreMs, to variations in spatial patterns of cavities and polypores. For instance, based on several case studies, we addressed the following questions: is the dissimilarity of assemblages hosted by cavities related to the between-cavity geometric distance? How is the occupancy probability of a cavity-dwelling beetle affected by the distance to the closest occupied cavity? Does an increasing sporocarp density at local scales foster the species richness of fungus-dwelling beetles at the sporocarp scale?

Finally, we discuss deemed consequences for conservation of TreM-associated taxa in managed forests.

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2-Larrieu L., Cabanettes A. (2012). Species, live status, and diameter are important tree features for diversity and abundance of tree-microhabitats in subnatural montane beech-fir forests. *Canadian Journal of Forest Research* 42: 1433-1445.

3-Larrieu L., Cabanettes A., Brin A., Bouget C., Deconchat M. (2014). Tree microhabitats at the stand scale in montane beech-fir forests: practical information for taxa conservation in forestry. *European journal of Forest Research*, 133:355-367

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## Fostering deadwood enrichment in managed forests – The importance of tree species and sun exposure for saproxylic species

(Oral)

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Central European forests have been shaped by more than 2000 years of human exploitation. During this time, the increasing requirement of timber led to significant structural changes within the ecosystem. Because of declining deadwood amounts, numerous saproxylic species become extinct or threatened. Yet, various strategies of deadwood enrichment have been developed since the 1990th mainly focused on a quantitative increase. As recently shown, also microclimate and tree species are important drivers of saproxylic communities. However, it remains unclear how active forest management can increase deadwood most efficiently. For this study, we exposed a total of 108 logs of six common tree species (*Abies alba*, *Carpinus betulus*, *Fagus sylvatica*, *Pinus sylvestris*, *Populus tremula*, *Quercus sp.*) under three different treatments of sun exposure (sun exposed on a forest meadow, shaded by forest canopy, experimentally shaded). Analysing two years of sampling, we tested the influence of tree species and sun exposure on  $\alpha$ -,  $\beta$ -, and  $\gamma$ -diversity of saproxylic beetles, spiders, and wood-inhabiting fungi. Diversity of saproxylic beetles and wood-inhabiting fungi was determined by both, tree species and sun exposure. However, diversity of spiders was determined by sun exposure only. The results of our study indicate that conservation strategies for deadwood-dependent organisms should not only focus on the amount, but more strongly on providing a high diversity of deadwood.

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11:45

Room: K308 Cabinet



## Effects of forest management and tree species composition on community composition and diversity of two groups of flying vertebrates

(Oral)

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Abstract of this presentation is not public





## Integrative forest management can promote biodiversity

(Oral)

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Integrative conservation strategies that combine production of commodities and conservation, are considered as a valuable tool to promote biodiversity in unprotected areas. In forests, a considerable proportion of biodiversity is dependent on deadwood structures, and an enrichment of deadwood is often proposed as important integrative conservation measure. The Bavarian State Forestry in Germany has implemented an integrative nature conservation strategy where the key element is the enrichment of deadwood during harvests. Deadwood is accumulated by leaving large and small diameter wood usually sold as firewood (discolored stems, crowns) after harvest combined with a retention of naturally developed deadwood. We examined the execution of this strategy in a forestry department in Bavaria (Germany), where it was implemented in 2006. We could show that with the implementation of the strategy deadwood amounts increased considerably. Therefore, we tested whether this strategy promotes biodiversity and influences assembly patterns of different species groups, which can give indications of a change in underlying mechanisms that shape the species communities, e.g. a change in the availability of niches. We conducted a before-after study to analyze the species numbers and the assembly pattern, based on functional-phylogenetic distance, of saproxylic beetles, saproxylic fungi, bird and plant assemblages in 68 beech forest plots. The plots were placed in forest nature reserves and production forest to include natural enrichment in reserves and active enrichment in production forests, which are both a part of the strategy. We tested whether integrative deadwood enrichment promotes the species numbers of the examined taxa and shifts the assembly pattern of the communities. For the assessment of assembly pattern, we used a distance matrix that combines functional and phylogenetic distance. With increasing deadwood amounts the species numbers of saproxylic beetles and fungi increased. The increases of species numbers occurred both in production forests with deadwood enrichment and in forest reserves. The species numbers of birds or plants did not change with deadwood enrichment. The functional-phylogenetic distance of saproxylic beetles increased towards an overdispersed pattern, i.e. increasing functional and phylogenetic dissimilarity between beetle species in the community, indicating an increase in the number of available niches with deadwood enrichment. Assembly patterns of the other examined taxa were unaffected by deadwood enrichment. This evaluation reveals a success of integrative deadwood enrichment in promoting the species numbers of saproxylic species and showing a fast increasing of niches for beetle communities.



## The Three Awkward Companions of the SDGs: Growth, Inclusivity and Sustainability.

(Oral)

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The Sustainable Development Goals have aspirations for achievements in respect of three important characteristics of development that have hitherto proven largely to be inimical. These are economic growth, inclusivity and sustainability. The cuckoo in the nest appears to be economic growth since thus far development that has been based on the pursuit of economic growth has been costly both socially and environmentally. The worrying growth of inequality is well documented and the unsustainable environmental impacts of rapid economic growth are evident. The SDGs mutely assert the compatibility of each but it is not clear what framework for development and progress would allow them to be compatible. This paper will use both theory and empirical examples to explore whether the three might be reconciled. It argues that the largest problem may lie in the continued dominance of key axioms in orthodox economics. The possibility of achieving the SDGs aspirations lies in the adoption of new forms of economics that are reoriented to human wellbeing.

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## Assessing the effectiveness of protected areas in southwest China using alternative approaches

(Oral and Poster)

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Protected areas (PAs) are at the forefront of conservation efforts, and yet despite considerable progress towards the global target of having 17% of the world's land area within protected areas by 2020, biodiversity continues to decline (Coad, L et al, 2015). Over the past two decades, attention has increasingly focused on assessing the effectiveness of management in these sites, especially to support adaptive improvements to management. The principal PAs in China are nature reserves, spanning over 80% of protected areas. (Weihua Xu et al, 2017). By the end of 2016, there were 2750 nature reserves in China, took up more than 14.9% of terrestrial land. However, little evidence showed their biodiversity conservation effectiveness based on quantitative assessments. The current assessment measures in China are mainly qualitative rapid assessments based on questionnaire survey or expert judgement, which might be subject to a range of biases. Those assessments are necessary when limited or no monitoring data are available, but still, more standardized, transparent and repeatable evaluations of biodiversity outcomes are expected to be built. Through a sampling survey, we found that the monitoring capacity has been largely improved within nature reserves at national level in recent 7 years. However, many of them failed to get the greatest benefits from the quantitative data-sets available to inform conservation outcomes. By starting with several case studies of forestry national nature reserves in southwest China, we try to build a comprehensive assessment system to evaluate the nature reserves' conservation outcomes based on their conservation targets, and understand the extent to which those nature reserves are currently supporting both biodiversity conservation and provisioning of ecosystem services to local communities. .

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## New opportunities for biodiversity conservation in rural China?

(Oral and Poster)

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Many conservationists associate China with substantial environmental problems linked to the country's rapid economic development and the associated pollution and exploitation of its natural resources. Nonetheless, recent migrations of large parts of China's rural population into the booming cities has created vast, increasingly depopulated rural areas, in turn allowing the central government to instigate a series of measures aimed at improving the environmental conditions of rural landscapes across the country. These measures range from a strict protection of remaining mature forests to a restructuring of rural landscapes through globally unprecedented reforestation campaigns that are commonly aimed at reducing soil erosion and flooding. The potential of the resulting landscape changes to enhance biodiversity and associated ecosystem services has received limited attention to date. Here, we present results from our studies of plant, predatory ground beetle and geometrid moth assemblages and of their diversity patterns across forested and agricultural landscapes in northern and north-eastern China over the last decade. We illustrate the potential of secondary and plantation forest landscape to harbor insect and plant assemblages of similar, or even higher species richness in comparison to assemblages recorded in large mature forests remnants, and we demonstrate a strong local recruitment patterns of species assemblages in our study region. We also show that turnover across the different taxonomic groups is highly linked to climatic conditions and the wider landscape context, while cross-taxon links are generally weak. We discuss the implications of our findings for the conservation and potential enhancement of biodiversity and associated ecosystem services across the study region.



## Impacts of environmentally realistic antidepressant exposure on behaviour and sperm traits in fish

(Oral and Poster)

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Pharmaceutical pollutants are increasingly being detected in ecosystems worldwide. Indeed, approximately 1 in 10 currently manufactured pharmaceuticals have been found in the environment. In this regard, pollution by antidepressants is especially concerning due to their capacity to cause changes to the central nervous system and endocrine system of exposed wildlife, often at disturbingly low concentrations (ng/L). One such pollutant is the antidepressant fluoxetine, which is among the world's most commonly prescribed psychotherapeutics and also one of the most frequently detected in the environment. Alarmingly, the primary target molecule of fluoxetine is evolutionarily conserved across a wide range of non-target species. As a result, fluoxetine can disrupt ecologically significant behavioural and physiological processes in wildlife. Despite this, the effects of environmentally relevant fluoxetine exposure on aquatic biota remain unclear. To address this gap, we investigated the impacts of environmentally realistic fluoxetine exposure-30 and 380 ng/L-on the behaviour and sperm quality of male eastern mosquitofish (*Gambusia holbrooki*). Specifically, utilising the mosquitofish, we investigated the impacts of fluoxetine on pre-copulatory mating behaviour and post-copulatory sperm traits, as well as, exploratory behaviour and boldness. We focussed on a combination of male behaviours (i.e. reproduction, exploration and boldness) and sperm quality because fluoxetine has the potential to alter the stress response of wildlife, as well as reproduction, through shifts in the hypothalamic-pituitary-adrenal axis. Importantly, changes in these behaviours and sperm traits could have a direct bearing on male fitness. We found that fluoxetine exposure altered the behaviour of fish at field-detected concentrations. Specifically, fluoxetine affected both association time, and copulatory behaviour carried out by males towards females. Interestingly, however, fluoxetine exposure did not impact exploratory behaviour or boldness, with sperm quality measures (i.e. sperm performance and viability) also not being affected. Our results indicate that fluoxetine exposure can impact reproductive behaviour with implications for organismal fitness and community structure.



## Developing effective wellbeing indicators for people and nature: how biocultural approaches can facilitate sustainable management of social-ecological systems

(Oral and Poster)

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Biocultural approaches—those built from local values and knowledges—can be used to better understand and manage social-ecological systems. A biocultural approach to indicator development begins with an understanding of the locally-grounded questions and institutions related to resource management. This approach leads to development of well-being indicators for people and nature that are deeply relevant to a local way of life, are easily integrated into existing structures and cultural practices, and are useful for local management<sup>1,2</sup>. We present results from a comprehensive literature review and ongoing collaborations, aiming to answer: who is using indicators developed with a biocultural approach, in what context, why, and how? Standardized database searches resulted in ~4,500 resources, from which we identified over 50 fully-formed indicator sets and frameworks that specifically relate to both: 1) social-ecological systems, with both biological and cultural elements, and 2) resilience, adaptive capacity, or well-being. We performed quantitative (e.g., number of indicators and categories, geographic scale) and qualitative (e.g., assessing methods of indicator development and application) analyses; we also held workshops and visioning exercises with communities in the Pacific to gain perspective on local values and management priorities. We explore case studies, in both European and non-European contexts, where a biocultural approach has been successfully implemented. For instance, one such framework developed in Melanesia assesses crucial aspects of the "traditional economy," such as resource access, cultural practice, and community vitality, which are foundational to Melanesian people's well-being. We also identify discrepancies between local management priorities and the systems currently in place from national and international frameworks; for example, indicator sets that emphasize incentives (e.g., subsidies) can encourage accumulation of goods and currency without previously considering or acknowledging alternative local communities' values and worldviews, and thus potentially undermine traditional practices and sustainable production. Lastly, we discuss some of the limitations and challenges in using a biocultural approach for indicator development (e.g., measuring intangible cultural elements of a system, crafting indicators that can assess feedbacks, prohibitory costs, meaningful and equitable collaboration), and suggest potential solutions.

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## Differential patterns of acute toxicity and genome instability induced by cadmium and lead in *Amietophrynus regularis* suggest implication for amphibian decline

(Oral and Poster)

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Amphibians are increasingly being used as bio-indicator of contamination in ecosystems due to their sensitivity to xenobiotics in the environment. Cadmium and lead compounds, ubiquitous mutagens and carcinogens, are capable of eliciting genome instability in adult toads which may enhance amphibian decline. Micronucleus cytome (MN-cyt) assay, a comprehensive cytogenetic test for the assessment of genome instability induced by xenobiotics in organisms, was utilized in the differential cytogenotoxic evaluation of Cd and Pb in adult *Amietophrynus regularis*. *A. regularis* was exposed to six concentrations (8–512 mg/L) of the metal solutions to determine the 96 h acute toxicity. Four toads per group were exposed to five sub-lethal concentrations (5–75%) of the 96h LC50 of the metals for 14 days. At post exposure, bone marrow and peripheral erythrocytes were collected for MN-cyt analysis. The metals induced differential concentration and time dependent increase in mortality with 96h LC50 of 36.36 mg/L (Cd) and 112.06 mg/L (Pb). No observable effective concentrations (NOEC); Cd=8.0 and Pb=32 (mg/L) and Lowest observable effective concentrations (LOEC); Cd=16.0 and Pb=64.0 (mg/L) were recorded for the metals. Derived toxicity factor (TF) showed that Cd was 3.08 times more toxic to the toads than Pb. The metals induced significant (





## Simulating eutrophication in a metacommunity landscape – an aquatic model ecosystem

(Oral and Poster)

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Community ecology has long focused on processes that regulate patterns of species distribution and abundance. Facing an era of anthropogenic global change and biodiversity loss, strategies for conservation biology are increasingly relevant. Our research deals with temporal and spatial aspects of two of the main threats for biodiversity, namely eutrophication and fragmentation. It is known that pulsed nutrient addition increases phytoplankton diversity by allowing higher number of coexisting species<sup>1</sup>. Furthermore, the benefit of a metacommunity landscape with intermediate connectivity is increasing autotroph diversity<sup>2,3</sup>. However, it is yet unclear if those two factors are additive in increasing diversity and if these effects can exceed to the consumer level. With the goal of understanding how eutrophication impacts biodiversity in a metacommunity landscape, we hypothesized that pulsed nutrient addition will increase diversity not only among autotrophs, but also in their grazers, and this effect will be even greater in a metacommunity landscape. We simulated eutrophication and fragmentation in a microcosm experiment with three phytoplankton species as primary producers and 8 microzooplankton species as grazers. The nutrients were supplied either continuously, or in a pulsed fashion. In combination with the nutrient factor, two different landscapes were tested: an isolated patch and a metacommunity (interconnected patches). Biodiversity was estimated as Shannon diversity and richness at regional and local scales. Furthermore, betadiversity was performed to investigate the dissimilarity among patches. As expected, nutrient addition had a great effect on phytoplankton diversity, with highest diversity in pulsed treatments, whereas different landscapes did not affect their diversity. The opposite was observed for grazers. Metacommunity landscape was responsible for greater diversity of zooplankton, however, without significant effects of pulsed or continuous nutrient addition. The betadiversity of both trophic levels combined was influenced most by pulsing nutrients. We could confirm that higher diversity of phytoplankton is attained with pulsing nutrient addition, even under grazing pressure. However, was not possible to validate the extension of these effects to the zooplankton diversity, which was mostly influenced by the landscape.

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## Effect of climate changing pattern on ecosystem productivity of Bhimtal lake (Kumaun Himalaya), India.

(Oral)

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Global climate change is recognized as an ecological threat on ecosystem productivity of aquatic ecosystem. Climate can be considered the major factor determining the distribution of species at a continental scale. Climate changes are recognized as important environmental regulatory factors to assess the ecosystem productivity in relation to changing pattern of abiotic and biotic characteristics in aquatic system of lake. Bhimtal lake is a subtropical lake located between 29° 21' N latitude and 79° 24' E longitude, at an elevation of 1332 m above mean sea level in Kumaun region of Himalayan zone of Indian sub-continent. The catchment basin of lake is posing a numbers of ecological stresses due to climatic variations, invasive land use pattern, degraded forest zones and changed agriculture pattern. The water surface area is decreasing due to massive infestation of aquatic macrophytes and water depth level showed a decreasing trend due to increased siltation along with sedimentation load. The present study focused on long and short term effect of climate change on ecosystem productivity of Bhimtal lake. The comparative meteorological data of last fifteen years of catchment basin of Bhimtal lake revealed that air temperature has been increased 1.5 to 2.1°C and 0.2 to 0.8°C in summer and winter seasons respectively, relative humidity decreased 4 to 6% annually and rainfall pattern changed erratically in rainy season. The surface water temperature of lake showed an increasing pattern as 0.8 to 2.6 °C, pH value decreased 0.5 to 0.2 in winter and increased 0.4 to 0.6 in summer and dissolved oxygen level showed a decreasing trend as 0.4- 0.7 mg/l in winter. The lake ecosystem productivity mainly depends on species richness, abundance and biomass of phytoplankton, zooplankton, benthos and fish species. A total of 5 groups of phytoplankton, 3 groups of zooplankton, 11 groups of benthos and 14 fish species were recorded in Bhimtal lake. The changing pattern of phytoplankton groups indicated that biomass of Chlorophyceae and Bacillariophyceae were decreasing as 1.99 and 1.08% respectively in Bhimtal lake but biomass of Cynophyceae group was increasing as 0.45% and contributing the algal blooming in lake surface water during summer season. The biomass of zooplankton and benthos were showed decreasing trend in winter season and increase in summer season. The population of endemic fish species i.e. Tor, Schizothorex, Barilius, and Nemacheilus showed decreasing trend as exotic fish species, Cyprinus carpio, Hypophthalmichthys molitrix showed as dominance in recorded fish catch data from Bhimtal lake. The present research study focused on correlation matrix among different climatic variables, physico-chemical characteristics with population of phytoplankton, zooplankton, benthos and fishes of Bhimtal lake. The present study will be contributed significantly to assess the current changing trend of ecosystem productivity of Bhimtal lake with different time sc



## At which spatial and temporal scales can fungi indicate habitat connectivity?

(Oral)

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Isolation of habitats in space and time affects species globally and in a multitude of ecosystems [1]. It is however often difficult to assess the level of isolation from the point of view of the focal species [2]. Wood-decaying fungal species have been used as indicators of 'conservation value' in Europe [3] and North America. The indicator species were commonly assigned based on expert opinions, but few scientific evaluations have been performed of what these species actually indicate. Building on previous classifications of wood-decaying fungal indicator species on Norway spruce, we hypothesized that indicator species would differ from non-indicator species in how they respond to local temporal connectivity - forest age, the intensity of historical selective logging and the presence of well-decomposed large logs, and to local and landscape-scale spatial connectivity - local forest area, local amount of deadwood and the connectivity to old forest in the surrounding landscape. Based on fungal occurrence data from a fixed number of spruce logs at 28 sites distributed across Scandinavia, we explored the spatiotemporal scales at which the local communities were affected by connectivity. Indicator species showed the strongest response to connectivity of old forest ( $\geq 80$  years) within 100 km, while non-indicator species depended on connectivity of younger forest ( $\geq 40$  years) at a smaller spatial scale ( $\leq 25$  km). Indicator species increased and non-indicator species decreased in total abundance with the increasing age of the local forest stand. Landscape-scale old-forest connectivity was beneficial for indicator species in all sites except those with relatively low amount of deadwood, while non-indicator species showed the opposite pattern. We identify a threshold of around 47 m<sup>3</sup> ha<sup>-1</sup> in the amount of deadwood where indicator species become abundant enough to influence non-indicator species through competitive interactions. There was a pronounced uniformity within each species group in the connectivity responses. We conclude that the studied indicator species indicate high forest age, high amount of resources and, given that the resources are plentiful, also high old-forest connectivity, but they do not indicate a long history without any logging operations or local deadwood continuity. The studied non-indicator species did not indicate any of the studied spatiotemporal connectivity variables. Indicator species are usually red-listed and may continue to decline in the future without habitat restoration efforts

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## Connectivity Conservation of Large Carnivores' Habitats in the Carpathians

(Oral)

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The Carpathian Mountains forming an arc roughly 1.500 km across seven states provide the habitat for some of the largest European populations of brown bears, grey wolves and Eurasian lynx, with the highest concentration in Romania. However, Ukrainian, Romanian and even Slovakian parts of Carpathians suffer from the lack of the functional nature protection and the effective landscape management. Several protected areas including the large number of NATURA 2000 sites have been declared, but their spatial design recalls rather patchwork instead of coherent network.

Populations of large carnivores with enormous spatial requirements and extensive dispersal and migratory needs are widely endangered by rapid development of roads and motorways creating long impermeable barriers across the Carpathians. As new traffic projects are planned on supra-national level, the same scale is needed for designing an extensive system of wildlife corridors.

Habitat suitability models for brown bear, grey wolf and Eurasian lynx were used to delineate core habitat areas and stepping stones important for dispersal. The Circuit Theory was applied for assessment of landscape connectivity and finally a coherent network of wildlife corridors was designed.

Proposal of such green infrastructure is going to be presented to regional authorities and stakeholders, to provide them with relevant information for negotiations with road and motorways planners.

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## A quarter of a century of the Habitat Directive: balance for Spanish plants

(Oral)

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The Habitat Directive (DH) was approved in 1992 and listed plant species in three sections: Annex II taxa for including their core areas in the Natura 2000 network; Annex IV taxa to apply a strict protection within and outside Natura 2000 sites; and Annex V taxa for ensuring their sustainable exploitation. Nowadays, DH covers over 480 plant species from 28 Member States.

Spain is the country that contributes the largest number of plants to the Annexes of the DH, with more than 200 species (177 in Annex II, 198 in Annex IV and 13 in Annex V). The total figure represents 2.9% of the national flora (Peninsular Spain plus the Canarian and Balearic archipelagos) and such species have been later included in state and regional protection laws. On all of them, a sexennial report must be presented in accordance with DH article 17.

The selection of plants for the Annexes, made in the 1980s, was already questioned shortly after its inception in Spain (Domínguez et al., 1996). Particularly, Annex II mixed cases of the greatest conservationist urgency with scarcely threatened species, probably due to a lack of information. More worrying than this heterogeneity was the fact that a copious number of truly threatened plants, previously collected at the Bern Convention, had been left out of the Annexes.

Since its approval in 1992, the DH has only been modified to include species from the new Member States that joined the European Union. Biases and gaps detected in the annexes have not been corrected in these 25 years of implementation and their inconsistencies have manifested more clearly as studies were expanded: from the 439 covered by the Spanish Red Book of vascular flora (IUCN categories CR, EN and VU), only 82 were included in the DH (Bañares et al., 2004).

The recent fitness check of the European Nature Directives is correct when talking about the umbrella effect of the combination of Annexes of the Directives on the conservation of European endangered species, what led it to discourage any 'change in the list of species listed in the Annexes at this stage'.

The recent economic crisis has aggravated the lack of adequacy of funds for research and monitoring of threatened species, a good part of which is destined to elaborate the European sexennial reports. This detracts resources for the monitoring of already endangered plants outside the Annexes which have been diverting for 25 years in studies of less or not at all vulnerable species. After this analysis, I suggest some measures to improve current DH efficiency and discuss possible lines of reform of its Annexes.

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## Forest restoration for biodiversity conservation: some case studies from Sweden

(Oral)

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Forest restoration for biodiversity conservation: some case studies from Sweden

Because of worldwide forest degradation, eroding biodiversity and ecosystem services, ecological restoration has become a global priority. In many boreal forest areas, intensive management for timber production has caused declines in biodiversity and decrease in habitat quality for a large number of specialized species. As very little undisturbed forest habitats remain in many regions of the world, we have reached a situation where we no longer can rely on passive conservation measures, i.e. setting aside conservation areas under a free development philosophy. Instead, to achieve conservation goals, we need methods for restoration of hitherto managed forest, as well as for active management of forest reserves.

In two separate field experiments we evaluated the effect of three different restorations methods: 1) restoration burning, 2) gap cutting and 3) selective harvest to remove Norway spruce to benefit deciduous trees (originally intended to benefit white-backed woodpeckers) on saproxylic beetles, a group of insects severely threatened by modern forestry. Beetles were collected with 3-5 window traps per stand.

As predicted, saproxylic species known to be fire favoured increased dramatically after burning. The immediate response shows that, initially, fire favoured species are attracted from the surrounding landscape and not produced on site. Gap cutting increased the abundance of cambium consumers but had no significant immediate effect on total species richness or assemblage composition of saproxylic beetles. The stronger effect of burning compared to gap cutting on saproxylic assemblages is probably due to the very specific conditions created by fires that attracts many disturbance-dependent species, but that at the same time disfavour some disturbance-sensitive species.

Selectively harvest to remove Norway spruce benefitted many species and the effects on species associated with sun exposure were particularly important, but many beneficiary species were also linked to dead wood from broadleaved trees. Red-listed saproxylic beetles showed a similar pattern with more species and individuals in restored sites. All three restoration methods clearly benefitted certain groups of saproxylic beetles, but to some degree different species. The implication of this is that several different restoration methods must be used to recreate/mimic natural disturbance regimes and the natural variation in boreal forest and thus benefit saproxylic species disfavoured by current even-aged silviculture.





## Intraspecific diversity, a hidden decline: A focus on paedomorphic newts in the context of fish introductions

(Oral)

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Intraspecific variation such as polymorphisms, significant evolutionary units, and local adaptations are essential parts of biodiversity. However, conservation assessments and guidelines usually focus on the species level making therefore intraspecific variability less considered. This is particularly the case for common species that are far from extinction but not from intraspecific homogenization. Facultative paedomorphosis is a polymorphism expressed in some newt populations and which is considered of major importance in both micro and macro-evolution. Whereas most localities have only metamorphosing individuals, some have also individuals remaining aquatic all their life by retaining larval traits such as gills at the adult stage. By doing long-term surveys in the main facultative paedomorphic populations of three newt species in ponds and lakes across several European countries, we showed that paedomorphs became extirpated from most sites during the last decades (1-3). The common phenotype, the metamorph, often persisted but also declined and sometimes disappeared afterwards. The main frequent cause of decline was the introduction of alien species, specifically fish. There is some hope as resilience of paedomorphs was shown in ponds, but not yet in lakes suggesting a possible definitive loss of paedomorphosis. Globally, the situation is dramatic, particularly in a few Balkan countries where all the main populations of paedomorphs, i.e. those that received a subspecific status, disappeared from the only mountain lakes where they were described. Consequently, both management actions to remove threats, such as alien fish, and an improvement of tools to preserve intraspecific diversity of common species are urgently needed.

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## Ecosystem services of soil microorganisms and microbiological component condition assessment of the quarry Pechurki.

(Oral)

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The obligatory component of any biogeocenosis is soil microorganisms, which perform a number of crucial metabolic and ecophysiological functions. They participate in plant cover recovery and in circulation of elements, promote maintaining of soil fertility and regulate parts of humification. The prime role of soil biota in a root delivery of plants consists in returning nutrients to their mineral forms, which plants can take up again. Soil microorganisms are shown to influence acid-base balance stabilization and transformation of root exudates. The decrease of toxic substances negative consequences level on biogeocenoses components was also established.

Soil formation criterion is the biological soils condition which is estimated on microbiological activity. In stability maintaining of communities and ecosystems development an important role is played by a condition of replantozem microbiocenoses though it has not been studied. It is relevant to study the microbiological component condition at the technogenic habitats.

The aim of this research was to assess the quantitative maintenance of a microbial component and its activity in the quarry Pechurki.

The microbial biomass content varied from 0,98 to 4,6 microg C/g of the soil, values increase with overgrowing term. In C<sub>mic</sub> value the studied samples can be arranged in this row: underlay > organomineral horizon > rock. Values of the microbial metabolic coefficient was not higher than 0,021 microg CO<sub>2</sub>-C/mg C<sub>mic</sub> per hour, what is showing an instable functioning of microbial societies. Thus the restitution of microbiological activity of disturbed lands is slowed down considerably and does not depend on the type of substrate and the plant community. The received results shown the low stability of microbial societies and the ineffectiveness of using the organic substrate, especially in the first stage of quarry overgrowing. In order to analyze succession of soil microbial communities investigation of metagenomics of soil samples has been conducted. Taxonomic analysis of communities at the phyla level did not reveal differences between different age dumps. In all cases, the largest phyla was the Proteobacteria (55.7%), Actinobacteria (17.0%), Bacteroidetes (10.3%), Acidobacteria (6.4%), and Chloroflexi (3.8%). The dominant taxa in young dumps were Acinetobacter (8.8% of the total community), Micrococcaceae (8%) and Pseudomonas (6%). In the middle-aged dumps, representatives of Micrococcaceae (4.5%) and Sphingomonadaceae (1.4%) prevailed. Old age dumps showed a high proportion of representatives of Bradyrhizobiaceae (5%), Chitinophagaceae (2.9%) and Hyphomicrobiaceae (2.5%) in the community. This work was supported by Russian Scientific Foundation, project № 17-16-01030 "Soil biota dynamics in chronoserries of posttechnogenic landscapes: analyses of soil-ecological effectiveness of ecosystems restoration"

2018/06/15

13:30

Room: A1 Wilhelm



## Genetic tools for biodiversity conservation and wildlife management

(Oral)

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Applied conservation genetics is a seemingly ever-evolving field and still highly relevant as many species are lost or further endangered each day. Most recently genomics has added more tools to the conservation geneticist's arsenal for untangling wildlife relationships, population connectivity, and genetic diversity. Today, some are pushing those boundaries further into investigating the efficacy, safety and morality of synthetic DNA for aiding biodiversity conservation. The challenge for applied practitioners and wildlife managers is to know what tools exist, their limitations, and which are best to answer a specific question. This challenge has increased in recent years not decreased. One of the most effective ways to demystify genetic tools for managers and practitioners is to provide an array of empirical examples of the application of various genetic tools in management of wildlife damage and biodiversity conservation. Many practitioners of wildlife management understand the power of genetics for wildlife management but also may not see a way to bring it into their work because it seems expensive or inaccessible. The goal of my talk is to provide real-world examples of conservation genomics and the ease of which some of these tools may be applied and accessed.

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## Prospects for genomic monitoring using minimally invasive sampling

(Oral)

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The decreasing cost and increasing scope and power of emerging genomic technologies are reshaping the field of molecular ecology. However, many modern genomic approaches (e.g., RAD-seq) require large amounts of high quality template DNA. This poses a problem for an active branch of conservation biology: genetic monitoring using minimally invasive sampling (MIS) methods. Without handling or even observing an animal, MIS methods (e.g. collection of hair, skin, faeces) can provide genetic information on individuals or populations. Such samples typically yield low quality and/or quantities of DNA, restricting the type of molecular methods that can be used. Despite this limitation, genetic monitoring using MIS is an effective tool for estimating population demographic parameters and monitoring genetic diversity in natural populations. Genetic monitoring is likely to become more important in the future as many natural populations are undergoing anthropogenically-driven declines, which are unlikely to abate without intensive adaptive management efforts that often include MIS approaches. Here we profile the expanding suite of genomic methods and platforms compatible with producing genotypes from MIS, considering factors such as development costs and error rates. We evaluate how powerful new approaches will enhance our ability to investigate questions typically answered using genetic monitoring, such as estimating abundance, genetic structure and relatedness. As the field is in a period of unusually rapid transition, we also highlight the importance of legacy datasets and recommend how to address the challenges of moving between traditional and next generation genetic monitoring platforms. Finally, we consider how genetic monitoring could move beyond genotypes in the future. For example, assessing microbiomes or epigenetic markers could provide a greater understanding of the relationship between individuals and their environment<sup>1</sup>.

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## Extreme droughts as a threat to a critically endangered species in southern Europe

(Oral)

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Climate change may impair the survival of rare species. In this study we used populations of the critically endangered pearl mussel *Margaritifera margaritifera* (Linnaeus, 1758) colonizing several rivers in the North of Portugal (the southern limit of their distribution) to assess the effects of future climatic scenarios. Our results, based on empirical and modelling data, showed that future survival is threatened by projected declines in precipitation for the 21st century, with implication on the river flows and water depths that might decrease below the species requirements. This situation could be especially critical during summer conditions since the ecological flows may not be assured and several river stretches may be converted into stagnant isolated pools. Connectivity may also be affected with reverberating effects on the mobility of *Salmo trutta*, the natural host of *M. margaritifera*, with consequences in the reproduction and recruitment of pearl mussels. In addition, the occurrence of extreme events such as droughts may also negatively affect pearl mussels. During the extreme 2017 summer drought we assessed the mortality of *M. margaritifera* in several Portuguese rivers. We found that massive die-offs occurred due to the low water level and mussels were mainly found stranded near the banks. Additionally, in some sites predation by wild boars (*Sus scrofa* (Linnaeus, 1758)) was also important. In view of future climatic scenarios, several *M. margaritifera* populations in Iberia (and elsewhere) may now be more at risk and conservation measures should be urgently applied, including: the negotiation of ecological flows with dam promoters, the restoration of riparian vegetation along degraded areas, supplemental stocking of hatchery-raised *M. margaritifera* individuals, and careful monitoring and translocations to deeper areas or ex-situ facilities to reduce mortality rates during summer extreme droughts.



## Effects of ecological restoration to promote structural variability in boreal forests

(Oral)

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Ecological restoration of boreal forests aims at re-instating the structure and dynamics of forests that have been degraded by silvicultural management. Forest restoration mimics natural disturbance dynamics to diversity forest stand structure and brings back fire as a natural part of forests successional development. Restoration has been shown to enhance populations of fire-dependent insects, benefit various deadwood dependent organisms and enhance the establishment of pioneering species.

Using a 12-year large-scale field experiment conducted in Natura 2000 protection areas along eastern Finland, we assessed how two alternative restoration methods (partial felling to add dead wood and felling combined with subsequent burning) affect structural diversity of boreal forests stands in comparison to untreated control (“passive restoration”). The measurements of trees, tree seedlings and dead wood have been conducted before and three times after restoration treatments during 2005-2017.

In ten years, restoration by felling+burning increased both the volume and diversity of deadwood, whereas felling only increased the volume of deadwood, diversity was not greatly affected. Instead, the development of the diversity of living trees strongly depended on initial stand structure and was usually lower on restored stands in comparison to untreated control stands. In the most severely burned stands, all trees died within two years after treatments, imperiling the continuity of deadwood in the future. Within initially mixed-wood stands burning enhanced the establishment of new generation of deciduous trees, but in pine-dominated stands hardly any deciduous establishment was seen in ten years.

To conclude, restoration clearly speeds up the development of deadwood volumes and diversity needed to host large portions of biodiversity, but in landscape scale, we suggest several restoration methods to be used simultaneously within the landscape, to ensure high variability in tree stand structure and deadwood continuity in short term and in the future.

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## **FRESHABIT: The LIFE integrated project for restoration of wetland ecosystems at the catchment level**

**(Oral)**

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Freshwaters provide multiple natural and cultural ecosystem services, which form the basis of Finnish water heritage. In most cases, the deterioration of freshwater ecosystems is due to a range of interacting background factors at many scales, and reversing the trend requires comprehensive restoration measures in catchment areas and water systems as well. Following this, to preserve our valuable water heritage, the co-operation across human-set boundaries is required.

Funding for restoration projects conventionally comes from one or few sources and is often targeted to a given habitat or species. However, enhancing the ecological status of many inter-connected habitats or species usually requires large-scale and multi-targeted solutions. LIFE Integrated Projects were introduced in 2014 to implement environmental legislation and strategies on the regional, multi-regional or national level, and to increase the impact of the EU LIFE programme.

FRESHABIT LIFE IP project, financed by the LIFE Integrated Projects funding, aims to improve the ecological status and biodiversity of N2000 freshwater sites in 12 selected catchment areas. Within FRESHABIT, common practices across the organizational levels of a range of actors is established, thus contributing importantly to 'capacity building' for further water management.

Due to the characteristics of the water bodies in question, most of the measures are implemented outside Natura 2000 sites on both state-owned and private-owned areas. Several water protection measures to reduce the environmental loading on water bodies are implemented, and habitats of waterfowl, fish, and other biota is restored. Especially the measures in the catchment areas include improvement and restoration of other habitats than freshwaters, e.g. peatland restoration. To secure the natural lifecycles of freshwater pearl mussel (*Margaritifera margaritifera*) and migratory fish, six fishways are constructed and related support measures implemented. The impacts of measures on the aquatic environment is monitored on a broad basis.

Acknowledging the importance of appreciation of and interest in Finland's water heritage among water management professionals, decision-makers, residents and recreational users, a variety of public events, nature schools and voluntary work sessions is organized, and stakeholders involved with actions in the early stage. FRESHABIT also promotes rural business in many ways, and creates opportunities for contractors in different parts of Finland.





## How woodpeckers can save the Białowieża Forest?

(Oral)

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### Economic benefits of woodpecker watching at the Białowieża Forest

Białowieża Forest (BF) is very famous for bison, beautiful old-growth stands and rich avifauna (e.g., woodpecker, owls, birds of prey, flycatchers). That's why this place attracts a lot of tourists who are interested in nature. Among people visiting the BF birdwatchers are the most important group consisting about 1/3 of tourists. The goal was to estimate the value of the White-backed Woodpecker *Dendrocopos leucotos* (WBW) and the Three-toed Woodpecker *Picoides tridactylus* (TTW) at BF, i.e., calculating how much money the visiting tourists leave to see these birds. The results were compared to the benefits derived from wood production. We conducted surveys among birdwatchers visiting BF in 2016. We asked them about bird species they wanted to see the most and about their costs of staying in Białowieża. Data on timber production we obtained from State Forest. Birdwatchers the most frequently indicated WBW and TTW. People who wanted to see at least one of these two species spent in Białowieża a total of 5.5 million euro, which is 34% of the total amount spent annually by all tourists. The woodpeckers are considered as indicator species associated with other natural features of the forest. As many as nine woodpecker species breed in BF, but their densities are rather low and the number of some rare species decrease. The most sensitive to habitat changes due to forest management (logging, removal of dead trees) are WBW and TTW. In 2017, as much as 170,000 m<sup>3</sup> of wood was removed from the BF. In many cases, logging was conducted along forest roads and tourist trails (dozens of kilometers). This worsened: 1) of woodpecker habitats, and 2) possibility to explore the forest by birdwatchers. It is worth to stress that, revenues from birdwatchers interested in WBW and TTW were higher than revenues from logging. Moreover, revenues from that kind of tourism goes to hundreds of local people (guides, shops, restaurants and rooms owners etc.), while revenues from timber production goes to big state company employing relatively small group of people. Significant money from birdwatchers could convince lawmakers that constant protection of all old stands in the entire BF can be more beneficial for both, the local community and nature.



## Woodpeckers and non-excavator birds in logged sites: same problem... same solution?

(Oral)

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Piedmont forests, the lower vegetation stratum of Andean forests in NW Argentina, have been severely disturbed with ~90% of its original range transformed into agricultural, live-stock pastures, industrial, and urban areas. One main current human activity in piedmont forest remnants is selective logging, legal and illegal, and always without criteria for biodiversity conservation. As part of a project aiming to preserve the biodiversity of piedmont forests, we show a study in progress on cavity-user birds, emphasizing on woodpecker species. We have conducted 3 field seasons at 3 undisturbed sites (US) and 4 logged sites (LS) with comparable sample effort, performing point counts to detect differences in cavity-user bird abundances, and looking for cavities used by birds (i.e. nests or roosts). We applied network theory to analyze these bird-tree interactions, i.e. nestwebs. We found that 14 of 22 cavity user bird species (e.g. toucans, parrots, flycatchers, woodcreepers, and woodpeckers) were significantly less abundant in LS than in US; particularly, from 4 woodpecker species occurring at our study area, only the White-barred Piculet (*Picumnus cirratus*) did not show significant differences in abundance between sites, and the Golden-olive Woodpecker (*Colaptes rubiginosus*) was not detected at LS. We found 143 cavities (i.e. interactions) in 14 tree species used by 14 bird species in US, and 66 cavities in 12 tree species used by 13 bird species in LS. Difference in the amount of interactions between US and LS was mainly due to woodpecker incidence: 108 vs 35 interactions respectively. Several network parameters, such as connectance, dominance, evenness, and robustness against tree species extinction simulations, were similar between US and LS. Woodpecker cavities were only occasionally used by non-excavators, both in US (18.7% of non-excavator interactions) and LS (19.4%). We found differences in the following aspects: 1) key tree species, determined by strength index, were snags (i.e. standing dead trees), *Calycophyllum multiflorum* and *Amburana cearensis* (an endangered Fabaceae) in US, and snags, *Anandeanthera colubrina* and *Astronium urundeuva* in LS; 2) the whole nestweb, as well as the 4 woodpecker species, were more generalists in US than in LS, probably caused by a shortage of suitable trees in LS; and 3) US had 2 interaction modules: one formed by excavators (woodpeckers plus a trogon) that excavated their own cavities in snags and in living trees, and the other by non-excavators mainly with decay-formed cavities in living trees, but also in snags; LS had a third module in which a few non-excavator species, absent in US, constituted a separate module with decay-formed cavities in snags. Our results show that selective logging is heavily influencing the woodpecker occurrence in LS, and that actions tending to preserve woodpeckers could have no impact on non-excavator cavity-users in our study site.



## Is the Eurasian Three-toed Woodpecker *Picoides tridactylus* a keystone species in boreal forest environments?

(Oral)

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The Eurasian Three-toed Woodpecker *Picoides tridactylus* is a widespread species of the northern Palearctic forests. The species prefers mature coniferous and mixed forests, favouring forests with a good proportion of dead and dying trees. Three-toed Woodpecker has a close connection to forest habitats with natural dynamics and disturbances; it inhabits areas recently disturbed by fire, wind, snow, or other agents that increase the amount of suitable substrate of its insect prey. Its diet consists predominantly of spruce bark beetles (Coleoptera, Scolytidae), although phloem sap of conifer trees is also used especially in springtime.

We present here results of both published and unpublished studies that are based on long-term population studies in boreal areas in southern and eastern Finland.

The territory sites of Three-toed Woodpecker are detected to locate in structurally complex forests, and there is a strong positive correlation with the occupancy proportion of its territories and the quality of the forest landscape. The species is observed to indicate general species richness of forest birds and structural diversity of forest environment. Its breeding density increases along the conservation value of forest landscapes for breeding birds. The Three-toed Woodpecker is also considered a candidate of umbrella species for the bark beetle biodiversity given its requirement for ample dead wood and thereby susceptibility to forest management.

The Three-toed Woodpecker is a primary cavity excavator, and its old nest cavities are used by various cavity-nesting bird species in its territories. The species frequently reuses its own cavities, but they have found to be very important for the Pygmy Owl *Glaucidium passerinum*. However, the general importance of the Three-toed Woodpecker as a cavity-producer in boreal forests is most probably much smaller than that of the Great-spotted Woodpecker *Dendrocopos major*.

Available evidence suggest that the Three-toed Woodpecker may regulate tree-damaging bark beetle populations during an epidemic. This underlines the benefit of protecting the species and its habitats as a means to possibly limit beetle damages in surrounding managed forests.

Based on the results and current knowledge, we evaluate the keystone species status and possible economic values of the Three-toed Woodpecker in boreal forest environments.

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2018/06/15

14:45


Room: A1 Wilhelm



## Quantifying Genomic Erosion in Endangered Species

(Oral)

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Abstract of this presentation is not public



## New highways and maintenance of large carnivore habitat continuity – a Croatian experience

(Oral)

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Brown bears (*Ursus arctos*), grey wolves (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) inhabiting the Dinaric Mountains of Croatia belong to the large and stable population of these large carnivores nearest to the Alps. Together with the neighboring Slovenian population segment, they comprise the source for recolonization of the Alps and much of Western Europe, either through natural migrations or transplanting of captured animals. The new highway has been constructed through the main portion of the large carnivore's core area in Gorski kotar during the period from 1996 to 2004. The current large carnivore range in Croatia was intersected with a fenced highway, possibly splitting the Dinaric mountain range into a northern (half of Gorski kotar and adjacent Slovenian part) and a larger southern part. The highway has a number of viaducts, tunnels and one specifically constructed (100 m wide) green bridge, named Dedin, for bears and other wild animals. We studied the impact of the highway on large and medium sized mammal movements, and estimated the highway permeability for those animals. The conclusions were: Large mammals of Gorski kotar (Croatia) preferred to use wide overpasses (100 m and wider) instead of narrow (10 to 50 m) underpasses. The ratio of large carnivores crossing the highway via wide overpasses can be three to six times higher compared to crossings through ten to 15 m wide underpasses. The highway in Gorski kotar, with 25% of the highway length in the crossing structures themselves, seemed not to be a barrier either for large carnivores (resident or dispersing) or for large ungulates. Based on experience gained with the Dedin green bridge, a new highway to the south of Croatia (to Split and Dubrovnik towns), has 200 objects (as potential crossing structures), included eleven dedicated overpasses (green bridges in widths of 120 m, 150 m and 200 m), one additional tunnel and five additional viaducts. The permeability of that highway is 13.1%, i.e. 50% less than the highway through Gorski kotar. We feel content that the 25% of highway permeability ensures habitat connectivity: We have determined that all large mammals used green bridges on regular basis, but the frequency and patterns of crossings vary during the day, as well as between large mammal species and groups. There was a strong negative correlation between human passage and passage of large carnivores as well as between passage of large carnivores and ungulate passage, and positive correlation between human and ungulates passage. Therefore, in order to increase usage of green bridges by large carnivores, human influence at green bridges should be eliminated or at least minimized.



2018/06/15

15:15

Room: A2 Wivi



## Testing for niche conservatism to plan conservation of elusive species under climatic change: small wild cats in the Indian subcontinent

(Oral)

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Abstract of this presentation is not public





## Restoration of Central European fens – the larger context

(Oral)

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Fens are groundwater-fed wetlands that once covered substantial surfaces in Central Europe. They deliver important services to society including carbon fixation, water buffering, biodiversity and nutrient retention. Nowadays most of these wetlands have been lost or highly decreased in size or quality. This has led to enormous losses in water buffering capacity and biodiversity and huge releases of carbon and nutrients. Despite all this negative effects of drainage even today freshwater wetlands still face the highest loss rate of all European habitat types. On the other hand, many countries have started restoration programs to get at least some of the functions of the lost wetlands back.

The present contribution will address factors that affect the sustainability of wetland restoration in relation to spatial scale and landscape connectivity. We will translate these findings into practical knowledge, aimed at evaluating restoration scenarios focusing on the optimisation of different services in restored fen systems. We will evaluate to what degree there are synergies possible between restoration activities aimed at increasing ecosystem resilience and those that seek to enhance other goals.

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## Protected area connectivity shortfalls and country-level priorities: global and European insights

(Oral)

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Connectivity of protected areas (PAs) is crucial for meeting their conservation goals. We evaluate the progress of all countries towards Aichi Target 11 of the Convention on Biological Diversity, which is to have at least 17% of the land covered by well-connected PA systems by 2020. We globally quantify how well the terrestrial PA systems of countries are designed to promote connectivity, using the Protected Connected (ProtConn) indicator [1]. In this global analysis, we focus in the part of the PA connectivity that is in the power of a country to influence, i.e. not penalizing countries for PA isolation due to the sea and to foreign lands.

We found that globally only 7.5% of the area of the countries is covered by protected connected lands, which is about half of the global PA coverage of 14.7% and below the 17% level of Aichi Target 11. Only about a third of the countries (both globally and in Europe) currently meet the Aichi Target 11 connectivity element. These findings suggest the need for considerable efforts to improve PA connectivity.

We further identify the main priorities for improving or sustaining PA connectivity in each country: general increase of PA coverage, targeted designation of PAs in strategic locations for connectivity, ensuring permeability of the unprotected landscapes between PAs, coordinated management of neighbouring PAs within the country, and/or transnational coordination with PAs in other countries. By doing so, we help to highlight important strengths and weaknesses of the design of PA systems for connectivity in the world's countries and regions.

The detailed results of the ProtConn indicator are made available through the Digital Observatory for Protected Areas (DOPA) of the Joint Research Centre of the European Commission [2], which can be accessed at <http://dopa.jrc.ec.europa.eu/>.

We conclude indicating some directions for potential further development of the ProtConn indicator and related analyses, which consist in (i) assessing the effect of the heterogeneity of unprotected landscapes using naturalness as a proxy for permeability, and (ii) assessing conservation management effectiveness of PAs for connectivity.

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UNIVERSITY OF JYVÄSKYLÄ



## Integration of ecosystem services concept in Central Asia

(Oral)

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Central Asia is a vast region that includes unique and diverse ecosystems. Currently Central Asian countries are facing serious challenges in the area of environmental sustainability, including water security, deforestation, air pollution and loss of biodiversity.

Natural ecosystems in Central Asia provide multiple benefits to local populations and play significant role to local, national, regional and global economies. Many of these ecosystems and services provided by them are underestimated and their value is not assessed in the economic terms, therefore not included in political decision making processes.

In this study we are analyzing current state of ecosystem services (ES) approach in Central Asia and identifying areas for further development and integration of ES concept into national economies. Analysis of current state of ES concept included researching uncertainties, knowledge and data gaps for understanding, monitoring and managing of ecosystem services in Central Asia.

Nowadays ES approach is not widely used in Central Asia. However there is increasing interest for integration of this concept to the decision making process in environmental management shown by researchers, NGOs and international organizations.

Several studies and interviews in Central Asian countries revealed low level of understanding of ES concept in society. NGOs in close cooperation with international organizations such as UNDP and CAREC are working on raising awareness of the value of biodiversity and ES.

ES approach is incorporated into the policy making processes in Kazakhstan as a part of macroeconomic and sectoral programs, thus making this country one of the first to join Green Economy Concept. ES concept is actively discussed in other Central Asian countries, some elements of this approach are included in countries strategic plans, but there is long way to go to implement them into policy and regulations.

One of incentive-based tools incorporating the values of ecosystems in decision making processes is Payment for Ecosystem Services (PES). Several studies concentrated on analyzing potential for using PES schemes for the poverty alleviation of communities and as adaptation strategy to climate change impact in Central Asia.

Case studies researching ES, especially in nature reserves, demonstrate the applicability of integration ES concept into policy-making at a national and regional scale. Tools and methodologies piloted at a local scale have identified potential for ES concept to support Central Asia's transition to a more sustainable development pathway.

Directions for the future development of ecosystem services approach include elaboration of a common typology of Central Asian ecosystem types and ecosystem service classification framework, integration of ES in regulatory framework and raising awareness among political leaders, policy makers and local population.



## Ecological corridors network in the Eastern Carpathians - areas of connectivity conservation

(Oral)

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Europe is characterized by a fragmented natural landscape, interspersed with high human population densities. In Romania, in 2016, highways occupied less than 1,000 km, of which approximately 200 km crossed forested areas. While development of highway infrastructure is vital to country's economic development and prosperity, long-term conservation of the biodiversity can be achieved only by implementing successfully mitigation measures and by harmonizing the sectorial policies for development with conservation strategies. The brown bear require the use of extensive habitats due to their large home ranges. Based on available data (at national level) and the ecological needs of the species, we generated maps of potential habitats and resistance maps to movements for determining the location of potential corridors. We used 6 environmental variables for identifying the potentially suitable areas and 6 variables for quantifying the brown bear preferences/barriers for/to movement. The model identified around 42000 km<sup>2</sup> of suitable habitats for the brown bear in the Romanian Carpathians. Potential ranges were also compared with the existing network of protected areas; however, only 41% of the protected areas were found suitable for bears. We identified approximately 7000 km<sup>2</sup> of suitable ecological corridors outside the suitable habitats, however 61% of the network is located outside the protected areas. Moreover brown bear conservation will depend on managing ecological corridors, based on supportive science outputs, deeper collaboration and strong policy on connectivity together with plans and strategies that champion large landscape conservation via state, regional and local initiatives.

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## Cryptic genetic biodiversity in freshwater fish: power for detection, and genomic characterization

(Oral)

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Sympatric populations represent conspecific populations that coexist in the same geographical area during at least a part of their life cycle. Such populations are of great interest in evolutionary biology, as they may represent the first steps of sympatric speciation processes and genetic adaptations to ecological niches. From the perspective of conservation and management, identifying and monitoring sympatric populations is imperative; they signify diversity below the species level which has been documented to contribute to the portfolio effect in ecosystem stability.

We hypothesize that sympatric populations are more common than what is currently recognized. There are several reasons to why such populations may have gone largely undetected and thus underrepresented in literature; lower statistical power of detecting population structure without grouping prior to genetic analysis, heterozygote deficiencies being overlooked due to technical biases of the genetic markers used, and that sympatric populations in general may have been perceived somewhat an exception to the rule of niche specialization and competitive exclusion.

We address issues concerning statistical power to detect cryptic genetic structure without grouping of individuals prior to analysis. Employing computer simulations, we evaluate statistical power of different tests in realistic population screenings. Further, we review the literature pertaining to sympatric populations focusing on freshwater salmonids for which most examples of sympatric populations appear to exist. We also use a combination of genetic and genomic techniques to verify and further investigate the population structure of cryptic sympatric populations of brown trout (*Salmo trutta*), an ecologically and socio-economically important species for which increased efforts are needed to safeguard genetic biodiversity.

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## The spatial impacts of recent loggings in renowned Białowieża Forest

(Oral)

**Grzegorz Mikusinski<sup>1</sup>✉, Jakub Bubnicki<sup>2</sup>, Marcin Churski<sup>2</sup>, Dorota Czeszczewik<sup>3</sup>,  
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Abstract of this presentation is not public



## Biodiversity, ecosystem services, and cost-effectiveness in large scale spatial planning

(Oral)

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During the past decade or two, spatial prioritization methods and software have been developed that can integrate large amounts of data in ecologically based spatial planning. Applications of these analyses include, for example, design of expansion of conservation area networks, ecological impact avoidance in infrastructure and other development projects, and land use zoning. The basic building block of these analyses is spatial data describing the distributions of many biodiversity features, including species and habitat types. Additional data about threats may be used to focus priorities either to areas that are threatened by anthropogenic pressures, or to areas that presently are safely away from pressures. Data about costs and opportunity costs can be included to promote cost efficient solutions, which also are desirable from a societal perspective. Recently, there has been focus design of green (blue) infrastructure and inclusion of ecosystem services into joint analyses together with biodiversity. It is a characteristic of ecosystem services that their connectivity requirements are more complicated than connectivity requirements of species or habitats. This is because accessibility of ecosystem services and their equitable availability to people generate connectivity requirements that are additional to the ecological connectivity requirements needed for the maintenance of ecosystem service provision.

In this presentation I review the possibilities of large-scale ecologically based spatial prioritization and planning. Presently, our analytical capability will typically exceed the quality of the underlying data, meaning that data availability and quality are the factors that primarily limit the utility of analyses. Even so, data availability is fast improving, and well-informed ecological impact avoidance can be implemented in societal decision making if the political will to do so exists.

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## Genetic, genomic, synthetic - new approaches for biodiversity conservation

(Oral)

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With the rapid development of genomic tools we are now able to assess genetic diversity as one of the three components of biodiversity in much higher accuracy. At the same time these tools allow us also to write and manipulate genetic material to a previously unknown extent. This is reflected in the development of the field of Synthetic Biology, where new biological systems are designed and constructed as well as existing natural systems being redesigned. The rise of this discipline is offering the potential to provide novel approaches to address problems in biodiversity conservation, whereas on the other side intentional genetic manipulation on a large scale is a topic of extensive discussion. Do we want to use such novel approaches when we want to stop the ongoing loss of species and habitats? Or do we position ourselves in a way that assesses these technologies more critically? In any case the field of synthetic biology is developing extremely fast and we have to find a way of positioning ourselves. I will here highlight the recent development and discussions in the field and present a few case studies where Synthetic Biology approaches might actually be a solution to previous intractable conservation problems such as the control of wildlife disease and the eradication of invasive species

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## Europe's Nature Conservation Policy: how did we get there?

(Oral)

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Biodiversity loss is caused by both local and higher-level environmental and governance trends, hence the response mechanisms for the conservation of biodiversity should also be of a multi-level nature. The European Union's biodiversity conservation policy materializes through the Birds and Habitat Directives (dating from 1979 and 1992 respectively), which were designed to create a coherent network of protected areas known as Natura 2000, as well as a system of species protection. These Directives need to be implemented at member state-level. Both Directives were submitted to a so-called 'fitness check' in 2016, which they passed, meaning that their effectiveness and usefulness was confirmed. We performed an analysis of the emergence of the EU conservation policy, to identify the policy arrangements that allowed the development of this contentious legislation in a time when biodiversity conservation issues were not as prevalent as today. Data were gathered among key actors who shaped the Birds and Habitat Directives, and hence laid the basis for Europe's current nature conservation policy. We used the policy arrangement approach (PAA) to adequately reconstruct past decision-making processes and interpret the (change in) policy arrangements. The legislative process was mostly confined to an 'epistemic community' of scientists, activists and policy-makers without direct participation of other socio-economical actors. This top-down, technocratic policy process was common at the time and contrasts with current policy arrangements. The rules of the game changed over time and a few individual policy entrepreneurs, appeared to be crucial for the realization of both Directives, as well for its eventual features. The EU nature conservation policy could be inspiring for other regions and/or supranational contexts, while current and future challenges to biodiversity conservation will demand continuation and stepping up the efforts of the EU and its Member States.

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## Sex-biased survival of nestlings under unfavourable conditions drives secondary sex ratio in little owls (*Athene noctua*)

(Oral)

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Identifying variation in key life history traits is crucial to predict population dynamics of endangered species. An increased bias in sex ratio as a result of low habitat quality can reinforce population decline and drive small populations to extinction. This is particularly true for monogamous bird species such as the little owl (*Athene noctua*). However, the underlying mechanisms driving biased sex ratios often remain elusive. Using a robust sample of molecular sex determination data recorded at two nest visits within each of 247 broods we examined the development in brood sex ratio, sexual size dimorphism and factors affecting the survival of little owl nestlings. Brood sex ratio in little owl broods was female-biased at fledging but not before the middle of the nestling period and it was female-biased at the end but not at the beginning of the breeding season. Female nestlings showed higher body mass than male nestlings of the same hatching rank. A survival analysis corroborated that late-hatched nestlings of low body mass showed reduced survival under adverse habitat conditions, resulting in a male-biased nestling mortality. Our conclusions therefore support theoretical predictions according to which the more sensitive sex will be disproportionately affected by unfavourable conditions that were previously identified by feeding experiments in the study system. This pattern of condition-dependent secondary brood sex ratio can severely affect the demographic parameters of endangered species and provides important implications for conservation.

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2018/06/15

15:00

Room: K305 Alvar



## Riparian vascular plant communities are not threatened by selective logging on the buffer strip – Buffer width matters

(Oral)

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Abstract of this presentation is not public



## Species co-occurrence patterns among cavity nesting birds across seasons and in a landscapes with varying habitat complexity

(Oral)

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Species co-occurrence patterns inform the selection of surrogate species in conservation planning because co-occurrence is often a non-random process. Probabilistic models can determine whether a species co-occurrence is significant (i.e., non-random) where significant positive co-occurrence indicates potential mutualisms and negative co-occurrence indicates competition (1). One challenge is that co-occurrence is dynamic over time (2), especially in successional habitats or seasonally with migratory species.

In complex landscapes, habitat quality may be related to the composition and complexity of available cover types (3) because species may benefit from exploiting resources in multiple cover types. This is known as landscape complementation, when non-substitutable resources, such as food and nest sites, are acquired in different cover types to meet requirements across the annual cycle. Species that rely on landscape complementation may be ideal surrogate species because their varied habitat requirements may lead to co-occurrences with a diverse set of species. This project focuses on Red-headed Woodpeckers (*Melanerpes erythrocephalus*, hereafter RHW), a species of conservation concern, at an active military base in Virginia, USA where prescribed fire and timber harvests are common. RHW has experienced a 68% range-wide population loss over the last 45 years and is designated as near threatened by the IUCN. Our objectives were to (1) determine if RHW prefer areas with multiple rather than one homogenous cover type and (2) if they are effective surrogates for cavity nesting species. We compared RHW abundance in sites with varying amounts of closed canopy forest, savanna and wetland. We also assessed species co-occurrence in the nonbreeding and breeding seasons as well as in homogenous (closed canopy forest) and heterogeneous (mix of closed canopy, savanna and wetland) habitats.

Our results indicate that sites with a mix of cover types have higher RHW abundance in both summer and winter. We also found more significant positive species associations among cavity nesting birds in the winter than in the breeding season, and in heterogeneous habitats. Specifically, 25% of species co-occurrences in winter were non-random compared with only 7% in the breeding season. None of the co-occurrence patterns were significant in closed canopy forests whereas 5-9% were significant in sites that had a mix of closed canopy forest and wetland or closed canopy and savanna habitat. White-breasted nuthatch (*Sitta carolinensis*), a weak excavator, was positively associated with more species than any other, and RHW had the second most significant positive species co-occurrences. Our preliminary results indicate that managing for a mosaic of suitable habitats is important for sustaining declining RHW populations across the annual cycle, and that this species may be a viable surrogate for other cavity nesting species.



## Burning harvested sites enhances polypore diversity

(Oral)

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Prescribed burning after clear-cut has been used as a silvicultural method, but it has also been found to support biodiversity. We asked what is the impact of fire on polypores that grow on stumps and slash left on clear-cut sites.

Eighteen one-hectare study stands were cut with different levels of retention trees and nine of the sites were burned the following summer. The study sites are located in eastern Finland in forests that are dominated by *Pinus sylvestris*. We sampled stumps and slash for polypores ten years after cuttings and burnings.

We sampled 14 235 stumps and 13 345 pieces of slash and counted 7 179 polypore records of 74 species on these. More polypores were found from burned stumps compared to the unburned stumps, but burning had no effect on polypores on slash. We found also some red-listed polypore species both from stumps and slash - more from those sites where the resource had been burned. All red-listed species that were found on unburned sites were found also on burned sites, except for one species.

Our results show that stumps and slash can be valuable substrates for wood-decaying fungi, including rare and red-listed species, on clear-cut forest stands. We recommend avoiding full-scale stump and slash harvest. e.g. for the purposes of bioenergy production, on clear-cut areas. Instead, we encourage to retain stumps and to apply prescribed burnings on harvested sites, to enhance polypore diversity in managed forests.



## Different management and restoration options for boreal forest – role of fire in the palette

(Oral)

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Fire is ecologically a very effective method to maintain and restore disturbance-based properties of boreal forests. In particular, whenever fire suppression has reduced fires during longer, i.e. decadal or centennial periods, introducing fire back to ecosystems produces immediate benefits for several taxa. In addition to the benefits that fire has on fire-associated biota, fire also diversifies forest structure and initiates succession that produce long-term forest structures that later on benefit several forest-dwelling taxa.

However, applying fire as a management or restoration tool is challenging due to several factors that complicate the outcome of a forest fire. Fire or prescribed or controlled burning is typically a very heterogeneous disturbance event that is modified by several factors. These factors are mostly associated with the fire severity. The resulting forest structures and the effects that burning has on biota appear to critically depend on this variability and heterogeneity. Furthermore, based on the historical patterns of fire in a landscape, the effects of fire on biota vary, probably depending on the available species pool that can colonize burned areas. And finally, while the effects of fire are evidently positive on many species, there are also conflicting outcomes, as some taxa may be very sensitive to fire and may thus disappear after prescribed burnings. The last issue is reflected also in conflicts that prescribed burning may cause to the provision of different ecosystem services. Based on current understanding, these conflicts are obvious at stand level but they are likely avoided by land-sparing approaches over larger blocks of forest landscapes.

In addition to the potential that fire has on restoring crucial forest properties in protected areas, the use of prescribed burnings has a significant underexploited potential in managed forests. In managed areas, fire is applied together with timber-harvesting operations. Fire and the substrates that a fire creates appear to be a significant tool to maintain species diversity after intensive harvesting. However, as in the restorative burnings in protected areas, several factors seem to modify the effects that fires have, and it is likely that burning harvested sites is mainly a complementary method to promote biodiversity. Nevertheless, long tradition of silvicultural prescribed burnings - to enhance soils and tree regeneration - provides also biodiversity benefits that have remained largely unknown so far.

In conclusion, almost complete disappearance of fires from several regions in boreal forests has been a major ecological change. Together with simultaneously introduced clear-cut harvesting practices, the disturbance regimes over large areas have drastically changed, leading to impoverishment of forest habitats and species. A novel combination of fires and forest harvests holds a major promise to sustain forest biodiversity in future landscapes.

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## The three-toed woodpecker: an important biodiversity indicator and model species for the conservation of biodiversity in boreal forests.

(Oral)

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The use of biodiversity indicators have been proposed as a comprehensive method for assessing conservation values at the stand scale. In the boreal biome, the three-toed woodpecker have been proposed as an indicator for high species richness of co-occurring forest birds. However, to be able to fully understand the potential of biodiversity indicators it is necessary to understand when indicators are valid indicators, as natural dynamics within boreal forest systems can effect bird communities and thus indicator values of species. To assess the impact of natural disturbances we collected data within a large-scale field experiment where we assessed the short term (4-5 years) impact of two restoration treatments mimicking natural disturbances – prescribed burning (n=10) and gap cutting (n=10), using continuous cover stands (n=20) as references – on boreal breeding bird assemblages. We performed detailed bird inventories, through territory mapping and additionally we collected data of local stand characteristics. In this study, we confirmed that the three-toed woodpecker belong to the best indicators of high species richness and abundance within resident forest birds occurring in middle and northern boreal forests. However, the three-toed woodpecker lost its indicator value after prescribed burning; in these stands the goldcrest was the best biodiversity indicator. Based on habitat associations we found that the three-toed woodpeckers is closely associated with structural complexity within forest stands, similar to co-occurring species. Thus structural complexity at such may influence species richness. Still the three-toed woodpecker can be used for conservation planning if their habitats/resource requirements are set as quantitative targets. To accommodate managers with management recommendation regarding these quantitative targets, we quantified refined habitat thresholds and related this with their foraging substrate selection. We found resource requirement thresholds by a 0.9 probability of occurrence of 1.5 m<sup>2</sup>/ha freshly dead spruce and 0.07 m<sup>2</sup>/ha dying spruce. By focal bird observations we were able to confirm that indeed modeled resources matched with important foraging substrates for three-toed woodpecker in mature forest areas. This suggest that proposed resource thresholds can be used to plan forest management concerning three-toed woodpeckers population. However, we need to consider additional habitat structures when we planning forest management aiming to conserve biodiversity.



## Using pollen DNA metabarcoding to investigate the foraging preferences of honey bees

(Oral)

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Honey bees contribute to human wellbeing; through the use of honey, wax and propolis, and as the pollinator of both wild and crop plants. The increased rate of honey bee colony loss has caused worldwide concern, caused by the interacting effects of habitat loss and fragmentation, agrochemicals, pests and diseases, and climate change. DNA metabarcoding provides a tool for identifying the pollen in honey and therefore the plants the honey bees are foraging upon. The DNA is amplified using the *rbcL* marker using a two-step protocol and sequenced on the Illumina MiSeq platform. Sequences are compared to our Barcode UK reference library using BLAST. Using the National Botanic Garden of Wales as our study site, we recorded the plants in flower and at the same time sampled honey from hives in the Botanic Garden's apiaries; one sited within the horticultural area and one sited within native habitat adjacent to a National Nature Reserve. Initial results for early season foraging in April and May showed that 437 genera of plants in flower were recorded in the study site but only 11% of these were used by the honey bees. Here we present the results of the honey DNA metabarcoding throughout the foraging season from May to September and compare it with the plant survey data to build a temporal and spatial picture of foraging for honey bees with access to a high UK floristic diversity. Having a detailed understanding of the habitat and foraging requirements of honey bees is required to fully understand declines and supply guidelines for suitable plants for healthy honey bee colonies.

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## A simulation experiment of vegetation and soils postpyrogenic restoration in Russia

(Oral)

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Russian forests have abundant natural resources and perform global ecological functions, as a carbon dioxide sink. As a result of climate warming (as one of the possible scenarios) forest fire hazard increases [1].

Pyrogenic factor is increasingly the cause of damage to a large area of natural landscapes, including both terrestrial and aquatic ecosystems. Being of the relatively rare natural phenomena in the past, the fires are moving into the category of catastrophic and unpredictable events, which in the recent years connected with modern climatic changes and with the problems of environmental management of forestry. The main substantial matter of pyrogenic effects on the border of atmosphere-lithosphere is soil organic matter, which changes under the fire effect radically and participates in regulation of ecosystem exogenic stability. Therefore, it is necessary to estimate a balance and dynamics of carbon stocks in forest ecosystems as a result of wildfires. This problem can be solved by means of a system of carbon and nitrogen biological cycle models in forest ecosystems, which has already been used for a comparative analysis of wildfires impact on forest areas in Russia and Canada.

Objects of the research are postpyrogenic soils characterized by formation of specific charcoal horizon with increased portion of postfire organic matter near Togliatty city (Samara region, Russia) affected by spontaneous forest fires in 2010 [2].

Carrying out the computational experiments with the ecosystem model EFIMOD can be useful in terms of probabilistic short-term forecasts creation of 5-10-15 years and in-situ observations tests. Simulation of the cumulative effects of repeated fire cycles over 140-years showed that one fire did not affect growing stock but decreased SOM by about 10%, and that three fires reduced the growing stock by 9% and decreased SOM by about 30%. Forest fires led to the significant loss of soil carbon (C), as well as nitrogen (N) which is a principal limiting factor in forest ecosystems of boreal and temperate ecozones. The effect of repeated fire cycles on land degradation is similar to that of soil erosion, through the loss of soil C and N. From a silvicultural perspective, the effect of fires is generally considered positive (e.g., promotion of seedlings establishment, removing of fuel from soil surface), however, this study concluded that repeated fire cycles can have a negative effect on forest ecosystems by reducing long-term soil productivity.

Modeling the dynamics of forest ecosystems succession and reforestation processes is an important part of studying wildfires impact on soil cover, because it represents an essential element of forestry activities designing focused on maintaining of the forest ecosystems stability.

This study was a contribution to the RussianScience Foundation, project No 17-16-01030

**Key words:** soils, wildfires, postfire soil development, ash, , EFIMOD

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## Monitoring Cumulative Effects of Human Activity on Alberta's (Canada) Biodiversity

(Oral)

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Due to its significant natural resource wealth, the province of Alberta in western Canada has experienced rapid expansion of related industrial activities (forestry, agriculture, and oil and gas exploration and development), as well as associated population growth, over recent decades. The resulting rate of conversion of natural ecosystems to support these activities led to increasing concerns regarding their cumulative effects on Alberta's biodiversity. As a result, in 2007, the Alberta Biodiversity Monitoring Institute (ABMI) was formally established to monitor the status and trends of Alberta's species, their habitats, as well as human footprint (HF).

The ABMI is a not-for-profit scientific organization that operates at arm's length from government and industry. The goal of the ABMI is to provide relevant scientific information on the state of Alberta's biodiversity to support natural resource and land-use decision making in the province. To meet this goal, the ABMI employs a systematic grid of 1,656 site locations across the province, spaced 20 km apart, to collect biodiversity information on terrestrial and wetland sites. At each location, data and field samples are collected for a wide range of plant and animal species through on-the-ground measurements, and also using motion-sensitive camera traps and acoustic technology. Since 2007, over 480,000 specimens-data on over 3000 species have been collected and processed, many of which represent new scientific records for the province, sometimes new records for Canada, and even records new to science. Annually, a percentage of the total sites is surveyed, with the sites revisited approximately every 7 years to measure trend in species abundance.

In addition to field surveys, Alberta's land cover and human footprint is monitored using remote sensing technology at two spatial scales. To report on patterns and trend in human footprint, the ABMI classifies human footprint into 115 feature types, which are then rolled up into the categories of energy, forestry, agriculture, residential and industrial, human-created water bodies, and transportation. The ABMI's accumulated biodiversity and HF database supports the creation of predictive species models that provide information on spatial distribution, habitat associations, responses to HF, and predicted relative abundance for over 800 species, including mammals, birds, soil mites, vascular plants, mosses (bryophytes), and lichens.

The scale and depth of the ABMI's monitoring program and biodiversity data make it a unique program nationally, and a leader internationally. In addition to ongoing protocol development and data analysis, the ABMI is committed to deriving value from its data and information for a wide range of Alberta stakeholders through concerted knowledge translation and stakeholder engagement efforts.



## Assessing mitigation options for an emerging fungal pathogen threatening European and Palearctic salamander diversity

(Oral)

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Emerging wildlife diseases represent both a major driver of global biodiversity loss and one of the greatest challenges to conservation science. In spite of the recognized extent and magnitude of disease-driven declines worldwide, and of the considerable research targeting them, successful mitigation remains elusive.

The amphibian chytrid fungus *Batrachochytrium salamandrivorans* (Bsal) causes lethal chytridiomycosis in several palearctic salamander species. This pathogen, believed to have recently entered Europe from its native range in Asia, has already driven the rapid collapse of populations of fire salamanders (*Salamandra salamandra*) in the Low Countries and threatens to cause massive biodiversity loss in Europe and North America.

Development of mitigation actions is urgently advocated; here, we formally assess the potential for mitigation success using epidemiological models.

First, we use an integral projection model to explore the impact of Bsal in a population of a highly vulnerable host species (fire salamander *S. salamandra*), and to evaluate potential mitigation actions. Available evidence suggests that a Bsal outbreak in a fire salamander population will lead to its rapid extirpation. Treatments (antifungals or probiotics) would need to effectively interrupt transmission (reduce probability of infection by nearly 90%) to reduce the risk of host extirpation and successfully eradicate Bsal. Improving survival of infected hosts is likely to be detrimental as it increases the potential for pathogen transmission and spread. Only the active removal of most of the host population has some potential to locally eradicate Bsal and interrupt its spread.

However, even this extreme possibility is challenged by the presence of additional host species. Using a multiple-host compartmental model, we show that co-occurring alpine newts act as a Bsal reservoir towards salamanders; their ability to clear infection results in a greater pool of infected individuals (particularly given the lack of acquired immunity), accelerating and sustaining the outbreak in salamanders. Substantial removal (>95%) of both species would be needed to avoid an outbreak at the community level; to maximize salamander persistence, with strong between-host transmission newts would need to be entirely removed from the system, making even this extreme action unlikely to even prove feasible.

In summary, mitigation of Bsal outbreaks in susceptible host species is highly challenging, requiring effective interruption of transmission and radical removal of host individuals. The ability of Bsal to infect multiple hosts further reduces management options. More generally, to explore and assess management options we recommend a focus shift from single species to the community level. To develop practical management actions, epidemiological models can be most effective if embedded directly in the management decision context, rather than adapted to it a posteriori.



## Forecast the response of forest birds to climate change and forest management: does citizen science data provide accurate predictions?

(Oral)

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In the context of global changes and biodiversity mass extinction, species distribution models (SDMs) are of major importance for conservation and management. In particular, such models can be used for mapping spatial distribution of endangered species and forecasting their response to climate and land-use change. In Sweden, intensive forestry has caused a strong decline of forest biodiversity. Climate change is also expected to cause range contractions for northern-boreal species which are at the limit of their range boundaries. As SDMs require a large amount of data, ideally collected over large spatial and temporal scales, citizen science based on volunteer reporting of species can constitute a promising alternative. However, citizen science data (CSD) also have several drawbacks (e.g. presence only, uneven sampling effort). Furthermore, CSD still lack validation by comparison to systematically collected data. The aim of our study is to assess the reliability of CSD for forecasting species occurrence in response to various management and climate scenarios. We compare the predictions obtained by two different and independent citizen science datasets, opportunistic reports (OR) from Artportalen, and systematically collected data (SC) from Svensk Fågeltaxering. Both datasets cover the same large spatial area (whole of Sweden) and time period (2000-2013). As the latter have a well-defined sampling design and protocol and engage experienced observers, we used this dataset as reference to assess the accuracy of models based on OR. Absence data have been inferred from OR based on questionnaires sent to observers evaluating their skills and reporting habits. We then built species distribution models (logistic regression) according to climate and environmental predictors (allowing non-linear effects and interactions). We further used these models to forecast the responses of multiple species to various climate scenarios (based on IPCC projections) and forest management scenarios (simulations in Heureka Forestry Decision Support System). The assessment focused on eight forest bird species that encompass a diversity of functional traits and ecological preferences. This allowed us to test how the models performances vary between species. We also expected different species responses to climate and management scenario with potential trade-offs to conciliate the different species requirements. More generally, our study provide further evidences for the relevance of using CSD to forecast species distribution. In particular, our results highlight that OR and SC have different strengths and limitations. Opportunistic reports seems provide more accurate predictions for rare or cryptic species, whereas SC perform better in sparsely populated areas.





## Population responses to climate variability: the importance of temporal scale

(Oral)

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New title: Population responses to observed climate variability across multiple taxa

Global climate change is likely to lead to concomitant changes in climate means, variability, and extremes, resulting in more variable and unpredictable environments to animal and plant populations. Increased variation in climatic conditions, such as in temperature and precipitation, could influence population dynamics by changing the mean and variation of vital rates and ultimately the population growth rate. However, empirical evidence for the effect of climate variability on wild populations is so far mixed.

In this study, we explored population responses to climate variability based on long-term empirical data ( $\geq 20$  consecutive years of annual abundance estimates) of 56 wild populations across multiple taxa (mammals, amphibians, reptiles, plants and insects) from the Northern Hemisphere. We sought to understand the influences of climate variabilities (temperature and precipitation in active and inactive seasons) on the temporal variation of annual population growth rates and the geometric mean of annual population growth rates (i.e. long-term population persistence) in order to identify organisms that are particularly sensitive to fluctuating climatic conditions. Population and climate variabilities were quantified from the coefficients of variation (CV) at two temporal scales (using a four-year moving time-window and across  $\geq 20$  years) to assess the effect of temporal scale on conclusions.

At the short-time scale (4 years; when high local variations are more pronounced), we observed a slight positive relationship between CV of population growth rate and CV of climatic conditions (precipitation and temperature) in the active season, suggesting that populations fluctuated more under variable than under stable climatic conditions. In contrast, at the long-time scale ( $\geq 20$  years), population variability was not associated with climate variability in the active season, and a negative relationship between CV of growth rate and CV of precipitation was observed in the inactive season. At both temporal scales, we found a negative relationship between life span and CV of population growth rate, indicating that the populations of short-lived species generally fluctuate more than those of long-lived species, but are similarly affected by climate variability. No statistically significant relationship was found between climate variability and the geometric mean of annual population growth rates.

Our results suggest that temporal fluctuations in population size across taxa are partially associated with climate variability, but that these fluctuations do not seem to translate into overall shifts in the long-term persistence of populations. This finding thus indicates that other factors than observed climate variability are probably more important to the dynamics of wild populations.



## Changes in species interactions within the cavity-using community in managed forest landscapes of the boreal mixedwood forest in eastern Canada

(Oral)

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Over the last 50 years the intensive use of even-aged management practices in the boreal forest of Canada has generated extensive landscapes of aggregated clear-cuts, which have considerably skewed the age structure of the forest towards regenerating and young stands. In contrast, mature and old forests in these landscapes become fragmented and rarefied. Moreover, since these habitats often have a linear shape (riparian buffers and cutblock separators), they become vulnerable to secondary disturbances such as wind throw, which can jeopardize the persistence and recruitment of standing decaying and dead trees. There is thus concern for organisms that rely on these forest attributes for nesting and foraging, particularly members of the vertebrate cavity-using community. In the boreal forest, woodpeckers are the primary cavity formation agents for the entire cavity-using community. Knowledge of their distribution in linear habitats of managed landscapes is thus critical for understanding the nest web structure of cavity users in such environments. We present a 10-year investigation on woodpecker habitat occupancy, reproductive success and productivity in linear habitats (ranging from 12 to 45 sites) of managed landscapes and permanent study plots in an unmanaged continuous forest tract (3000 ha) in the boreal mixedwood forest of Québec, in Canada. In each linear habitat, we conducted systematic ground surveys and direct inspections of tree holes with a 15-m telescopic pole on which we mounted a camera that could fit into holes with a diameter of >2 cm. We found that linear habitats in managed landscapes harboured all five species of woodpeckers that are nesting in the unmanaged boreal mixedwood forest. Apart from the Pileated Woodpecker (*Dryocopus pileatus*), for which sample size was too small to conduct statistical comparisons, the reproductive success and mean number of fledglings of most woodpecker species was not significantly different in linear habitats than that of breeding pairs in the unmanaged forest. We also found that species richness of non-cavity excavators, particularly those that occupy large cavities, was less in linear habitats of managed forest landscapes than in the unmanaged continuous forest tracts. We evaluate how habitat loss and fragmentation in managed landscapes affects the nest web structure of the cavity-using community particularly with regard to woodpecker species persistence in linear habitats. We discuss how this knowledge can assist stakeholders and policy makers in the development of sustainable conservation strategies for the cavity-using community.



## Global and national biodiversity initiatives, socio-economic potential, and scalability of reintroduction of fungi into dead wood

(Oral)

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Data sharing, data archival and data citation are new, but increasingly important elements of the scholarly activities. Global Biodiversity Information Facility (GBIF) aggregates data, shared by a global network of publishing organisations: natural history museums, citizen science organisations, and, importantly, national biodiversity data systems, such as FinBIF. Data on the rare species are often stored in the restricted access databases for red-listing. Availability of background distribution data is essential for biodiversity monitoring and assigning species with threat categories.

What happens after species go regionally extinct? Approaches to reverse regional extinctions include habitat restoration and species translocation. In a study carried out in S Finland, we prove that species translocation is a working approach for wood-inhabiting fungi – a group rarely, if at all, used in restoration, but functionally important for forest ecosystems. Saproxylic fungi decline as a consequence of forest fragmentation and loss, and of habitation degradation. In our study, all selected red-listed species of fungi established in the inoculated logs as mycelia, and three species produced fruiting bodies. Early decay logs supported greater success rate among the inoculated strains. Following the experiment, we observed fungivorous insects grazing on and colonizing the fruiting bodies of the reintroduced species, thus proving the inclusion of the translocates into the forest food webs.

We are lacking the most important structural element for biodiversity in boreal forest, the dead wood. In Nordic countries and many other regions, decaying wood is a biodiversity treasure habitat, both in numbers of inhabiting species, and in complexity of the interaction webs. Dead wood is a microhabitat with slow successions, and unassisted colonization of newly created dead wood may be too slow to counterbalance the deterioration at the landscape level. As the source populations of fungi remain intact and inoculums can be produced at low cost, we argue that habitat restoration can translate into biodiversity restoration faster and with higher cost-efficiency, if combined with species translocation. In dead wood successions priority effect of old-growth pioneer decomposers support guilds of old-growth forest successors. Early decayers from the nearby populations in the species-rich old-growth forests would be the best choice of source strains. Reintroduction of the basal species in the food webs has a potential of positive effect for the associated species.

Our method enables faster recovery of forest biodiversity, which translates into socio-economic benefits. Availability of biodiversity data systems are needed to support strategical planning of habitat restoration and species translocation to increase cost-effectiveness. An integrated approach would combine source strains from nearby populations, data on habitat quality and connectivity, and our inoculation technique.



## Forestland connectivity in Romania – implications for management and conservation

(Oral)

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Forest management rules imposed on all forests in Romania provide habitat conditions for many species across forest landscapes, empirically proven by the high biodiversity of the Carpathians and their surroundings. However, they do not address explicitly the spatial arrangement of forest patches across landscapes and therefore, assessment of connectivity (inside tracts of continuous forest - i.e. intrapatch connectivity - and also among spatially separate patches – i.e. interpatch connectivity) is important. To analyze this, the CORINE Land Cover data set (2012) available for Romania was used. Forest patches were classified into three size categories ensuring survival of tree populations on short term, medium and long term: Interconnectivity Nodes (1,5 to 14,9 ha, minimum 30 m width), Habitat Islands (15,0 ha and 499,0 ha, minimum 100m width) and respectively Habitat Continuum (over 500 ha with a minimum 200m width). Connectivity of each patch to others around was assessed for a maximum threshold distance of 1 km. Further connectivity was classified in terms of its strength (i.e. depending on the size category to which a patch is connected) and quality (i.e. size and structure of resulting connected cluster). Next, distribution of the main forest tree species on the various size, connectivity strength and quality patches of forest vegetation was assessed. Results show a good connectivity of forest patches both in terms of intrapatch connectivity (85% of area is included in HC class) and interpatch connectivity (92,4 % are in 12 clusters over 10.000 ha; among these the one around Carpathians sums up 86,7 % out of the total forest area). Main tree species show a generally good connectivity, better in the mountainous areas than at lower elevations (area in Habitat Continuum patches: 97,5% for Norway spruce vs. 63,3% for pedunculate oak to; strong connection - 97,8% for Norway spruce vs. 67,2 % for pedunculate oak; high quality connectivity - 98,2% for Norway spruce vs. 68,6% for pedunculate oak). These results confirm that management guidelines inherited from the past are providing good conditions for connectivity of forest in general and for main forest tree species. Enforcement of these rules in the future should ensure conservation of species across the forested landscapes at national level and also provide routes for migration in the context of climate change. However, as a large proportion of forestland is today non-state, financial incentives for private owners are a key condition to further accept these restrictions and ensure this major goal.



## Ecosystem services of soils of the Lena River Delta

(Oral)

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The Lena Delta is the largest Arctic delta with an area of about 29,630 km<sup>2</sup>. The large rivers deltas are a special type of ecological systems in which the formation of soil occurs under conditions that differ from the uplands. Soil formation in deltas is closely related to the interaction of stream flow and drift flowing.

The Lena Delta is located in the tundra zone, cryogenic processes such as permafrost activities, cracking and solifluction occur in the soil. Thermokarst forms a spotty fine-polygonal and hillocky microrelief on watersheds and its slopes; large-polygonal and flat large hillocky microrelief - on extensive marshy plains. Soil diversity in the delta is represented by several groups: Podzols, Cryosols, Fluvisols, Umbrisol, Histosols, Gleysols. Vegetation is mainly represented by moss-lichen tundra, as well as motley-grass phytocenoses on the territories of flooding.

One of the most important ecological functions of soils in this region is the regulation of the organic matter fluxes in the biosphere. The delta is a great reservoir of organic matter, presented in the form of peat. The content of organic carbon reaches 25% in the topsoils organic horizons. In conditions of global warming and coastal abrasion all the organic matter that was once part of permafrost is exposed and becomes accessible to various microorganisms that exude methane and carbon dioxide. Data were obtained on the microbiological activity of soils, the mean value of CO<sub>2</sub> emission is about 80 mgCO<sub>2</sub> / 100g \* day<sup>-1</sup>. In our view, the CO<sub>2</sub> emission is closely related to the microrelief and soil structure, since the highest emission value is found in flooded meadows and thermokarst lakes. Carbon stocks in the soil of the delta are estimated at 496 \* 10<sup>13</sup> kg at a depth of 1 meter. According to the molecular content of humic substances in the soil accumulates a large amount of stable aromatic compounds. Within arctic biomes such accumulation is not typical, this may indicate that soil formation occurs according to the podzolic type. A fulvate-humate type of humus mostly characterizes the soils of the Lena Delta. These data indicate that the degree of humification of organic matter rises and the biogenic substances do not drift down the profile but accumulate in the organic horizons, which is a prerequisite for a high level of fertility. The increase in temperature due to global warming will primarily affect the biodiversity of the region. In the delta today, a large number of shrubs (dwarf birch, willow), as well as trees (larch) develops. With the rise of temperature, these species will increasingly holder the territory of the delta and possibly displace the zonal ones.

Thus, the soils of the Lena Delta are an important link among all of the ecosystem services in the region. In the conditions of a severe Arctic climate, they serve as a favorable place for soil microbiota, which indicates active processes of humification and transformation of organic matter in the soil.



## How to detect elusive species? Detection dogs in nature conservation

(Oral)

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Nature conservation often faces the problem that many species are difficult to monitor. This is especially true for species that elusive, nocturnal, or hard to capture. In addition, some of those threatened species are conflict-laden at the same time [1]. Without proper monitoring data, it is challenging or even impossible to make evidence-based statements regarding these species' distributions, population status and trends which is inevitable for their conservation and management. Importantly, this does not only include small-bodied pest species but also medium-sized or large vertebrate species. For example, the Eurasian wolf (*Canis lupus*), the Eurasian lynx (*Lynx lynx*), or the Eurasian otter (*Lutra lutra*) are locally listed as (critically) endangered, listed in the annex IV of the European Habitats Directive, and can locally cause severe conflicts with humans. Improving monitoring methods is thus highly important.

Monitoring of a species can be done through visual or acoustic observations or through evidences that the species was present in the recent past, such as tracks, scats, or hair. Evidence-based monitoring has the advantage that it is non-invasive and thus harmless. It can be done by humans but also with support of special detection dogs, such as scat, den, or roost detection dogs. While in former times dogs have been used for hunting, since the last century, they are increasingly used to detect rare or elusive species and their evidences. The use of wildlife detection dogs is particularly well established in America, New Zealand, Australia, and Africa, but also European monitoring projects increasingly deploy detection dogs. We tested the advantages of scat detection dogs in the Eurasian otter and found that detection dogs were more likely to find the scat of the correct species than humans visually searching for scat. Moreover, detection dog teams were twice as fast and collected three times more scats. In a review of almost 600 publications, we then looked for general advantages and disadvantages of wildlife detections dogs. We found that in most studies detection dogs increased efficiency making it a cost-effective method. Some authors claimed that the species would not have been found without detection dogs. Also, their well-developed olfactory sense allowed dogs to differentiate much clearer between signs of related species reducing false detections. Occasionally, a combination with other methods, such as cameras, hair sticks, or live-trapping, was suggested. Only in <1% of all studies, detection dogs performed worse than other monitoring methods, mainly due to inappropriate training or too dense vegetation where dogs could either not enter or not search freely. We conclude that given proper training, wildlife detection dogs can significantly increase both data quantity and quality in species monitoring.

[1] Klenke et al. 2013. Human-Wildlife Conflicts in Europe. Springer.





One detection dogs alerting at otter scat.

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## Preliminary conservation assessment of Cuban giant centipedes (Chilopoda: Scolopendromorpha)

(Oral)

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**Abstract:** In nature conservation, there is a general recognition of the need for increased knowledge about the Earth's species and for national capability to survey and inventory biological diversity, since conservation planning largely depends on spatial information about the distribution of biodiversity [1]. Centipedes (class Chilopoda) are terrestrial arthropods with a predatory lifestyle and generally nocturnal habits. They are potentially important organisms for ecological and conservation studies because they could serve as indicators of environmental change and of the diversity of ground-dwelling, flightless invertebrates [2]. The class Chilopoda comprises approximately 3,110 species, 700 of which belong to the so called giant centipedes (order Scolopendromorpha) [3]. Seven genera and 25 species of scolopendromorphs are reported to occur in Cuba. However, they were in urgent need of revision to make it possible to map their recorded distributions and carry out a preliminary national conservation assessment. Thus, 180 years of available literature and related museum specimens were reviewed, the corresponding taxonomy was updated, and a new species list, a new key and 19 species diagnoses were collated to provide a reference for future studies. A species new to Cuba and a species new to science were found in museum collections. Three localities had primary georeferences and 105 published localities were secondarily georeferenced. All localities and species were mapped and their occurrence inside the National System of Protected Areas (NSPA) was analyzed. Only 22 out of 211 protected areas were found to harbor recorded giant centipedes. Only 9 of 17 autochthonous species (53%) and 3 of 7 endemics (43%) had recorded occurrences in the NSPA, though 2 of those 7 (29%) had at least 70% of their occurrences within protected areas. It was concluded that the Cuban NSPA does not adequately cover autochthonous and endemic species of Scolopendromorpha, and that the group is considerably undersampled.

**Keywords:** Scolopendromorpha, Cuba, taxonomy, distribution, protected areas, gap analysis.

**References:**

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## Woodpeckers as early indicators of forest naturalness

(Oral)

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The primary aim of conservation-oriented management is the maintenance and enhancement of forest structural and compositional heterogeneity, and the creation of nesting, breeding, sheltering microhabitats for forest-dwelling species. A 32 ha oak-dominated, 80-year-old, structurally and compositionally homogeneous forest stand was selected for the first complex conservation-oriented forest management in Hungary. By mimicking natural disturbances, active management actions were implemented in 20 ha area of the study site in the winter of 2015-2016. The management actions included the girdling of standing living trees, bark stripping of tree individuals, felling to create gaps in the canopy, downed woods, and high stumps. Altogether 15% of the living wood biomass was converted to deadwood in the 20 ha area. We found feeding signs of woodpeckers and nuthatches on the majority of the treated tree individuals very soon after the treatments, and observed the foraging activity of the following species: black woodpecker, great, middle and lesser spotted woodpeckers, grey-headed woodpecker, and nuthatch. Visual feeding sign survey was carried out in wintertime, one and two years following the active management actions on 150 treated tree individuals on the tree- (trunk, branch) and bark and sapwood parts (outer bark, inner bark, and sapwood) and described as a percentage. The surveyed trees represented three species and five deadwood types: wounded-, girdled-, downed tree, low and high stump. The statistical analysis unfolded the relation of the four background variables - tree species, deadwood type, tree part, bark and sapwood part -, and the two temporal replicates of the feeding activity. Our results showed that 1) woodpecker activity was primarily determined by the deadwood type and the bark and sapwood part variables, and was independent of tree species and tree part, 2) feeding activity was the highest on the outer bark, but feeding on the inner bark increased between the two surveys, 3) one year after the treatment significantly higher activity was recorded on the high and low stumps than on any other deadwood type, 4) the second survey detected very high activity on girdled trees and increased feeding on downed woods. These preliminary results show the rapid and changing nature of foraging activity of the investigated bird species after conservation-oriented management. The very quick response of woodpeckers and nuthatches suggests the potential use of these species as early indicators for increasing naturalness in temperate forests. In the framework of a running LIFE project, we intend to extend the survey to at least 20 oak-dominated pilot sites under active conservation-

oriented management and monitor the foraging activity of woodpeckers over a long time period.





## Quantifying and assessing the need and potential for assisted migration

(Oral)

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Assisted migration (AM) has been suggested as a conservation strategy for aiding species to reach newly suitable locations as climate changes. The magnitude of decrease in range size and the extent of emerging new areas can be used to guide decisions on the applicability of AM. However, before our studies it had not been formalized how predictions of changes in suitable areas, acquired using e.g. species distribution models (SDMs) or expert assessments, should translate into management decisions. We presented a conceptual framework for identifying situations in which projections from such predictions indicate that a species could benefit from AM. We translated predicted changes in suitable area into separate quantitative metrics for migration need and migration potential on the basis of the amount of lost, remnant, and new area.

We apply the method using outputs of consensus SDMs that forecast the future suitable areas for 13 vascular plant species with poor dispersal capacity under different climate change scenarios and future times. Based on the predicted changes in suitable area for the species, and the metrics for the need and potential for AM calculated thereof, we found substantial differences in the number of species benefitting from AM under different climate change scenarios. By the end of the 21st century only one of the species would benefit from AM under mild climate change, while for all but one of the studied species AM appears to be a useful conservation method under strong climate change.

We also tested the effect of different modeling attributes on the metrics and find little variation between SDMs constructed using different combinations of modeling methods. However, the choice of climate variables had a larger influence on the level of the metrics. We therefore suggest that the choice of climate variables should receive ample attention when measuring climate change threat through SDMs, both for AM and in general. Moreover, experiments aiming to uncover critical environmental factors for individual species should be executed extensively enough. Nevertheless, as illustrated by our results, dispersal assistance may be needed for many species under a wide range of possible future climates; the presented metrics have potential to aid the screening of multiple species for identifying AM-candidates as part of broader decision-making frameworks.



## Conservation genomics: why?

(Oral)

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Rapid developments in DNA analysis technologies have occurred over the past five years, now enabling in-depth analysis of the genome of virtually any species. These advances hold huge potential for improving management tools in species of conservation interest and/or for promoting sustainable use of commercially important species, but currently, there is skepticism within the conservation community as to whether the field of conservation genomics will ever progress beyond academic research. In my presentation, I will outline why I believe it should, and how this might be achieved by presenting examples of genomics approaches that are being used to develop new cost-efficient genetic tools for management of salmonid fish species. If time remains, I will also discuss the challenges of bridging the "conservation genomics gap" that can come about due to differences between the needs of academic and applied research and consider possible solutions.

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## Global-scale assessment of forest management impacts on biodiversity patterns

(Oral)

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Integrating biodiversity conservation into forest management has been highlighted as one of the means for halting and reversing the recent biodiversity loss. This integration requires that we understand the mechanistic linkage between anthropogenic disturbances and biodiversity patterns, and it is fundamental for implementing ecological management actions, such as impact mitigation and offsetting by restoration. The empirical evidence on forest management impacts on biodiversity has been accumulated mostly locally, but the response of biodiversity patterns to anthropogenic disturbances remains poorly known. Furthermore, there is no consensus about how diversity patterns of local communities differently shift among forest biomes with different taxonomic composition and regional species pools. Global-scale plot datasets, including both intact and managed forests provides an opportunity to test how vulnerable tree species assembly is to anthropogenic interventions under different biogeographical conditions. To assess disturbance impacts on maintenance of biodiversity across a variety of forest biomes, community phylogenetics, which can disentangle hierarchical species assembly processes from local to global scales, is a promising approach and may contribute to predicting restoration success for each local forest community. Here, we collected plot census data for 1101 plots with 23072 tree species from 293 published papers, and created tree species abundance datasets for individual plots and a phylogeny including all species. Using these datasets, we calculated taxonomic and phylogenetic measures for each plot: taxonomic diversity (Fisher's alpha), evenness (Pielou's E), abundance-weighted net-relatedness index (NRI) and nearest taxon index (NTI). NRI and NTI indicate the degree of species clustering or dispersion relative to a referred phylogeny and represent the influence of abiotic/biotic filtering on species assembly in local communities. Then, we examined disturbance impacts in each biogeographical realm (Neotropic, Afrotropic, Indo-Malay, Australia-Oceania, Nearctic and Palearctic) on the taxonomic/phylogenetic measures using generalized linear mixed model. For the disturbed forests, especially logged forests, the taxonomic diversity and evenness generally showed negative deviation from that of the intact forests. NRI and NTI of disturbed forests showed both positive and negative deviation from that of the intact forests: those were positive in the logged-forests in Australia, Indo-Malay, Neotropic and/or Palearctic, and negative in Africa and Nearctic. Our findings suggests management impacts on potential species assembly processes. Phylogenetic clustering in the logged forests, especially in Indo-Malay and Australia, indicated environmental filtering, which may reflect management-driven species re-assembly associated with similarity of phylogenetic niche among species. Phylogenetic over-dispersion in response to logging disturbances, especial



## Is group familiarity important in conservation translocations?

(Oral)

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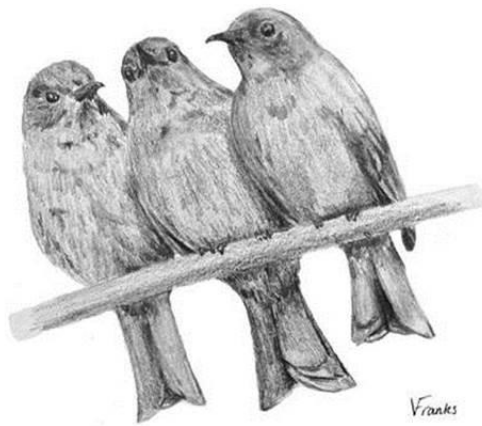
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Translocations can create an abrupt transition to an unknown environment. Learning by observing others (social learning) may be an important way that naïve animals can adapt their behaviour quickly and survive the post-release period, particularly when peers are familiar [1]. However, little is known about how social bonds are maintained or disrupted during translocations, or if altered social dynamics have consequences for population stability [2] and the success of our conservation actions. Establishing new populations (or supplementing pre-existing ones) by moving groups of juveniles is a main focus of conservation for hihi (*Notiomystis cincta*), a threatened New Zealand passerine. Juvenile hihi form social groups post-independence from their parents (see image), and these social relationships alter their ability to discover new food sources in situ. We used a recent translocation to test how movement changes social bonds. We collected data on associations (i) pre-translocation, (ii) in temporary captivity during translocation, and (iii) following release to track how social bonds change during translocations. Associations were recorded pre-translocation and post-release by observing individually colour-ringed hihi, to determine which birds were repeatedly seen together in the same locations at the same time. During temporary captivity, we used video recordings to document behaviour. Furthermore, during the temporary captivity stage we established aviaries of familiar and un-familiar hihi from within the source population to assess if translocating coherent groups maintained social bonds. We discuss the consequences of maintaining and disrupting social bonds for social learning (food finding) and survival rates post-release. Despite a growing awareness that the characteristics of social networks can have consequences for the rapid spread of behavioural change, social associations are rarely accounted for in conservation translocation events. However, this could be an important consideration when animals often change behaviour as a first-response mechanism to survive in new environments.





*Image: Sketch of three juvenile hii sitting together on a branch, the typical social behaviour seen in groups.*

[1] Swaney, W., Kendal, J., Capon, H., Brown, C., & Laland, K. N. (2001). Familiarity facilitates social learning of foraging behaviour in the guppy. *Animal Behaviour*, 62(3), 591-598.

[2] Kurvers, R. H. J. M., Krause, J., Croft, D. P., Wilson, A. D. M., & Wolf, M. (2014). The evolutionary and ecological consequences of animal social networks: emerging issues. *Trends in Ecology & Evolution*, 29(6), 326-35.

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## The Oz Mammals Genomics initiative: developing genomic resources for mammal conservation at a continental scale

(Oral)

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The Australo-Papuan region has a unique mammal fauna, which faces unique threats and poses important evolutionary and ecological questions. Genomics has great potential to advance our understanding of the region's mammals and their conservation. The Oz Mammals Genomics Initiative brings together museum collections, researchers, data specialists and wildlife management agencies to comprehensively tackle rodent, bat and marsupial genomics at a continental scale.

There are few published whole genomes for Australian marsupials. We are developing well-assembled genomes from a broadly representative range of marsupial taxa, to facilitate new insights into evolution and to provide reference data for conservation studies. Genome projects are now underway for seven priority species: the fat-tailed dunnart, brush-tailed rock-wallaby, eastern bettong, mountain pygmy possum, Leadbeater's possum, bare-nosed wombat and eastern barred bandicoot.

Our current understanding of evolutionary relationships among many mammal taxa remains incomplete. To improve resolution of genus and species boundaries, we are generating comprehensive phylogenies of all extant and recently-extinct terrestrial mammals native to the Australo-Papuan region. We are using exon capture methods to sequence over 1000 genes from around 500 species of marsupial, rodent and bat, including samples from vouchered museum specimens wherever possible. This work will clarify taxonomic boundaries for several species of conservation concern, such as the Christmas Island flying-fox.

Finally, the availability of reference genomes and phylogenies will provide a solid base for population-level studies. We are developing conservation genomic datasets for a selection of threatened mammal species. Using exon capture and genotyping-by-sequencing methods, we will measure genetic diversity and inbreeding, determine population structures, and identify adaptive variation. The inclusion of museum specimens as well as recently-collected samples will enable comparisons of modern and historic levels of genetic diversity. Conservation projects have been prioritised so that genomic data are contributing directly to urgent management decisions, for example to inform translocations, reintroductions and captive breeding.



## Cross-ecosystem effects of stream restoration: biodiversity and ecosystem functioning

(Oral)

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Stream restoration in Finland has traditionally focused on larger rivers, aiming to enhance the well-being of salmonid fishes. The key strategy has been to increase in-stream habitat heterogeneity, usually with at least some success. Most restoration projects have not targeted biodiversity and stream ecosystem health and it is therefore not surprising that any biodiversity effects have been modest at best. More recently, the focus of stream restoration has shifted to upper parts of the river network, headwater streams. Forestry, particularly the massive transformation of peatlands to commercial forests via drainage ditching, has been historically intense in Finland, causing nutrient enrichment, altered hydrological regime and streambed sedimentation in the recipient freshwater ecosystems. Restoration of headwater streams therefore largely focuses on mitigating the negative impacts of fine sediments on benthic biodiversity and key ecosystem functions. Removing sediments from the streambed has proven extremely challenging, and most restoration measures therefore strive at (i) reducing any further input of fines (streamside restoration), and (ii) increasing the hydrological retentiveness of a stream by adding stony enhancement structures or large wood (in-stream restoration). In a series of field surveys and mesocosm experiments we have assessed the effectiveness of restoration in enhancing benthic biodiversity and stream ecosystem functioning. Our results show clear positive effects of boulder additions on aquatic bryophytes, with indirect positive effects on the diversity of benthic invertebrates (with a time lag). Key ecosystem processes (algal primary production; leaf decomposition) remained largely unchanged. However, the strongest responses to in-stream restoration did not occur in the stream channel but in the adjacent forest. Diversity of riparian plants did not change much but their guild and community composition did, due mainly to increased hydrological retentiveness in reaches with added wood. Log additions helped restore the natural flow regime, benefiting species that tolerate being submerged during floods. Our study showed the intimate linkages between the stream and the streamside forest. Traditionally, management and conservation of streams and riparian forests have followed separate paths. However, as restoration (or any other management action) in one of the two interlinked ecosystems also affects the other one, they should be managed and protected in an integrated effort. Our future studies on stream-forest interactions will focus on (i) effects of stream restoration on the reciprocal energetic subsidies across the stream-forest interface; and (ii) prediction of the effects of altered hydrological regimes on the capacity of variously restored vs. impacted streams to retain terrestrial inputs of organic matter.

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## Perspectives on Piciformes: impacts on biodiversity from holes to whole landscapes

(Oral)

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The development of tools that accurately describe relationships between woodpeckers and their environment is important for natural resource management, since woodpecker cavities can be used by a diversity of animals. We can use molecular tools to identify patterns of within-cavity diversity, and remote sensing tools can assist in characterizing the environments associated with woodpeckers and the cavities they create. Our objectives were to: 1) use molecular methods to describe some aspects of the diversity found within cavities, 2) describe lidar-based tools that can be used to measure small structures such as cavities, and 3) explore how lidar technologies can be used to explore woodpecker-associated diversity from the cavity to the landscape. In Washington and Idaho (USA), we used molecular approaches, bird surveys, and a variety of remote sensing tools to examine relationships between woodpeckers and diversity in ponderosa pine (*Pinus ponderosa*) and aspen (*Populus tremuloides*) forests. We characterized the fungal communities in recently excavated cavities (n=31) of four different woodpecker species and compared those fungal communities with those from unexcavated trees (n=31). Fungal community composition differed between cavities and unexcavated trees, and finer-scale differences were seen between cavities of different excavators. At the cavity scale, we used a lidar (i.e. laser-based) smartphone device and app called the Spike by ikeGPS to measure known cavity entrance dimensions as small as 3cm by 3.5cm. Such information is important because the size of the cavity entrance influences cavity accessibility for different users. Additionally, cavity entrance sizes might influence microclimate characteristics, which could be particularly important for groups such as fungi. The Spike device was highly accurate in measuring cavity entrance dimensions within 30m of a target cavity and up to 15m above the ground (r=0.91). Using airborne lidar remote sensing, we modeled and mapped both woodpecker species richness and total bird species richness across an aspen-conifer gradient using the program RandomForest. We then examined the spatial congruence between woodpecker richness and overall bird species richness, and we found a high correlation (r=0.71) between woodpecker species richness and total avian species richness. Woodpeckers can be considered surrogates for diversity, and the integration of multiple tools and approaches to further understand the relationships between woodpeckers and their environment will improve conservation in the context of changing forest management practices and changing climates.



## Pathways to achieve the Sustainable Development Goals

(Oral and Poster)

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As we are closing in on the deadline set by the Convention on Biological Diversity (CBD) to achieve the protection of 17% of land and freshwater areas and 10% of marine areas by 2020 (i.e. Aichi Targets), and biodiversity decline continues unabated, conservationists are divided as to how much natural space should be conserved to protect biodiversity. Some argue that if fully achieved, the Aichi Targets for protected area expansion and habitat restoration will suffice to avert further extinctions. On the other hand, there is a growing support for the 'Half-Earth' vision, which aims to secure at least half the planet for nature conservation. Some recent studies have shown that such goals may be achievable, provided that some ecosystems would be restored. However, these studies often ignore other societal goals, and the socioeconomic reality of economic growth and food security, both important drivers of biodiversity changes worldwide and generally at odds with biodiversity conservation.

We determine which socioeconomic pathways and policies are required post-2020 to achieve goals for biodiversity conservation and ensure food security worldwide. We use optimization algorithms and targets for species conservation and food production under alternative socio-economic scenarios to 2030 to plan at the same time for both biodiversity and food security. We integrated both Half-Earth and Aichi targets 11 and 12 with different scenarios aiming to reduce habitat loss by increasing agricultural efficiency, changing diets and reducing human population growth. We highlight the key socio-economic changes needed for achieving future visions for biodiversity conservation to be feasible and the areas of the world where most protection and restoration are needed to achieve these visions.

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2018/06/15

15:00

Room: A2 Wivi



## Climate change mitigation through adaptation: the effectiveness of forest diversification by novel tree planting regimes

(Oral and Poster)

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Abstract of this presentation is not public



## Identifying umbrella species for connectivity conservation in Europe

(Oral and Poster)

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The viability of many species depends on the potential of successful dispersal between populations across broad landscapes. This is particularly true for terrestrial large mammals, many of which are sensitive to the impacts of habitat fragmentation and isolation. Climate and land-use change further necessitate proactive management and conservation of areas that facilitate animal dispersal. Connectivity conservation is therefore one of the most widely-applied conservation measures, but needs to be mapped at large scales with the potential of being used by multiple species.

We conducted an analysis to map connectivity between protected areas for large terrestrial mammals in Europe. We simulated multiple-paths for 20 species in Europe to map the potential connectivity at species-specific scales using four different methods based on ecological assumptions. We then identified the paths that were most common amongst the different species, and suggested multi-use corridors. We also identified the suite of species that best represent the connectivity needs for other species, and therefore best suited to serve as umbrella species for connectivity conservation in continental Europe. Further, we related the connectivity characteristics for each species with its life-history traits, conservation status, and habitat characteristics to get an understanding of general characteristics that explain connectivity patterns.

Our results provide a coarse-representation of important areas for potential dispersal of multiple species and support the development of management strategies to enhance connectivity conservation in Europe.

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## Using in-situ predation to train a vulnerable prey species

(Oral and Poster)

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Fenced reserves and sanctuaries are a common strategy for protecting species from predation, but if individuals of a prey species are removed from their predators for an extended period they can lose predator avoidance strategies. In addition, species that have not evolved with predators may be unprepared to deal with them. These processes are termed 'prey naiveté,' which is implicated as one of the major factors in the decline of prey species. To address this, some studies have tried to train naïve individuals to recognise predators prior to release, using predator cues such as olfactory, auditory and visual stimuli, but these training attempts have not necessarily been successful in terms of post-release survival (e.g. Moseby *et al.* 2012). It is possible that only direct contact with a predator can reduce prey naiveté, either through natural selection or improved wary behaviours.

In the present study we exposed a fenced population of greater bilbies (*Macrotis lagotis*) to a controlled number of feral cats (*Felis catus*) (n=5) for two years in a large (26 km<sup>2</sup>) fenced enclosure. We then translocated n=42 bilbies (half exposed and half unexposed) to a separate enclosure with a larger population of feral cats (n=10). The cat-exposed bilbies were significantly more likely to survive 40 days, and the bilbies with no cat exposure were more likely to be preyed upon, suggesting that *in-situ* predator exposure may result in greater predator avoidance strategies and may be a useful long-term strategy for improving the reintroduction success of fenced populations.

Moseby, K.E., Cameron, A., Crisp, H.A., 2012. Can predator avoidance training improve reintroduction outcomes for the greater bilby in arid Australia? *Animal Behaviour* 83.4, 1011-1021.

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## Forest indicator species correlate only weakly with richness of red-listed species and perform poorly compared to simple stand variables

(Oral and Poster)

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In the face of worldwide biodiversity declines, a variety of conservation measures are being implemented to preserve species and their habitats. Due to imperfect ecological knowledge and limited economic resources, these conservation measures often involve the use of shortcuts. Among these, the use of indicator species – organisms whose characteristics are used as an index of other ecosystem attributes – has been proposed as a tool for conservation planning and monitoring in a range of environments. The overarching aim of this study was to evaluate the usefulness of signal species as indicators of high species richness among species of special conservation concern in a managed boreal landscape. To address these questions, we surveyed wood-decay fungi, bryophytes, beetles, and forest structure in a large number of stands characterized by varying management histories within a geographically restricted area, and related the occurrence of signal species and basic forest characteristics to the number of red-listed species.

Our study, involving a large number of forest stands covering a wide gradient of forest characteristics, showed that indicator species commonly used in forest conservation planning do indicate red-listed species, at least to some extent: When considering stands of all ages, the presence of signal species was associated with higher richness of red-listed species, and the number of signal species correlated positively with that of red-listed species. However, when restricting the analyses to older forests, we could not detect any correlation between signal species and the richness of red-listed species. When we included information on forest structure in the analyses we found that, for predicting the richness of red-listed species across all of our study stands, the amount of coarse woody debris and stand age were much better predictors than the presence-absence or number of signal species. Moreover, adding information about signal species to models based on these forest variables did not bring any substantial improvements to our capacity to predict the number of red-listed species. This suggests that – in this particular setting – information about signal species does not contribute with information about red-listed species beyond that already derivable from forest stand measurements.



UNIVERSITY OF JYVÄSKYLÄ



## EU LIFE PROGRAMME Contributing for Nature Conservation in Practice

(Oral and Poster)

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The LIFE programme is the European Union's funding instrument exclusively devoted to the environment. Since its establishment in 1992, the LIFE "Nature and Biodiversity" strand has co-financed more than 1600 projects. This continuous source of targeted financing has radically changed the capacity of many countries and regions to care for and manage Natura 2000 network sites and to support the EU Biodiversity Strategy. The LIFE projects' actions vary and can encompass the development of management plans and other policy documents, support the enlargement of the Natura 2000 network, improve knowledge of species and habitats, direct conservation actions, and organize capacity building and awareness raising activities. Most LIFE projects targeting habitat restoration have enabled the concerned sites to achieve favorable conservation status. The LIFE programme for Environment and Climate Action plays a catalyst role to promote the implementation and integration of environmental and climate objectives in other policies and Member State practice. The new LIFE 2014-2020 Regulation (EC) No 1293/2013 establishes the Environment and Climate Action sub-programmes of the LIFE programme for the funding period, 2014–2020, with the budget set at €3.4 billion in current prices. The 'Environment' strand of the new programme covers three priority areas: environment and resource efficiency; nature and biodiversity; and environmental governance and information. The 'Climate Action' strand covers climate change mitigation; climate change adaptation; and climate governance and information. This communication will present some nature conservation examples and best practices from successful projects addressing conservation challenges in the European Union, with the aim of contributing to their active dissemination and the new LIFE programme approach for 2014-2020.

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## Factors prevailing distribution of Eurasian Pygmy Owl and setting conservation priorities in Latvia

(Oral and Poster)

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Knowledge of species geographic distribution is of a critical value in conservation biology as it reflects the distribution of its realized ecological niche - the habitat preferences and requirements for survival. In this study we modelled the distribution of Eurasian Pygmy Owl in Latvia to set conservation priorities and evaluate the effectiveness of existing specially protected area (SPA) network for this species. We used MaxEnt to analyse the countrywide species distribution over a set of 34 ecologically meaningful factors describing different landscape and habitat classes, forest types, ages, dominant tree species as well as time since forestry disturbances etc. Analysis was conducted at 25 ha cell resolution using within-cell statistics as well as various landscape statistics of 490 ha and 1960 ha surroundings. The resulting habitat suitability map was used as input for zonation to set conservation priorities and to evaluate the importance of existing SPA network.

The most important negative contributing factor in the model was the amount of agricultural lands while forests of at least five-meter height and the total area of old-growth conifer and mixed forests in 490 ha surroundings were positive. Spruce was the preferred tree species, and the age of the oldest forest patch within the analysis cell was a better predictor than the average forest age. Time since the last forestry disturbance was an important contributing factor as well. Our findings of landscape features in 490 ha and up to 1960 ha surroundings are consistent with previous knowledge of species breeding territory size<sup>1</sup> and highlight the importance of 80-490 ha protection zone for territory. According to zonation analysis, priority 2% of the land territory hold 10% of the assumed population, 10% of the land hold 38% of the assumed population and 25% of the land hold 70% of the assumed population. A third of the assumed population is located in just 8% of the land territory, and by protection of this, the species extinction risk is estimated at 24%. From these most important sites, 23% may be considered as protected (9% by full forestry restrictions and 14% by partial, but possibly effective restrictions), 15% are protected with mostly seasonal forestry restrictions and 62% have no legal protection. In total, specially protected areas currently hold 17% of the assumed species population.

We prove Eurasian Pygmy Owl to be an old growth forest specialist and conclude, that the specific conservation sites (micro-reserves) for this species should be established at larger areas than the current national legislation allows, and that Natura 2000 site network alone is not sufficient for protection of this species.

1. Strom, H. & Sonerud, G. A. Home range and habitat selection in the Pygmy Owl *Glaucidium passerinum*. *Ornis Fennica* 78, 145–158 (2001).



## Effects of forestry treatments on forest site conditions and the biodiversity of different organism groups

(Oral and Poster)

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There is a paradigm shift in Central Europe from the rotation forestry systems towards continuous cover forestry that provides a diversification of possible management practices. In a mature, temperate sessile oak-hornbeam forest in Northern Hungary, four different forestry treatments were experimentally studied: preparation cutting (30% partial harvest), clear-cutting, retention tree group, and gap-cutting using six replicates in block design. The effects of these treatments were studied on forest site (microclimate and soil) conditions and on community structure (species richness, abundance, species composition) of vascular plants, enchytraeid worms, ground beetles and spiders between 2014 (pre-treatment) and 2016 (post-treatment).

Light availability increased in all treatments; it was the highest in clear-cutting, intermediate in gap-cutting, and the lowest in preparation cutting and retention tree group. Vapour pressure deficit (function of air temperature and humidity) increased only in the clear-cutting. Soil temperature increased mainly in the clear-cutting and retention tree group. Soil water content was the highest in gap-cutting, intermediate in clear-cutting and lowest in preparation cutting and retention tree group.

The treatment effect and the sensitivity of community variables were versatile among organism groups. Plant cover increased in all treatments, especially in the gap-cutting and clear-cutting. The abundance of worms decreased in clear-cutting and retention tree group. The species richness of plants increased in clear-cutting and gap-cutting, for enchytraeids it strongly decreased in retention tree group. The treatment effect on the abundance and species richness of spiders and carabids was weak. The effect of treatments on species composition was significant for all organism groups, but it was relatively strong for spiders and enchytraeids and slight for plants and carabids.

Although plants were very sensitive to the changes of light conditions that resulted considerable increase in the species richness and cover in gap-cutting and clear-cutting, their composition slightly changed due to the survival of perennial forest species. Enchytraeid worms were the most sensitive organism group for treatments, soil temperature and humidity changes resulted deteriorated assemblages in retention tree group and clear-cutting. Good dispersal ability of spiders and carabids could compensate the effect of treatments establishing only compositional differences among the treatments. Based on this short observation period we can conclude that fine-scale forestry treatments like gap-cutting had only moderate effect on forest site, which is favourable for conservational perspectives.

The study was supported by Hungarian Research Found (OTKA 111887) and by the National Research Development and Innovation Office (GINOP-2.3.2-15-2016-00019), website of the Pilis Experiment project is <http://pilikiserlet.okologia.mta.hu/en>.





## Red List of Ecosystems: assessing the quality of boreal forests in Finland

(Oral and Poster)

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IUCN recently published guidelines for Red List of Ecosystems (RLE) risk assessment [1]. The RLE criteria include consideration of changes in an area and the geographic distribution of ecosystems but also of changes in the biotic and abiotic ecological quality of ecosystems. In widely distributed ecosystems, such as boreal forests in Finland, ecological quality is often more important than the spatial extent of an area in assessing threat status. Therefore, it is important to find quantitative variables that are good surrogates for the overall quality of an ecosystem.

In the RLE assessment of Finland, we divided boreal forests into 40 ecosystem types. Of these, forests with mineral soils (19 types) have a greater spatial extent than all other terrestrial ecosystem types in total (c. 300 types). We classified these forest types based on fertility, successional stage (young, mature and old) and dominant tree species (conifer or deciduous). For the assessment of their biotic quality, we used the data provided by the Finnish National Forest Inventories (NFI) which include several variables that can be used in the RLE assessment of forest ecosystems. Of them, we selected three: dead wood (m<sup>3</sup>/ha), large trees (number of trees/ha) and deciduous trees (% of volume of living trees). Following the IUCN guidelines, we calculated the relative severity of changes for each variable based on the present values and the reference values (50 years ago; RLE criterion D1) within each ecosystem type. The Red List category of the ecosystem type was based on the average of the severities of the changes in variables. For meeting also the RLE criterion D3 (reference year c. 1750), the historical values of dead wood and large trees were estimated based on expert opinions.

The RLE assessment in Finland was carried out at the national scale and separately for the northern and southern parts of Finland. For the forest types, we made the regional assessments first and from them calculated the average Red List categories at the national scale, weighted by the areas of each ecosystem type in northern and southern parts. The final report will be published by the end of 2018.

We highly encourage the use of the representative and continuously updated NFI data for RLE assessments whenever possible.

[1] IUCN 2017. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.1. Bland, L. M., Keith, D. A., Murray, N. J., and Rodríguez, J. P. (eds). Gland, Switzerland: IUCN. 99 pp.





## Identifying the spatial scales of forest structural change in two boreal regions

(Oral and Poster)

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Global environmental change alters forest dynamics, but the effects vary regionally and the changes often occur at various spatial and temporal scales. Hence, and due to the slow ecosystem responses to environmental changes, long-term, multi-scale studies are needed to understand how forests respond these changes. We studied scale-dependent changes in the structure of unmanaged boreal forests. We asked (1) at what spatial scales do structural changes occur, and (2) whether these scales differ between different regions and landscapes.

We studied 2 km × 2 km forest landscapes at two different boreal regions: Northeastern Finland (three landscapes) and eastern Quebec, Canada (two landscapes). For each landscape, we produced two raster maps depicting forest structural change between two points in time. We analyzed these maps with multiresolution Bayesian scale space approach, where (1) the spatial scales at which the most salient structural changes occur were identified, (2) the scales were used to decompose the maps depicting forest structural change, and (3) the scales of changes were quantified from the extracted components. To produce the maps depicting forest structural change, we visually estimated canopy cover in contiguous 0.1-ha cells from a recent and two historical stereopairs of aerial photographs, and formed time series with total lengths varying between 38 and 52 years, depending on the landscape. Using field measurements and tree ring data, we reconstructed canopy cover in the year each photograph was taken for a random sample of 66 of the 0.1-ha cells, and used the reconstructions to calibrate the interpretations, and to quantify the interpretation error. We compiled the calibrated interpretations to raster maps, and produced maps depicting canopy cover change by subtracting canopy cover maps of consecutive time points.

At both studied time intervals, forest structural changes occurred at multiple spatial scales in landscapes with different disturbance histories and tree species compositions. The spatial scales of changes ranged between 0.1 ha and > 100 ha. In each landscape, the scales at which the structural changes occurred were similar between the both studied time intervals. Between landscapes, the scales of changes were similar at small scales, but differed at large scales. These preliminary findings indicated that similar small-scale structural changes were typical for both studied boreal regions. Structural changes occurred also at large spatial scales, but these scales of changes differed between landscapes.



## The Finnish Biodiversity Information Facility FinBIF - an integrated open data infrastructure supporting research and decision-making in conservation.

(Oral and Poster)

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FinBIF was established to accelerate digitisation, mobilisation, and distribution of biodiversity data and to boost its use in research, administration, and the private sector. The core of the service has been built in a 3.5-year project ending in June 2018. The service has been operational since 2015, but it is continuously being developed. FinBIF comprises (1) a growing network of generators of data (species observations, specimens in collections, DNA barcodes); (2) a data warehouse integrating copies of primary datasets; and (3) the portal Laji.fi / Species.fi where anyone can search the data and download it for use. FinBIF is built to mediate all open-access biodiversity data in Finland. Currently all major Finnish natural history collections are starting to share their digitised data through FinBIF, as do several species survey and mapping initiatives run by the Finnish Museum of Natural History LUOMUS, Finnish Environment Institute SYKE, Natural Resources Institute Finland Luke, Parks & Wildlife Finland, and a number of other, primarily non-governmental organisations.

The Global Biodiversity Information Facility GBIF is the international forerunner of the service model implemented by FinBIF. However, while GBIF already shares around a billion data points, it exhibits two main limitations: (1) the growth of the GBIF-mediated data largely rely on national initiatives feeding data into GBIF, and (2) GBIF is not primarily directed to support national or local application; lack of spatial resolution and coverage of data often hamper such use. FinBIF remedies this situation by mobilising large masses of spatially accurate data on species from Finland and neighbouring areas. It also provides means to partners and individuals to record, compile, manage and share their own observation data.

In addition, FinBIF integrates the service model of GBIF with that of the International Barcode of Life project iBOL (ibol.org), which is creating a digital identification system for life by utilising DNA barcodes (sequence diversity in short, standardized genome regions). DNA barcodes facilitate accurate and automated identification of organisms independent of phase of development and of sample size and quality. The Finnish initiative, FinBOL, which works on completing a DNA barcode reference library for the Finnish biota, is integrated with FinBIF, thus combining specimens and barcodes with spatially and temporally extensive occurrence records.

Finally, FinBIF covers also digitisation of natural history collections. The national collection management system Kotka (kotka.luomus.fi) holds a rapidly increasing digital record of Finnish collections and it feeds directly into Laji.fi.

Examples of research utilising FinBIF-mediated data include species distribution modelling, studies of the effects of climate change on biodiversity and other bioclimatic studies, development of nature conservation methodology, and the analysis of species' threat status trends.



## Maintaining habitat connectivity in an urbanising world: understanding interactions in large-scale coupled habitat and settlement networks

(Oral and Poster)

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For their survival, animal species depend on networks of well-connected habitat patches (i.e. habitat networks). Likewise, the well-being and economic prosperity of many human societies depend on networks of settlements that are well-connected by roads and traffic (i.e. settlement networks). In many regions across the world, settlement networks are densifying and expanding due to a rapidly growing and urbanising human population. Such changes to settlement networks often lead to decreases in habitat size, quality and/or connectivity, thereby diminishing the integrity of habitat networks and ultimately the survival of species. However, interacting processes within settlement networks (e.g. settlement growth can increase traffic flows and vice versa) make it difficult to predict how changes in a region's settlement network will affect its habitat networks. Nevertheless, such knowledge is essential for conservation, landscape and transport planning to simultaneously ensure human well-being and the protection of biodiversity. Such knowledge can be derived from models that simulate the dynamics within and between settlement and habitat networks at regional or national scales. Yet, most urban and road ecology studies focus at smaller scales and on specific types of human-animal interactions and to date such large-scale, integrated models have not been developed. Here we present results from a research project (CHECNET: coupling human and ecological networks for sustainable landscape and transport planning) aimed at understanding trade-offs and synergies in coupled habitat and settlement networks. With simple simulations studies in hypothetical landscapes, we have previously shown that the configuration of roads and settlements can have significant effects on habitat connectivity [1]. We now focus on empirically derived settlement and habitat networks in the Swiss plateau (i.e. a densely populated region in Switzerland). Large-scale habitat networks for a range of amphibian species are constructed with an innovative approach making use of readily available animal occurrence data (programmed in R and Python). These habitat networks are then coupled to a dynamic settlement network, which is simulated with a Swiss-wide land-use transport interaction model (FaLC, [2]). With this model, changes in settlement size and traffic flows can be predicted under a range of policy and socio-economic scenarios. We present the interactions that we found between these networks and their implications for conservation planning. Our results underline the importance of considering the interactions in large-scale habitat and settlement networks in order to maintain habitat connectivity in an urbanising world.

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UNIVERSITY OF JYVÄSKYLÄ



## Ecosystem Services in Coastal Zone for Sustainable Development: The Gulf of Finland and Saint Petersburg

(Oral and Poster)

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Coastal zone contains a rich diversity of ecosystems which supply various ecosystem services that essential for the sustainable development, keeping the balance of socioeconomic and environmental processes. Simultaneously, however, coastal zone is exposed by continuous anthropological activities, such as constructions along the shore or water pollution from the city which could lead on to the eutrophication and hypoxia in hydrosphere. With increasing population of waterfront cities, coastal environment has been changing rapidly, thereby ICZM (Integrated Coastal Zone Management) and clarification of interests between ecosystem services and sustainable development is required.

The Gulf of Finland forms a complex ecosystem between freshwater and sea water, and at its coastal zones, obviously, owned even more intricate space with an ebb tide and a high tide. Every year the city of Saint Petersburg, which is situated at the eastern part of the Gulf of Finland is expanding, more and more people are moving to this city, and new constructions is carrying out including the Krestovsky Stadium, which was opened in 2017 for the FIFA Confederations Cup, Passenger Port and its excavation work of seabed, and Saint Petersburg Flood Prevention Facility Complex (dam). Confronting with this swift transition of ecosystem is a crucial matter for every hierarchic class of biota, as well as human-beings, because they formed the basis of the ecosystem services, which are essential for the sustainable development.

This research aims to illustrate the connections between ecosystem services and sustainable development by exemplifying the actual data as area studies of the Gulf of Finland in aspects of ICZM and TEEB (The Economics of Ecosystems and Biodiversity).

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Presentation cancelled by author



## Spatial patterns, structure and size-class distribution of a semi-arid mopane mono stand subjected to high elephant damage

(Oral)

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Abstract of this presentation is not public



UNIVERSITY OF JYVÄSKYLÄ



## Bird health and sperm quality in relation to environmental levels of neonicotinoids

(Oral)

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Neonicotinoids pesticides are commonly used in agriculture. They are administered mainly prophylactically as seed coating, but can also be sprayed in some cultures. Several characteristics of these molecules make them prone to be transported from the field of application to the surrounding areas. As a consequence, neonicotinoid insecticides represent an environmental risk to non-treated land with potential consequences for non-target species. In this context, we visited 62 farms over the Swiss lowland agricultural area managed under three types of agricultural practices: conventional, integrated production called “IP-Suisse” and organic. We collected soil and vegetation samples in cultivated fields as well as in ecological focus areas (EFAs). Additionally, we captured between 5 and 20 house sparrows (*Passer domesticus*) in each visited farms, with the aim to examine whether neonicotinoid concentrations in soils and plants are related to indices of the birds’ health (body mass, blood and sperm redox status, sperm quality) and/or neonicotinoid concentrations in the birds’ plumage.

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## Ecosystem Services: A bridge or a barrier for environmental management?

(Oral)

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Across disciplines, the concept of ecosystem services has become an accepted concept through which the complexities of the natural world and its relationships with human society are explained and embedded into global environmental policy. At a time when global ecosystems are continually under pressure due to anthropogenic influences and interactions, it aims to provide policy makers, practitioners and scientists with a common language. In spite of this widespread acceptance, the concept of ecosystem services is in its very nature complicated and full of complex, and sometimes, intangible interactions. As the field of ecosystem service research has grown, the ecosystem services framework has developed, most recently through the Follow on to the UK's National Ecosystem Assessment (2014), to encompass: four different categories of ecosystem services (regulating, supporting, provisioning, and cultural), various ecosystem processes and characteristics, the final ecosystem services and the many associated benefits. While stakeholders have, for the most part, adopted this relatively new language and terminology, questions remain as to whether the ecosystem services concept provides the common language it promotes. There are concerns that the complexities associated with ecosystem services as a concept make it inaccessible for people living and working in these ecosystems.

The paper seeks to better understand how and why the ecosystem service concept is (or is not) being used, with a view to improving its application for the benefit of natural resource management. Through a questionnaire survey, this presentation examines three main questions relating to the perceptions of UK marine and coastal stakeholders, researchers and policy makers towards the concept of ecosystem services:

- What are the views and perceptions of marine and coastal practitioners in the UK towards the term ecosystem services?

- Do these differ between sectors and user groups?

- How do these attitudes/ views influence the use of the concept?

While this study focuses on marine and coastal management in the UK, the findings contribute to the ongoing debate around ecosystem services as a tool for effective environmental management and policy development. We will present respondents' views about its role as either a barrier or a bridge, or both, within the marine and coastal science-policy-practice interface. Finally, the presentation sets out a series of recommendations to support the future use of the ecosystem services concept in UK coastal and marine management.

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## Assessing object-oriented LiDAR metrics for characterizing bird habitat in a management perspective

(Oral)

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Light Detection and Ranging (LiDAR) provides detailed information on the three dimensional structure of the environment, and is increasingly used in habitat modeling for a wide variety of species including birds. LiDAR has been shown to improve predictive performance of species distribution models. It is recommended that explanatory variables in habitat models should be meaningful from the species point of view in order to best explain species distribution within a landscape [2]. However, is good predictive performance of a habitat suitability model sufficient to impact local conservation actions? In order to take appropriate and more efficient management decisions, we hypothesize that the metrics explaining the species distribution need to be also meaningful for managers. Some LiDAR point clouds metrics such as the standard-deviation of penetration ratio between 0.5-10m [1] are not easy to interpret. However, metrics extracted using object-oriented methods may fill this gap by giving metrics based on existing landscape components. Instead of calculating metrics over a surface unit (the pixel), an object-based classification group together neighboring points because they belong to the same overall structure which define an object type (tree, road, building, gap).

The aim of this study is to improve forest management planning by using LiDAR predictors meaningful for both the species and managers. We are here focusing on the case of the Capercaillie (*Tetrao urogallus*), an avian species of conservation concern occurring in the French Jura Mountains. Capercaillies favor old mixed forest with a mosaic of structurally different habitats (gap openings, moderate canopy cover area, isolated resting trees, presence of shelters) and the species is threatened by habitat loss and degradation. Habitat restoration planning is thus a fundamental aspect of species conservation actions.

We extracted a range of object-oriented metrics from LiDAR datasets, defined with the support of conservation experts and forest managers. We then compare habitat suitability models based on inhomogeneous point process models, such as Maxent, fitted with either commonly used “points cloud” or new “object-oriented” LiDAR metrics.

Preliminary results indicate that both categories of metrics yield similarly accurate predictions of Capercaillie habitat suitability. Thus, we hope that the use of object-oriented metrics, with their likely improved interpretability, will allow for more practical recommendations supporting forest management planning in favor of Capercaillie conservation.

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## Integration of evolutionary diversity in conservation planning: recent advances and new perspectives

(Oral)

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Spatial conservation planning has evolved remarkably in past decades, moving from strategies consisting in identifying spatial patterns of species richness, endemism and turnover to sophisticated prioritization frameworks [1]. These frameworks aim at identifying conservation networks that maximize overall representation and persistence of biodiversity and ecosystem services, while accounting for cost-efficiency of available resources. Meanwhile, evolutionary scientists have highlighted the need to consider evolutionary history shared among and between species, in order to assure biodiversity persistence and maximize evolutionary potential. However, there is still a wide gap between conservation planning and evolution disciplines. Reasons to this gap include: 1) an uncertain added value when explicit considering evolutionary diversity in conservation plans; 2) lack of clarity on how to set conservation objectives when considering different facets of evolutionary diversity; and 3) methodological limitations in mapping evolutionary diversity. In this talk I will review the progress towards, and limitations and perspectives of, integrating conservation planning and evolution disciplines. In particular, I will focus on a recent methodology to map intra-specific lineages (phylin) [2], and how to combine these maps with commonly used spatial prioritization frameworks and tools [3]. Finally, I will discuss how recent developments in high throughput sequencing and in the field of ecological modeling can contribute to aid conservation planning in the future.

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## Bridging Flood and Coastal Erosion Risk Management with the Well-being agenda: The influence of multi-level governance in Wales (UK)

(Oral)

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Coastlines play an important role in health and well-being, providing a range of goods and services, from spaces of recreation and reflection, to foundations for community- and self-identities, heritage and culture, to name a few. However, these are often threatened by the dynamism of natural processes, such as coastal flooding and erosion. Likewise, Flood and Coastal Erosion Risk Management (FCERM) raises a number of well-being dilemmas. Indeed, the decision to realign, remove or lower existing defences has implications for the local economy, social cohesion, feelings of ontological security and place attachment, as well as impacts for the environment and human health.

In Wales this has been recently reinforced by the Well-being of Future Generations (Wales) Act 2015, which places a statutory duty on all public bodies to actively contribute to the achievement of national well-being goals through all aspects of policy and decision-making. Seven well-being goals are outlined in relation to economic, social, environmental and cultural facets of well-being, including prosperity, resilience, health, equality, cohesive communities, culture and language, and global responsibility. However, how to assess, align and negotiate the potential conflicts between FCERM and the well-being agenda is poorly understood, yet remains an important step forward if the two agendas are to be delivered in tandem.

Conducted under the auspices of the “CoastWEB” project (valuing the contribution which COASTS make to human health and WellBeing), this research draws from in-depth policy and legal analysis, stakeholder network analysis, and interviews with Welsh policymakers and practitioners. Focusing on core governance arrangements for FCERM and well-being, we present the results of preliminary analysis and evaluation. Identifying points of synergy and conflict, and importance of ‘bridging mechanisms’, we highlight various pathways through which multi-level governance is both facilitating and constraining the tangent pursuit of societal resilience and well-being on the Welsh coastline. Through this analysis we identify governance intervention measures and design principles, emphasising the importance of reflexive and legitimate practices. It is anticipated that the methodology and findings may be of interest to other nations similarly endeavouring to secure the well-being of future generations on dynamic coastlines.

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## THAT'S THE PRESS, BABY! THE PRESS! BUT THERE'S SOMETHING YOU CAN DO ABOUT IT. THE MANAGEMENT OF THE GREY SQUIRREL SEEN THROUGH THE EYES OF THE MEDIA

(Oral)

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Eradication of introduced populations are key conservation tools to mitigate the impacts caused by established alien species. Although the scientific community widely agrees with the necessity to manage and control invasive species, the public opinion often may not support these projects, especially if the species have a strong appeal to the public. The public opinion could be affected by mass media, in particular when the audience has little experience with a particular issue (media-dependency hypothesis). A good communicative campaign could increase the acceptance of management activities and the probability of success, while a poor campaign may lead to more problems or even failures. In a media-saturated society the information reported by the press could be considered as an indicator of the public attitude. Consequently, this information may be used to evaluate the public opinion, and therefore the effectiveness of the communicative campaign performed by a project.

A media content analysis, both qualitative and quantitative, has been used to assess the effectiveness of the communication campaign of the European LIFE EC-SQUARE project on the management of the grey squirrel (*Sciurus carolinensis*) in North Italy (Piedmont, Lombardy and Liguria regions). From 2011 to 2014, most of the information sources available to the public, such as newspapers, magazines, web news, were collected and analysed in searching the information concerning the project. Each piece of news was then classified adopting two techniques, the key words approach and the syntactic analysis approach, and allocated into three categories: 'favourable', 'neutral' and 'contrary' to the project.

A total of 166 news have been analysed, which correspond to a mean of one news every 8.8 days along the four years of the project. A higher interest of the media for the activities in Liguria (50% of the news) was probably connected to the management actions conducted in urban parks, where citizens used to feed the animals. The frequency values of the three categories were different between the three regions involved in the project ( $\chi^2_{26} = 28.16$ ,  $p < 0.05$ ), with a higher frequency of negative articles in Liguria in respect to the other regions. Therefore, in Liguria the project encountered a greater initial opposition, despite the management solution proposed was based on the surgical sterilization of squirrels and not their live-trapping and euthanasia as in the other regions. However, the number of negative articles focused on Liguria decreased from March 2013 till the end of 2014 ( $F_{1,7} = 6.05$ ,  $p < 0.05$ ,  $R^2 = 0.46$ ), indicating an effect of the local communication campaign. In general, each frequency peak of newspaper articles against the project was followed by a peak of favourable news. Furthermore, during the project the trend was reversed, with peaks of positive articles, stimulated by the project, before a reaction of opponents to the projects generating.



## Transitions to Sustainable Livelihoods to Reduce Threats to Biodiversity in North Sulawesi, Indonesia: Lessons From the Behaviour Change and Sustainable Transition Research Traditions

(Oral)

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Selamatkan Yaki (SY: Indonesian for “Save the macaques”) is an education, research and conservation programme focused on protecting the Critically Endangered Sulawesi crested black macaque (*Macaca nigra*) and its native habitat of North Sulawesi, Indonesia. Due to habitat loss and hunting (primarily supplying an elitist, non-subsistence market), these endemic primates have experienced population declines of over 80% in the past 40 years. SY aims to protect the remaining population of macaques and the rich biodiversity of North Sulawesi through a collaborative, multi-stakeholder conservation strategy, based on a Species Action Plan for *M. nigra*.

A multitude of approaches to the conservation objectives comprise extensive demographic, attitudinal and ecological monitoring, an education and awareness raising strategy, protected area management and ecotourism. A focus on social diffusion is applied via the “two-step approach” – empowering local role models ranging from religious leaders, youth representatives and celebrities to spread the conservation message and assist in removing barriers to effective behaviour change. Long-term cooperative efforts aim to reduce biodiversity pressures with development of a sustainable livelihood strategy.

Sustainable, or alternative livelihood projects (ALPs) have long been used either as standalone projects or integrated within broader community development programmes. ALPs aim to reduce the prevalence of activities deemed to be environmentally detrimental by substituting them with lower impact livelihood practices that provide at least equivalent benefits to increase income and wellbeing of rural communities.

Despite numerous reviews reporting lessons learned in the formation of ALPs, a paucity of evidence exists supporting the effectiveness of projects in meeting biodiversity conservation objectives. Proposed interventions are often “standard issue” and may not talk to the specific needs, aspirations, natural resources and capacities of the target community, or fit within current policy frameworks. This can leave communities feeling “pushed” towards change, maybe by criminalisation of previous income-generating activities, rather than “pulled” by the opportunity for change, diversification and economic growth. Such transitions should be part of a systems approach, appreciating the complexity of both structural and individualistic factors, maintaining sensitivity to communities’ needs and continually monitoring key variables for change.

An early-stage case study from Indonesia is presented, with discussion opened by considering emergent lessons from behaviour change and sustainable transition approaches, and how these can be integrated into models of sustainable livelihoods. Questions pivot around the socio-cultural and political barriers to change, social practices as a potential lens for approaching sustainable livelihoods and the normative opportunities for fostering new ways of sustainable living.



## Flow as a disturbance agent: fish responses to serial flooding in a hydrologically-variable dryland river system, Australia

(Oral)

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Lowland rivers are one of the most prominent freshwater ecosystems globally, yet are also one of the most imperiled from expanding human settlements, agriculture and water resources capture. Many countries are implementing environmental water programs to help offset the ecological impacts of human activities. While these rely on knowledge of ecological responses to flow variability, their strength lies in access to data from as wide a range of hydrologies as possible, and both natural and managed events.

I examined shifts in fish assemblage structure and recruitment across a lowland distributary network in Australia's northern Murray-Darling Basin. Sampling during 2011 and 2012 coincided with a small flow pulse followed by two large flood events. It was hypothesized that assemblage structure would vary significantly over time but that abundances of all common species would respond in a similar (positive) manner to flooding.

Assemblage structure varied substantially among sites at the beginning of the season, particularly following the initial, small managed release. However, assemblages had a far greater similarity following the two floods, although began to diverge again by winter. Native species displayed varying responses to the flood events in their recruit abundances. Juvenile carp gudgeons declined markedly in abundance after the first large flood and were absent following the second large flood. However, spangled perch (*Leiopotherapon unicolor*) and bony herring (*Nematolosa erebi*) showed a generally positive response to both floods in their recruitment. Recruit abundances for the exotic carp (*Cyprinus carpio*) increased by up to 55,000% following the initial large flood, yet were nearly absent following the second flood. Size-structure data for the exotic goldfish (*Carassius auratus*) indicated a similar pattern to that of carp.

These findings confirm the general adaptation of indigenous aquatic species to local flow conditions, including highly variable discharge rates and large floods - albeit that species with a greater lentic preference (carp gudgeons) may be impacted by larger events. Further, they indicate the corresponding potential for a disconnect between exotic species and local climatic variability despite the broader colonisation success in these taxa.

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## Can dietary specialization be used for conservation? Foraging and ecological restoration by hihi (*Notiomystis cincta*)

(Oral and Poster)

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While it is now widely acknowledged that individuals within species behave differently even when faced with similar environmental challenges, few studies have identified how this variation arises and what impacts it has on the environment itself. This is critical to consider given that the ecosystems species inhabit are often under threat. The hihi (*Notiomystis cincta*), a threatened New Zealand passerine and important pollinator of native plants, provides an excellent model for investigating the causes and consequences of specialization through the lens of foraging. Following near-extinction around 1890, hihi have been reintroduced to several island and mainland sites, but habitat suitability has proved a major barrier to establishing self-sustaining populations. Here, we consider how we can increase the restorative effects of translocations by selecting individuals based on foraging traits that will i) increase their likelihood of survival and ii) promote ecosystem processes such as pollination. We tested these ideas by tracking a hihi cohort as individuals either remained on their natal island or were translocated to a novel site with more mature forest structure and less intense competition. As a whole, the translocated group broadened its diet, but individuals differed in their dietary shifts. We examine the consequences of preexisting dietary preferences for these individuals and use preliminary data on pollination-related trait variation among hihi to discuss the lasting effects a founder population can have on its habitat.

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## Effects of retention forestry on bats: relations between forest structure and the landscape matrix

(Poster)

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With more than 1200 species worldwide and comprising roughly one fifth of all mammalian species bats are of great importance for global biodiversity. As bio-indicators they are frequently selected target species for conservation programmes. Most species depend on forests for at least part of the year: forest gaps are used as foraging sites, old and dead trees as roosting locations. However - in spite of the expanding forest area in Europe - only a small proportion thereof is set aside for nature conservation purposes. The vast majority is primarily managed for wood production, which leads to a simplified forest structure, lacking gaps, dead wood and senescent trees. Retention programmes, integrating old-growth structures in a managed forest matrix are thus considered beneficial for the promotion of forest biodiversity, but their effectiveness for bats may strongly depend on the landscape context and targeted species. Whereas species-specific associations of bat occurrence with forest structures has been shown on a local scale, minimum landscape-scale requirements for abundance and distribution of such structural elements are lacking.

In this study, embedded in a transdisciplinary research programme examining the effectiveness of retention forestry for biodiversity in temperate forests, we relate bat diversity, activity, and type of use to forest characteristics and landscape heterogeneity. We expect that: (1) The species-specific use of structural elements at the local scale will be modulated by the surrounding landscape. (2) The diversity of species and functional guilds will increase with heterogeneity at both the forest stand and landscape scale. (3) The relative abundance and diversity of forest-specialists will increase with the abundance of old forest (habitat trees) and standing dead wood in the surroundings.

Bat species were recorded using non-invasive bioacoustic methods (ultrasonic sound recording) at 135 study plots of 1ha, distributed across the Southern Black Forest, Germany. Forest structure and landscape patterns were assessed within a 25km<sup>2</sup> buffer by remote sensing complemented with plot-scale terrestrial mapping. LiDAR-information capturing the 3D-characteristics of sub-canopy space was used to predict bat occurrence at the stand scale.

Here we will present the first results on how retention forestry promotes bat diversity, which species benefit from retention measures and how this effectiveness depends on the surrounding landscape. By relating bat presence and diversity to structural characteristics quantitative threshold values for integrative forest management will be derived.



## Filling in knowledge gaps: new reports on distribution and ecological requirements for two Data Deficient East African bat species.

(Poster)

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Efforts to sample bat biodiversity in Africa have been patchy, as reflected on the assessments of the IUCN, reporting 22% of the bat species in sub-Saharan Africa as Data Deficient[1]. This is also due to limited funding targeting these species since such projects retain relatively high risk of failure connected with field challenges and difficulties in locating the species. However, Data Deficient species are also claimed to be on average more threatened than fully assessed ones[2,3]. Therefore, accumulation of knowledge and its prompt sharing is critical for the implementation of conservation measures where needed.

Here we report new records for two extremely rare and poorly known African bat species, Macinnes's Mouse-Tailed bat *Rhinopoma macinnesi* and Hamilton's Tomb Bat *Taphozous Hamiltoni* (both Data Deficient). These species are historically known only from very few locations in East Africa and their actual distribution, population abundances and ecological requirements are still unknown[1]. We recorded the presence of these species using mist-nets during three field expeditions conducted in 2016-2018 in Sibiloi National Park, northern Kenya, and its surroundings. We provide a description of habitat in the foraging sites for the two species. Additionally, we carried out further sampling of *T. hamiltoni* in 2018, recording echolocation calls and employing radio-tracking to identify roosting sites and estimate distance commuted between roost and foraging ground.

Given the lack of recent reports of these species elsewhere, their presence in this area is of great relevance. However, despite the presence of Sibiloi National Park, these populations will likely be threatened in the future by rapid change in local climate, determined by anthropogenic exploitation of local water resources. We therefore recommend periodical monitoring to guarantee their persistence.

[1]IUCN (2017). The IUCN Red List of Threatened Species. Version 2017-3. <http://www.iucnredlist.org>

[2]Jetz W, Freckleton RP (2015) Towards a general framework for predicting threat status of data-deficient species from phylogenetic, spatial and environmental information. *Philosophical Transactions of the Royal Society B-Biological Sciences* 370: 20140016.

[3]Bland LM, Bielby J, Kearney S, Orme CDL, Watson JE, Collen B (2017). Toward reassessing data-deficient species. *Conservation Biology*, 31(3): 531-539.



## The Effect of hydration/ dehydration cycles on hatching efficiency, growth and survival of *Artemia parthenogenetica*

(Poster)

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The aim of this research is study the effects of hydration/ dehydration cycles on the hatching percentage, survival and growth of *Artemia parthenogenetica* cysts.

Experiments were carried out in three treatments from one to three hydration/ dehydration cycles. Then cysts hatching percentage of each treatment was determined in 3 replicates according to the standard method. Survival and growth were measured on days 8, 11, 15, 20, and 25 of growth. The results indicated that two hydration/ dehydration cycles nearly increases hatching percentage and survival of *Artemia parthenogenetica* cysts (86.38%) comparing to control group (85.79%). Excess hydration/dehydration cycles cause a reduction in survival percentage. Therefore the survival percentage in three hydration/dehydration cycles is significantly lower than other treatments. But growth of *Artemia parthenogenetica* is not significantly affected by cyclic hydration/dehydration.

To sum up, in *Artemia parthenogenetica*, against other species of *Artemia*, hydration/dehydration cycles are not essential, and performing it decreases cyst hatching percentage.

Keywords: *Artemia parthenogenetica*, Hatching, Cyst, Hydration/ Dehydration.

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## Effect of traditional use on Vulture's population in Lagos, Nigeria

(Poster)

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Vultures are the planetary vacuum cleaner; foraging on carcass potentially reducing disease outbreaks. Unfortunately, in Lagos, Nigeria, illegal trade in wildlife and traditional use of vulture parts constitutes a potential threat to its conservation. High market demand for the species is gradually leading to its population decline. A 3-months survey was carried out in four markets predominately known for wildlife trade namely: Epe, Ikorodu, Bariga, and Oyingbo to investigate the current trend in vulture parts utilization and the cultural perception of the indigenous people. The study was carried out through the use of Focused Group Discussion (FGD), formal interview and a questionnaire survey. Three hundred respondents including wildlife vendors, bushmeat consumers, traditional practitioners and community heads were interviewed. Data obtained were analyzed using descriptive statistics. The respondents' perceptions were expressed in percentage while the market value of vulture parts was expressed in dollars (USD). Ninety-five (95%) of the respondents believed that there is a gradual decline in the population of vultures through Hunting (51%), habitat destruction (30%) and traditional use (14%). Vultures are traditionally used in medicine, voodoo, rituals and coronation ceremony for kings. Live birds and dried feathers and heads of vulture are freely displayed in the market for a prospective buyer. A single feather cost as much as 1.44 USD while the head sold for 17.29 USD and the whole bird for 74.89 USD in the open market. Feathers of vultures are traditionally hanged at door post as protection against evil spirit while the heads are burnt and grounded into power, blended with other concoctions to fortify and prolong life of newly installed kings. Live vultures are sacrificed to appease gods, revoke evil, curses and for treatment strange and incurable ailments such as stroke, infertility, mental sicknesses. The result from the study confirmed that high demand for vulture parts in traditional practice is one of the major drivers of vulture decline in Lagos state



## Invasive ranges of gorse in the Mount Lofty Ranges of South Australia and Sri Lanka

(Poster)

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Gorse (*Ulex europaeus* L.) is an extremely competitive invasive plant that displaces native biodiversity including agricultural wealth. Assessments of the phenology and soil seed bank of gorse are needed to understand the factors influencing their high reproductive efficiency and invasiveness. This study aims at understanding how certain traits of gorse contribute to its reproductive success in two climatically distinct regions in its invasive range, South Australia and Sri Lanka. Several traits, namely fruit:flower ratio, seed production, pod predation and the density of seeds in the soil seed bank were examined. Results suggest that the reproductive success of gorse in Sri Lanka, in terms of fruit:flower ratio, is less than that of gorse plants in South Australia. Results also suggest that gorse populations in Sri Lanka had higher seed numbers per pod compared with gorse in South Australia. Predation of pods was negligible in the study sites in both countries during the period of study. We observed significant differences in the density of gorse seeds in the top 5 cm layer of the seed bank between 3 m away from shrubs and under gorse shrubs. This estimated density of gorse seeds under shrubs in Sri Lanka was 2141 / m<sup>2</sup> which was 1.5 times higher than that of South Australia. The findings of this study provide some baseline information for managers to design programs for control of gorse. Also it reveals that the contributions of traits that influence the reproductive success of gorse could vary among countries in the invasive range.

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## Human, Wildlife and Climate Change Interaction in Upper Mustang, a Himalayan Region

(Poster)

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The global climate is changing. The impacts of climate change are being felt everywhere in a number of ways, but the most critical are likely to be those impacts that are threatening the life of flora and fauna. Fast receding glaciers in the Himalayas of Nepal have been a major concern, as they have been the prime source of water to more than a billion of people living in the Indo-Gangatic region.

The aim of this study is to understand and assess the interactions of human and wildlife with respect to climate change and to explore the adaptation strategies of local communities and wildlife of Upper Mustang which lies in Annapurna Conservation Area.

To address the research questions of this study, different methods were used to find out the answers. Impact assessment was performed through the analysis of meteorological data, data from Annapurna Conservation Area Project offices and people's perception on climate changes and adaptation strategies relative to wildlife occurrence in Upper Mustang. Mann-Kendall statistical trend and Excel test were used to assign statistical significance of the trend. Temperature and Precipitation trend of 30 years period from 1984-2014 was analyzed. With the view of accessing the actual impacts in study site, people's perception was studied through generalized questionnaire survey and focal group discussion of local people and staff of Annapurna Conservation Area Project were organized. Especially, older age people were given priority in questionnaire survey as they have got life long experience of change in environment.

The result showed that the Average Maximum and Minimum temperature was found increasing at the rate of 0.06°C and 0.03°C per year respectively. Increasing trend in the annual precipitation was found at the rate of 2.4684 mm per year. Increase in sporadic rainfall has caused unequal distribution of rainwater causing some places to become dry pocket areas and some with high level of rainwater. Community has identified new sources of drinking water and other adaptation measures. The occurrence of wildlife was found decreased. But because of the rise in awareness and enforcement of laws by governmental bodies, no official record of wildlife killings has been recorded for last few years. Also, the social and religious faith has played an important role in wildlife conservation. Over exploitation of vegetation with the use of new means of transportations and equipment has led to the loss of wildlife habitat and the farmers to give up their ages old yak and sheep herding occupation shifting towards easy cash occupation like tourism business.

On the basis, it is concluded that, climate change is real and has severe impacts on the livelihood of local community and on the wildlife movement. Further research could be undertaken to study the other factors associated with this issue.

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## Using citizen science data for a species recovery project for house martins in Swiss communities

(Poster)

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House martins are in decline in many western European countries. The reasons for the decline are poorly understood, but as a species placing their nest on the outside of buildings, the house martin strongly depends on human tolerance. Beside the general decrease in insect abundance, important causes for the decline thus are the disappearance of nests due to renovation or demolition of buildings, the diminishing acceptance of homeowners and inhabitants for house martin nests on buildings and a lack of loamy bare ground that offers nest building material where the birds are still welcome. As part of a long term species recovery project for the house martin, the Swiss Ornithological Institute started a web based citizen science project in 2013 to collect information on exact addresses of house martin colonies for conservation purposes throughout Switzerland. The data from this platform and from another large citizen science platform [ornitho.ch](http://ornitho.ch) were used to create an inventory of known locations with house martin nests. To enforce species conservation, each Swiss community harbouring house martin nests receives the inventory together with 2 new fact sheets: One is directed at home owners and inhabitants of buildings with nests and contains information about the breeding ecological of the species, the legal basis against removing nests and how to plan renovation work. The second is directed to the local governments and shows the possible conservation actions to be realized at the community level. The data of the inventory is available in a GIS-format and can thus easily be adopted by local authorities, ecologists, architects and developers during building development.

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## A highly-endangered species on the edge: distribution, habitat use and outlook for *Colias myrmidone* in newly established Natura 2000 areas in Romania.

(Poster)

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Romania is one of the last strongholds of the Danube Clouded Yellow (*Colias myrmidone*), which is the most critically endangered and rapidly declining butterfly species in Europe. Recently, three Natura 2000 sites were established for its conservation. Knowledge gaps of the ecology and the underlying drivers for decline and extinction of the species hinder the development and implementation of suitable management plans. Here, we approached this conservation dilemma from two perspectives. Firstly, we related *C. myrmidone* occurrence to habitat characteristics. Secondly, we investigated the social-ecological conditions in two Natura 2000 sites in Romania. We synthesize insights from these holistic investigations and derive management recommendations. Management in occupied sites contained a mixture of small-scale, extensively used parcels with larger extensively grazed pastures interspersed with other semi-natural elements. In general, people appreciated conservation efforts for the butterfly but were concerned about restrictions that may narrow their activities and their economic benefits. Locals observe and expect further land use changes in the area, which may threaten *C. myrmidone* in Romania. Fostering viability of humans and butterflies in Romania integrates scientific knowledge and people into management decisions. In our study areas, however, exclusively top-down approaches were applied in the past and functioning ways of co-management need to be established. Most importantly, the sustainability of *C. myrmidone* in Europe requires coordination with alternative EU-subsidy schemes and sufficient financial support for the maintenance of traditional and ecologically feasible management.

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## Transforming Wli Waterfalls into Ecotourism Adaptation Activity: The Threat of Climate Change.

(Poster)

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Wli waterfall, an ecotourism attraction, provides livelihood opportunities to many of the community members. Apart from human activities, climate change is expected to exacerbate stress on the waterfall in delivering socio-economic benefits to the people. On this basis, the study examined the likely impacts of climate change (variability) on availability (flow) of Wli Waterfalls, and determined the potentials of Wli waterfalls as an adaptation activity for sustainable development.

The study examined monthly data records for climatic variables (temperature and rainfall) from Ghana Meteorological Agency. This data was used to check reliability and consistency of the waterfall within the context and pattern of the climatic elements. Two variables in both climate elements were calculated and compared using total monthly rainfall (TMR) and the number of rainy days (NRD), while the monthly average number of high (AnH) and low (AnL) temperatures for two decades was analyzed to ascertain the degree of variability in the two periods to understand the figures and established trends *ex ante* for the Waterfalls.

By this approach, both rainfall and temperature which are independent variables in river fluxes revealed changes in rainfall distribution and temperature between 1970 – 1980 and 2000 – 2010 which could affect all year-round ecotourism practice, livelihoods, and adaptation options.

As part of the recommendations for a sustainable economic activity, local management of the resources, capacity building of managers, and regulating human activities around the waterfalls were suggested.

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## The impact of protected area network expansion on the conservation status of Finnish breeding birds

(Poster)

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Species extinction risk, often measured by the IUCN Red List status, is a widely used indicator for the state of biodiversity. Changes in the Red List status have shown alarming and rapid declines of biodiversity, both globally and in Finland. As an example, 45% of the 249 breeding bird species in Finland have been considered threatened (Red-listed) in 2015, compared to a significantly lower proportion 36,9% in 2010. Even though protected areas are considered to be a key strategy in halting biodiversity decline, there is limited evidence on the link between the establishment of protected areas and a reduction in extinction risk. The designation and management of protected areas represents a measurable financial cost, and this investment is often covered using public funds. As resources for nature conservation are limited, it is important to know if the investment in species protection truly yields the intended conservation results.

The aim of this study is to quantify the impact of protected area cover and spending in maintaining the conservation status of Finnish breeding birds. To do this, I use the Finnish Red List Assessments for birds in years 2000, 2010 and 2015. I have calculated the change in status for each species between assessments in years 2000-2010 and in 2010-2015. I have then calculated the increase in protected area coverage for each bird species' distribution since 1996 until 2010. For the public spending, I estimate how much money has been used to establish more protected areas per each species on a regional level. This information is based on data on regional protected area establishment spending provided by the Ministry of Environment. The expanded protected area coverage and the increased monetary investment in protection are then compared to the improvement or deterioration in the Red List status. Since species' extinction risk is explained both by species' average body mass and migration ecology, these will also be included in the analyses. Phylogenetic relatedness among species will also be considered.

Currently all the data has been gathered and the analysis on the increase of protected area coverage and monetary investment will be finished during spring 2018. My results will shed light on how the increased investment in protected areas might be linked to the conservation status of species.

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## Aquaculture and the conservation of wild salmon populations

(Oral)

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Aquaculture of Atlantic salmon is a highly successful industry that affects wild salmon populations in ways that threaten their genetic integrity and viability. We have identified a set of SNPs that distinguish between wild and farmed salmon, and developed a statistical method to quantify genetic introgression of escaped farmed to wild salmon. One half of 200 studied wild populations in Norway show significant introgression of farmed salmon in wild salmon (1). The level of introgression increases significantly with the proportion of escaped farmed salmon in the population over the last 25 years. Introgression affects several vital life-history traits of wild salmon. The age and body size at return of wild salmon to a river vary with the level of introgression, and differ between groups of populations having different phylogenetic origin and ecotype (2). Controlled experiments of families of wild and farmed salmon, and their hybrids, show differential survival between wild and farmed offspring in nature. Moreover, the experiments have uncovered some of the mechanisms that determine the fitness and effects of farmed offspring in the environment. Our study and an extensive literature (3) provide evidence that domesticated introgression has a strong effect on important biological characteristics of wild populations. We expect gene flow from other genetically altered domesticated animals to have similar effects on their wild conspecifics. The methodology used in these studies can serve as a model for how to quantify and understand effects on wild biodiversity of domesticating aquatic organisms.

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## Local biodiversity erosion in South Brazilian grasslands under moderate levels of landscape habitat loss

(Oral)

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Habitat loss is one of the greatest threats to biodiversity, causing negative effects on the biodiversity of natural vegetation remnants. Brazil's southern grasslands belong to one of the largest temperate grassland regions in the world and stretch over two biomes. 50% of their natural extent in Rio Grande do Sul, Brazil's southernmost state, has been lost in only 35 years due to agricultural expansion. To date, there is no empirical evidence for the effects of habitat loss on these grasslands' biological diversity, undermining their conservation.

Using data from a large-scale biodiversity survey, we asked here if local plant communities respond to levels of habitat loss representative of the entire region ( $\leq 50\%$ ). Vegetation in grassland remnants was sampled in 24 landscapes at three 70 x 70 m localities each, using 9 plots of 1 m<sup>2</sup> per locality. To investigate whether species losses were a consequence of stochastic or nonrandom local extinctions and whether plant communities became more homogenized in terms of spatial variation and lineages, we evaluated species richness, beta-diversity components (spatial turnover and nestedness), as well as phylogenetic diversity, in respect to landscape change. In part of the landscapes, arthropods were sampled to investigate if loss of plant diversity had a cascading effect on other trophic levels. We evaluated generic richness of ants, an omnivore group with high levels of plant associations, in respect to a plant community's phylogenetic diversity.

We found local plant communities to have fewer species, less spatial turnover, increased nestedness and lower phylogenetic diversity in landscapes with less grassland cover. Our results suggest that the observed species loss can be linked to taxonomic homogenization and is nonrandom, decreasing the evolutionary diversity within the community. Furthermore, ant richness declined by 50% in plant communities with the lowest phylogenetic diversity, suggesting effects of habitat loss propagate to higher trophic levels.

We conclude that the biological diversity of South Brazilian grasslands, both at the producer and consumer level, is at risk under the current rate of land-use conversion, even at habitat losses below 50%. To avoid substantial biodiversity loss, conservation and more restrictive policies for conversion of native grasslands to different land uses in South Brazil are urgent.



## Monitoring under the EU habitats directive

(Oral)

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The EU Habitats Directive was adopted in 1992 and requires site protection for selected habitats and species (listed in Annexes I & II), strict protection for selected species (Annex IV) and allows for management measures for some species (Annex V). Article 11 of the directive requires “surveillance of the conservation status of the natural habitats and species referred to in Article 2 [ie habitats and species listed on Annexes I, II, IV & V]) while Article 17 require Member States to report every six years – “This report shall include in particular information concerning the conservation measures referred to in Article 6 (1) as well as evaluation of the impact of those measures on the conservation status of the natural habitat types of Annex I and the species in Annex II and the main results of the surveillance referred to in Article 11”.

The directive requires the use of an agreed format, this did not happen for the first report covering the period 1994-2000 but for subsequent reports (2001-06; 2007-2012) an agreed format was used. This includes an assessment of ‘Conservation Status’ based on the definitions of ‘Favourable Conservation Status’ given in the directive together with supporting information on habitat area, population size, threats and pressures, conservation measures etc. Guidelines were published for each reporting cycle to try and ensure harmonisation between the countries and to allow aggregation of the reported data to give assessments of Conservation Status at an EU scale. Results from the last report are available in a report published by the European Environment Agency (EEA 2015) and show that most habitats and species are not at Favourable Conservation Status although there is much variation between groups and countries. This is not surprising as the habitats and species were mostly selected as they were thought to be threatened.

Although there are many issues with the resulting dataset, it provides the first EU wide dataset for habitats and for many of the species groups. The next report is due in 2019 and will cover the period 2013-2018. Revised guidelines have been published and the format slightly revised to try and address some of the problems identified in earlier reporting cycles. However for many species and habitats there is still a lack of information at national level, especially outside protected areas.

The Article 17 reports were a major input to the recent review of the Habitats Directive undertaken by the European Commission and were also used to help set some of the targets under the EU 2020 biodiversity Strategy. They have also been used an input for other work, including the recent Red List of European Habitats.

EEA (2015) State of nature in the EU. EEA Technical report No 2/2015, EEA, Copenhagen.

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## Approaches towards a European Monitoring of Biodiversity in Agricultural Landscapes

(Oral)

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The EU Biodiversity Strategy to 2020 aims to halt the loss of biodiversity and the degradation of ecosystem services in the European Union (EU). One major driver in the loss of biodiversity is the agricultural management in many European landscapes. There is a growing pressure that far more efficient biodiversity measures in a much wider extent have to be taken in order to achieve the aims of the EU Biodiversity Strategy. However, up to now an implemented monitoring of biodiversity in agricultural landscapes is widely missing. Thus the need for a robust and coherent monitoring methodology is apparent. Such a monitoring would also enhance the data availability for the biodiversity indicators used for the evaluation of European policy, e.g. the Common Agricultural Policy (CAP) and would help to specify detailed targets on national and regional levels.

For the development towards such a European monitoring approach the European Commission launched the project EMBAL ("European Monitoring of Biodiversity in Agricultural Landscapes") in 2017. In this approach a rapid assessment of the structure of the agricultural landscape and the state of farmland biodiversity was developed considering the results of a thorough analysis and elements of 13 existing monitoring approaches at national and European scale. Elements of the High Nature Value (HNV-) Farmland indicator (Peppiette et al 2012), the LISA-approach (IFAB 2015 / 2017) and other approaches in Europe (Herzog et al. 2016) were included in the new approach and a concrete manual was drafted and agreed on European level. A field test in five European countries has been carried out and the applicability of the drafted methodology could be approved. The EMBAL methodology is based on field surveys of plots with a size of 25 ha (500 x 500 m). The survey follows a three-fold approach: (1) an area survey (mapping), where parameters on agricultural parcels and landscape elements are recorded, (2) a vegetation survey based on transect walks, during which parameters of the vegetation and key species are assessed and (3) a photo documentation, which is a useful tool for the visual characterization of the plots as well as tracking change over time.

The presentation gives an overview on current approaches and the overarching EMBAL-approach. Further results of pilot investigations of the European monitoring of biodiversity are shown.

### Literature:

- Herzog, F. & Franklin, J. (2016). State-of-the-art practices in farmland biodiversity monitoring for North America and Europe. *Ambio*, 45(8), 857–871.
- IFAB (2015 / 2017). Landscape Infrastructure and Sustainable Agriculture (LISA). Reports from two European monitoring studies on farmland biodiversity. Available under [www.ifab-mannheim.de](http://www.ifab-mannheim.de)
- Peppiette, Z. et al. (2012): Approaches to monitoring HNV farming – EU-framework and country examples. Chapter 5.8 in Oppermann, R., Beaufoy, G., Jones, G., 2012 (eds.) High Nature Value farming in Europe. Ubstadt-Weiher. Pages 502-516.



Presentation cancelled by author



## Research of abandoned Tibetan mastiffs and interaction with local carnivores in Sanjiangyuan National Natural Reserve, Tibetan Plateau

(Oral and Poster)

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Between 2000-2012, a high market demand for Tibetan mastiffs stimulated dog raising in Tibetan Plateau but soon collapsed market led to abandonment of dogs. Due to high reproductive ability and adaptability, increased free-ranging dogs are emerging threat to local wildlife including snow leopards, which are an endangered and flagship species that helps maintain the health of whole local ecosystem. Because monks often offer food and shelters, the abandoned dogs tend to gather around monasteries, which are usually located in snow leopard habitats. Through assessing the density, distribution patterns, social structure, activity patterns, diets, and parasites of both free-ranging dogs and snow leopards, we found the former are potential predators, prey, competitors, and disease transmitters for the later. By working with communities and government, we identified sterilization and adoption would be feasible and optimal solutions and carried out early test in 2 villages.

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## Estimation of grasslands species diversity from their spectro-temporal heterogeneity using satellite image time series with high spatial and temporal resolutions

(Poster)

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Grasslands represent a significant source of biodiversity in farmed landscapes because of their plant and animal diversity. However, this biodiversity is threatened by the intensification of agriculture. It is therefore important for ecologists and conservation scientists to monitor biodiversity on large spatial scales. Satellite remote sensing constitutes a useful tool to inform biodiversity over large extents thanks to the broad spatial coverage of sensors. However, until recently, the study of grasslands in fragmented landscapes, such as found in Europe, has been limited because of sensors' low resolutions. Indeed, grasslands are rather small elements in the landscape which require a high spatial resolution to be detectable. New generation satellites offer new opportunities for grassland's monitoring because they provide combined high spatial and temporal resolutions images at no cost thanks to the ESA free data access policy. In remote sensing of biodiversity, the Spectral Variation Hypothesis (SVH) [1, 2] assumes that the spectral heterogeneity measured in the image is related to the spatial heterogeneity of the habitat the image represents. The diversity of species being related to the heterogeneity of the habitat [3], the spectral heterogeneity can be used as a proxy for species diversity [1]. In this study, we hypothesis that the grassland's species differ in their phenology and, hence, that the temporal variations measured from satellite image time series (SITS) can be used in addition to the spectral variations. We propose new spectro-temporal indices derived from SITS as proxies to estimate the species diversity in grasslands. Our method to assess the spectro-temporal heterogeneity is based on a clustering of grasslands using a robust technique [4] suitable for high dimensional data issued from SITS. We tested the method on 192 grasslands from southwest France using an intra-annual time series of 18 SPOT5 satellite images. The results show that our indices – the entropy and the intra-class variability – explain better the variance of the Shannon's index of grasslands than the commonly used Mean Distance to Centroid [2] that does not require an a priori clustering. However, there is no significant improvement when using the temporal variations in addition to the spectral heterogeneity. The results suggest that the temporal variations measured from SITS may be more related to the effect of management practices in grasslands. Limiting the SITS to a period when no management practices occur may alleviate this effect. We also suggest to extend the SVH to the functional diversity, by using functional traits related to the phenology of species to further exploit the potential of SITS issued from new generation satellites.

[1] M. W. Palmer, P. G. Earls, B. W. Hoagland, P. S. White, and T. Wohlgemuth. Quantitative tools for perfecting species lists. *Environmetrics*, 13(2) :121–137, 2002.

[2] D. Rocchini, N. Balkenhol, G. A. Carter, G. M. Foody, T. W. Gillespie, K. S. He, S. Kark, N. Levin, K. Lucas, M. Luoto, H. Nagendra, J. Oldeland, C. Ricotta, J. Southworth, and M. Neteler. Remotely sensed spectral heterogeneity as a proxy of species diversity : Recent advances and open challenges. *Ecological Informatics*, 5(5) :318 – 329, 2010. Special Issue on Advances of Ecological Remote Sensing Under Global Change.

[3] J. Wilson, S. J. Fuller, and P. B. Mather. Formation and maintenance of discrete wild rabbit (*Oryctolagus cuniculus*) population systems in arid Australia : Habitat heterogeneity and management implications. *Austral Ecology*, 27(2) :183–191, 2002.

[4] C. Bouveyron, S. Girard, and C. Schmid. High-dimensional data clustering. *Computational Statistics & Data Analysis*, 52(1) :502 – 519, 2007.

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## Threatened birds, dynamic habitats and disturbance processes – conservation biology in one of the worlds most understudied savanna ecosystems

(Oral)

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The Beni savannas of Northern Bolivia are one of the world's most remote, understudied and threatened grassland ecosystems. Here, vegetation dynamics are driven by complex interacting environmental and agricultural disturbance processes, including flooding, fire and cattle grazing. In turn, the distribution of bird communities is shaped by how these processes influence prevailing vegetation composition and structure. We explore how the distribution and habitat use of avian grassland specialists is influenced by habitat structure and disturbance history along the cerrado-grassland gradient with focus on three key conservation species, *Alectrurus tricolor* (cock-tailed tyrant), *Coryphaspiza melanotis* (black-masked finch, and *Emberizoides herbicola* (wedge-tailed grass-finch). Our results indicate that: i) Cock-tailed tyrants specialize on specific disturbance-sensitive micro-habitats within the cerrado-grassland ecotone, while black-masked finch and wedge-tailed grass-finch are generalists but track available food resources that may be influenced by the timing and severity of disturbance processes; ii) Black-masked finch and cock-tailed tyrants have greater sensitivity to grazing pressure and agricultural fire-management than the more common wedge-tailed grass-finch – a factor likely contributing to their current high rates of global decline; iii) Prescribed burning is integral for the conservation of avian communities within this region, but scale, timing and frequency are likely important considerations due to their influence on key habitat resources; and iv) Management within protected areas that aims to retain a range of post-burn stages in a shifting mosaic could help to support wider avian communities. Our study develops a better understanding of how disturbance processes influence biodiversity in this understudied region. Our results will be critical for strengthening management protocols in protected areas like the Barba Azul Nature Reserve, and will help inform more sustainable approaches to agriculture in the wider Beni Savanna region.

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## Inaccessibility determines primary forests distribution in the Western Carpathians, but their future is not guaranteed

(Oral)

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Currently, most forest landscapes are intensively managed and primary forests around the world are disappearing rapidly with strong negative impacts on biodiversity. However, national inventories of primary forests and consistent methodology to conduct these assessments are absent, which results in further loss of these unique ecosystems. We developed a comprehensive methodological approach to identify primary forests, and we conducted a complete national inventory within the territory of Slovak Republic (49,036 km<sup>2</sup>). We analyzed the primary forest distribution pattern and studied whether the last primary forests represented all types of potential forest vegetation. We also evaluated the area of primary forests destroyed and endangered by logging in the last decade.

We identified 10.282 ha of primary forest remnants, which represent 0.47% of the total forested area and only 0.2% of the entire landscape. The distribution of primary forests was clustered. Primary forests were preserved in relatively higher elevations, steeper slopes, and undulating terrains (contrast relative relief). They were located in greater distances from roads and settlements compared to other forest habitats. Primary forests did not represent all types of the potential natural vegetation. Several habitat types are completely missing (e.g., flood plain forests).

Despite the small total area of these valuable primary ecosystems, more than 30% of them are directly endangered by logging. Between 2009 and 2017, logging occurred on 27 localities, and 144.53 ha of primary forests was destroyed, mainly by the salvage logging. Primary forests are exposed to an increased pressure of rapidly developing forest management technology and forest product demands. Road construction increases accessibility in mountain areas that have been largely protected due to their inaccessibility for centuries. Protected areas, such as national parks or NATURA 2000 sites, do not ensure conservation of primary forests, and alarmingly 90% of logging in primary forests was conducted in national parks. Our extensive study highlights the ineffectiveness of protected areas in Europe and the importance of national primary forest inventories; we recommend the inclusion of European primary forest conservation strategies to stop the rapid loss of the last primary forests and their unique biodiversity.



## Old Growth Forests in the Ukrainian Carpathians: Criteria and Indicators, identification methodology, and results up-to date

(Oral)

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Historically, identification and conservation of OGF remnants in the region has undergone several stages:

- 2006-10 – pilot application of the OGF concept within the High Conservation Value Forests identification (FSC certification mainly);
- 2008-12 – pilot field works on the Old-Growth Forests (OGF) identification in Ukrainian Carpathians;
- 2012 – harmonized C&I for OGF identification in Maramuresh part of the Carpathians (RO / UA) developed;
- 2012 - now – large-scale field identification;
- 2014 – the OGF C&I above used as a basis for the Virgin Forest C&I by the Carpathian Convention, see: [http://www.carpathianconvention.org/tl\\_files/carpathiancon/Downloads/03%20Meetings%20and%20Events/COP/2014\\_COP4\\_Mikulov/Follow%20Up/DOC13\\_Criteria\\_Indicators\\_virginforests\\_FINAL\\_26SEP.pdf](http://www.carpathianconvention.org/tl_files/carpathiancon/Downloads/03%20Meetings%20and%20Events/COP/2014_COP4_Mikulov/Follow%20Up/DOC13_Criteria_Indicators_virginforests_FINAL_26SEP.pdf) ;
- 2017 – framework Law on the Protection of Virgin, Quasi-Virgin, and Natural Forests approved in Ukraine;
- 2018 (?): incorporation of the C&I and the Methodology into the Ukrainian national legislation.

Criteria and Indicators in brief: Minimum area (20 ha); Form (plot /massif width, regardless of its length, cannot be less than 200 m); Species composition according to the native forest type; Stand structure (mosaic, vertical and horizontal); relevant presence of Dead wood; Human interventions are negligible.

Identification methodology comprises 3 stages:

- Preparatory: plots of potential virgin or old-growth forests are selected using forest management database;
- Field identification: each parcel is inspected for corresponding to the C&I listed above at inventory points representatively covering the entire area of the parcel.
- Final: results of the field work are analyzed, status of each plot is identified, and the GIS-associated database compiled

As of 01.01.2018, around 90 thousand ha of OGFs in the Ukrainian Carpathians were identified in the field. Map of the plots identified and their descriptions can be found at: <http://gis-wwf.com.ua/> .



## Do cultural taboos conserve wildlife?

(Oral)

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Several contesting claims exist about the role of indigenous communities in wildlife conservation. Although cases of local conservation behaviour have been documented, focus has now shifted from labeling indigenous people as guardians or exploiters to identifying socio-political factors leading to local conservation within the broader context (Smith and Wishnie 2000)<sup>1</sup>. We empirically tested the effectiveness of cultural norms, especially hunting taboos, in regulating hunting in Idu Mishmi community of Northeast India. Idus harvest large-bodied animals under strict taboos linked to the notion of cosmic retribution. We combined the anthropological framework on hunting and ritual (Valeri 2000)<sup>2</sup>, with a quantitative analysis of wild meat consumption to understand the interaction between ritual practices and wealth on wild meat consumption patterns (Brashares et al. 2011)<sup>3</sup>. Monthly data were gathered on wild meat consumption, hunting activity and observance of taboos with a representative sample of 90 households from January to September 2014. These variables were modeled as a function of household wealth, education, ethnicity and seasonality using a mixed-effects framework. Results show that rich outsiders and wealthiest among the Idus consumed considerably more wild meat than others. Observance of taboos was stricter in Idus of lower wealth classes and with lower levels of education. Though taboos apply to anyone who consumes wild meat, they are stricter and longer for the hunter. Wealthier Idus bought meat from the less wealthy thereby using wealth to transfer the burden of taboos over to the poor. Combined with long-term qualitative data and animal density estimates from camera trap studies, we show that in this situation cultural restrictions do impact hunting. However, taboos are less effective when the society is linked to wider market economy as is the case with wealthier Idus. Finally, I argue that Idu hunting taboos do not work in isolation, rather all cultural restrictions are connected to one another and are fundamental in the making of Idu identity. This research contributes to debates on making conservation more relevant and effective by incorporating complex dimensions of human-nature relations.

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Presentation cancelled by author



## Perceptions of multiple stakeholders of the role of urban greenspaces in providing ecosystem services and disservices in fast-growing cities of Sub-Saharan Africa

(Oral and Poster)

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Abstract of this presentation is not public



## Space use data and systematic conservation planning inform habitat conservation priorities for brown bears in Romania

(Oral)

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Recovery of large carnivores in the European human-dominated landscapes has sparked a debate regarding the optimal landscape conditions in which carnivores can thrive and coexist with humans (López-Bao et al. 2015). Here, we use brown bears (*Ursus arctos*) in the Romanian Carpathians to test and develop a framework for identifying habitat conservation priorities based on a novel integration of resource selection functions, home range data, and systematic conservation planning (Pop et al. 2018). We used a comprehensive GPS telemetry dataset from 18 individuals to (1) calculate sex-specific seasonal home ranges, and (2) characterize population-level habitat selection. We then used systematic conservation planning software Zonation to identify contiguous areas of high conservation value for males and females by using Manly's habitat selection ratios as weights for habitat layers, and home range information as a smoothing parameter for habitat connectivity. Home ranges were smallest during winter (median [IQR] for November-February: 28.2 km<sup>2</sup> [9.8-42.4]), and largest during the intense-feeding season (September-November: 127.3 km<sup>2</sup> [62.2-288.5]), with males having larger home ranges across all seasons. Females consistently selected for mixed forest habitat during all seasons. Males selected mixed forest during winter; then switched to a rather generalist approach, selecting regenerating forest, and mixed and coniferous forests during low-feeding/reproduction and wild berries seasons. We identified large tracts of forest habitat (~14% of the landscape) that was selected across all seasons as key habitats for brown bear conservation in the Eastern Carpathians. Spatially, high-value winter habitat was the most dissimilar for both males and females, suggesting that conservation actions should focus on protecting contiguous denning habitat. These key findings can inform the management and conservation of the brown bear population in the Romanian Carpathians, currently plagued by high uncertainty in management outcomes (Popescu et al. 2016) by identifying critical intervention areas for maintaining landscape connectivity, enable transboundary management, and contribute to maintaining Favourable Conservation Status, an important target of European Union Strategy for Biodiversity.

1. López-Bao, J.V., Kaczensky, P., Linnell, J.D.C., Boitani, L. & Chapron, G. (2015). Carnivore coexistence: Wilderness not required. *Science* 348, 871–872.

2. Pop, M. I., R. Iosif, I. V. Miu, S. Chiriac, L. Rozyłowicz, and V. D. Popescu. 2018. Combining resource selection functions and home range data to identify habitat conservation priorities for brown bears. *Animal Conservation*. in press

3. Popescu, V. D., K. A. Artelle, M. I. Pop, S. Manolache, and L. Rozyłowicz. 2016. Assessing biological realism of wildlife population estimates in data-poor systems. *Journal of Applied Ecology* 53, 1248-1259



## Four study years on the nest site use of the Great Spotted Woodpecker - the role of two invasive tree species in riparian forests

(Oral)

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The study has been carried out 2014-2017, in Hungary, in the Central Tisza Landscape Protection Area, in two, approximately 40-50 ha, old, unmanaged softwood willow-poplar gallery forests on the bank of the river Tisza. Two North American invasive tree species that are widespread throughout Central Europe are present in great numbers in the two study areas. One is the green ash (*Fraxinus pennsylvanica*), the other is the boxelder (*Acer negundo*). The invasion of these tree species is a significant environmental problem, as the two species hinder the development of native riparian tree species.

I studied the nest site characteristics of the generalist Great Spotted Woodpecker (*Dendrocopos major*). The study areas were differed in terms of the proportion of invasive tree species. Both species are the two most frequent ones at both areas, though these species are present at the second area with much greater proportions. The questions of the study were: Which arboreal characteristics could predict the nest site occupation of the studied woodpecker species? Were the used nest sites differed between the structurally different study areas? What were the preferred characteristics of the nest trees?

Nest trees were mapped following the calls of the chicks in four breeding seasons in both areas. Data on arboreal vegetation were collected in 0.05 ha circular plots. Nest site plots were centred at the position of nest trees, habitats were measured with circular plots centred on a 100 by 100 m semi-random grid. Species, diameter at breast height and condition (living, decaying or dead tree) were recorded for each tree that had a diameter at breast height, greater than 3 cm. Continuous variables were extracted from raw data. Principal Component Analysis and Generalized Linear Models were used for the analyses.

Comparing to semi-random sites, nest sites had more native and less invasive trees and more willow and less boxelder trees. Both group of nest sites represented more green ash trees than semi-random sites. The differences between nest sites of the two area reflected the main differences between semi-random sites of each study area, as the second area had more native and less boxelder trees. Nesting cavities were mainly made in decaying or dead willow and white poplar trees, their diameter at breast height were between 30 and 90 cm.

I feel confident to predict that the further decrease of autochthonous tree species may influence these habitats negatively. As major cavity excavators, the study species could play key role in such transformed communities, these changes would have significant effects on cavity dependent species. As nowadays, these tree species support the essential under- and midstorey layers, the control of their mixed-age stands could even cause harm to the ecosystem processes. Adaptive management strategies should be made, to secure the current processes of such ecosystems, while conserving the native forest communities as much as possible.

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## Habitat overlaps between red panda (*Ailurus fulgens*) and Asiatic black bear (*Ursus thibetanus*) in Himalaya

(Oral)

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Nepal is rich in biodiversity due to variability in elevation from 67m to Mount Everest. Out of 20 protected areas, government of Nepal has established 11 protected areas in Himalayan region of the country. Information on habitat preference and distribution of most of the wildlife species is lacking due to lack of the scientific study about the habitats of the animals. Studies to explore the relation between more animals are very limited. Government of Nepal and others conservation partners are feeling difficulties to manage the wildlife in their natural habitat due to lack of scientific and reliable information on their habitats. Habitat overlap survey can be the best study to identify the relation between the two species so the conservation of one animal can benefit the other one. In this study we identify important habitat parameters and overlapped habitat of the red panda (red cat bear; *Ailurus fulgens*) and Asiatic black bear (*Ursus thibetanus*) by the help of Maximum Entropy (MaxEnt) modeling in the Makalu Barun National Park, Nepal. GPS points of the species occurrence were collected from field and environmental variables were extracted from freely available sources. We identified the topographical and anthropogenic variable as best predictor of the distribution of the both species. The study area covers the 644 km<sup>2</sup> habitat of Asiatic black bear and 534 km<sup>2</sup> habitats of red panda. The 440 km<sup>2</sup> habitat of both species is overlapped, which is 82 % habitat of red panda and 68% of habitat of Asiatic black bear. Most of the habitats are located inside the Buffer Zone of the National Park so the effective conservation work should be focused inside the Buffer Zone for the conservation of both species.

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Presentation cancelled by author



## Impacts of fire in active and passive restoration on the boreal forest soil and vegetation

(Oral)

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Abstract of this presentation is not public

Presentation cancelled by author



## The significance of knowing how knowledge performs

(Oral)

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Scientific knowledge is performative, as it not only represents but also constitutes reality. In politically charged fields such as environmental policy and governance, science-policy interactions are often integrated into the scientific process. It is therefore important to articulate the details of how knowledge performs its power. The articulation should be sensitive to the self-reflexive character of knowledge. It makes a difference in science-policy interaction whether those who engage in the interaction know how knowledge is performative. My aim in this presentation is to develop an account of the process of science-policy interaction that recognizes the self-reflexive nature of human knowledge. I identify analogical relationships between science-policy interactions on one hand and the workings of distributed cognition in Shakespearean theatre on the other. I illustrate the account empirically by explaining the outcomes of science-policy interaction in European research policy and Finnish energy policy. The work conceptualizes an inherent dilemma in contemporary calls for socially relevant research. While research funders demand researchers to be policy relevant, the best option for researchers who understand the process of science-policy interaction may sometimes be not to intervene in policy and thus appear to be insensitive to the funders' demands.

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## Data for conservation: GBIF supporting conservation science and its application

(Oral)

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The need for evidence-based conservation remains of vital importance in achieving targets as set out by the Convention of Biological Diversity. The Global Biodiversity Information Facility (GBIF) is an open-data research infrastructure funded by the world's governments and aimed at providing anyone, anywhere access to data in standardised format about all types of life on Earth. Since its inception, there has been a rapid increase in the amount of available data, covering a breadth of taxonomic groups and temporal and geographical scales (GBIF, 2017a). A range of source data are standardised in line with the Darwin Core and Ecological Metadata standards and published as one of four dataset types – each one becoming progressively richer, more structured and more complex. GBIF thus acts as both a source of species-related data and a vehicle to ensure that data generated through research and its associated organizations are available for discovery, access and re-use in future research with full attribution through citations.

With its wealth of primary biodiversity data, GBIF is uniquely placed to contribute data relevant for conservation and, there is a growing body of research, both theoretical and applied, that is making use of this data (GBIF, 2017b, c). As of January 2018, of nearly 3000 research papers citing use of GBIF as a data source, 403 (14%) relate to conservation. In addition, there is clear need for the development of training and tools for the use of GBIF-mediated data amongst biodiversity professionals with an increased global demand for data-driven conservation practice and decision making. The presentation aims to highlight how researchers are using GBIF-mediated data within conservation biology, and GBIF activities that support the use of GBIF-mobilised data, notably through its BID programme.

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Presentation cancelled by author



## Conditions for sustainable human societies

(Oral and Poster)

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All populations, including humans, are sustained by fluxes of energy and materials from a finite environment. Physical constraints on biological design result in ubiquitous and predictable "allometric scaling laws" (Brown et al. 2004), pervasive in ecological theory. However, unique to the human species is its capacity to harness extra-metabolic energy in the form of renewables and fossil fuels to power the development of more complex societies, from agricultural and industrial to modern technological lifestyles. We use ecological theory to compare variation in densities and individual energy use in human societies (varying in societal complexity) to other land mammals. We show that societal complexity (from hunter-gatherers to modern cities) not only associates to greater energy fluxes (both per capita and at a population scale), but also allows escaping from ecological laws. Moreover, densest cities across the globe flux greater energy than net primary productivity on a per area basis, becoming sinks. This condition poses formidable challenges for establishing a sustainable relationship on a finite planet. In an attempt of evaluating sustainable conditions of such demands, we developed a mathematical model, coupling human population growth, the benefits they obtain from the natural system or "ecosystem services" and technological development. In our model, high population numbers attaining basic standards of living can only be sustained under "clean technology" (technology capable of having a net positive impact on ecosystem services flow compared to their consumption). Otherwise, those numbers signify the establishment of "mad-max" scenarios (sensu Costanza 2000), with societies attaining less than basic standard of living conditions or the acceptance of inequalities. A rapid shift to clean technology to power modern societies, is necessary now more than ever



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## Protecting Forests in Sweden: Biological, Social and Climatic Implications

(Oral)

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Nature and people are being exploited all over the world, not least in Sweden. The forest and ancient traditions rooted in the Scandinavian taiga are now under hard pressure from the logging industry. Sweden is still far from reaching the Nagoya Aichi targets, having only 5% of formally protected forest as compared to the 17 % target. Especially the old growth forest in the north of Sweden is under great threat, even if it has belonged to the indigenous people of Sweden for hundreds of years. This is a form of ongoing colonization legitimized by the State. Even today, Sweden's ambition level is low when it comes to its native people. Sweden has still not yet ratified, in contrast to Norway, the most important international convention on indigenous rights, the ILO Convention 169 on Indigenous and Tribal Peoples. Unlike Finland, Sweden has not even recognized in the Constitution status of its native people as original inhabitants of the land. Compliance toward the logging industry and not recognizing indigenous people and their livelihoods also have harsh environmental consequences, as clear-cutting releases large volumes of greenhouse gases. Forests need to be protected for their biological, social and cultural values, recognizing that resilient forest ecosystems will be necessary to mitigate and withstand climate change.

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## Self-evaluation and Declaration of ICCAs in Spain: a Community-led Peer-review Process

(Oral)

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ICCAs is a term widely used to indicate areas and territories conserved by local communities and indigenous peoples, for example, by the IUCN, the Convention on Biological Diversity or United Nations. The ICCA Registry, a database maintained by UN-Environment - World Monitoring Conservation Centre enables indigenous peoples and local communities to list their conserved areas at international level. This provides an opportunity for indigenous peoples and local communities to contribute to a better understanding of the global extent of conserved areas, their importance for conservation, and the challenges that local communities face in defending their territories and livelihoods against diverse threats.

There is consensus that local communities and indigenous peoples themselves should drive the process of assessing at national or regional level what areas and territories meets the ICCA definition, through a peer-review protocol outside of government or NGOs interferences, as a prerequisite for the registration. An example of such a protocol was developed by the ICCA Consortium and Iniciativa Comunes — an association of communities governing commons in Spain — for Spain, finally approved in June 2016. In the Spanish protocol, each candidate ICCA is subjected to a review by several anonymous representatives of other ICCAs similar in terms of geography and sector. In this way, vested interests related to self-declared areas that do not meet the ICCA definition (e.g. does not achieve relevant biodiversity conservation goals) can be kept in check. The custodian communities as a collective are empowered to assess and take responsibility of the conservation efforts, as well as to maintain the quality of the data of the submissions. Given the fact that, only in Spain, there are several thousand of areas that could easily meet the ICCA definition, this process open the door of a more sustainable, democratic and effective conservation approach. The same process is currently being putting in place in Iran, Philippines and Taiwan, among other countries.

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## Effectiveness of protected areas in preventing rubber expansion and deforestation in Xishuangbanna, Southwest China.

(Oral)

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Protected areas (PAs) are key refuges for the world's remaining biodiversity, especially in the species rich tropics. However, the tropics also support high human population densities. Xishuangbanna supports a disproportionate fraction of China's biodiversity (~25 %) within only 0.2% of China's land surface area. With the increasing demand for natural rubber in China, rubber plantations have expanded rapidly within Xishuangbanna (by 153.4 km<sup>2</sup> y<sup>-1</sup>). By 2010, they occupied 22.1% of its land surface area and were encroaching on PAs. We studied the degree to which PAs in Xishuangbanna were successful in preventing rubber expansion and other non-conservation land uses within their boundaries. We used matching methods to minimize bias due to PA location and to compare land use conversion rates. Matching analysis found that between 1988 and 2010, approximately 11 % of PAs land area was deforested, at a rate of 10.7 km<sup>2</sup>yr<sup>-1</sup>. This is significantly higher than the deforestation rate of 9.3 km<sup>2</sup>yr<sup>-1</sup> that would be calculated by applying conventional analysis techniques. PAs were shown to be less effective than had previously been thought.

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## The effects of partial cutting in black spruce-feather moss bioclimatic domain on hydromorphic soils<sup>2</sup>

(Oral and Poster)

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The goal of this project was to study the hydrologic, ecological and dendrometric processes that occur after a partial cut on hydromorphic soils in north-western Québec. Partial cuts are good to mimic the natural disturbances of the boreal forest such as insect outbreaks, windthrow and fire. To this day, there is no better option to recreate the irregular structure that characterizes the naturally disturbed forest stands. We also think this type of forest management is still under use in Canada, especially in Québec we want to give strong arguments in its favour. This idea is part of the concept of ecosystem-based management which is part of the main guidelines of the forest management in Québec. In western Québec, the management must compose with water saturated and cold soils. In this context, we wanted to link water table variations to the radial growth of the black spruce (*Picea mariana* Mill). A better knowledge of this dynamic will provide useful information to evaluate all the outcomes and the feasibility of the partial cut. When we use the conventional harvesting method in this environment, we face problems such as maintaining stand productivity. In our case, we also want to see if we can mitigate the rise of the water table after a cut on hydromorphic soils. We expect that a rapid rise of the water table will be the driving factor of the low productivity and the regeneration problems.

key word: boreal forest, ecosystem-based management and hydrology.

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UNIVERSITY OF JYVÄSKYLÄ



## Understanding and governing spillovers and leakage

(Oral)

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The session's goal is to progress on measuring, quantifying, understanding and developing solutions to address the conservation threats related to telecouplings, such as those embodied in trade flows. This presentation discusses one specific type of linkage between distant places, i.e., land-use spillovers defined as situations where land-use changes or interventions on land use (policy, program, new technologies...) in one place result in effects on land use in another place. We highlight leakage as one specific form of spillover caused by a land-use intervention, such as an environmental conservation policy, which triggers land-use change elsewhere, thereby reducing the overall benefit of the local intervention. We present a recent theoretical effort synthesizing the different pathways of some major forms of spillovers including leakage, and the conditions under which these different pathways may occur. We then discuss current operational advances in improving the tracking and transparency of supply chains in order to possibly identify and respond to leakage, and discuss how such transparency efforts may deliver on improving the sustainability of international supply chains of agricultural commodities. We then discuss how these concepts help understand movements of supply chains and land-use changes in Southern Africa. For that purpose, we present remote-sensing based maps of land-cover and land-use changes in Northern Mozambique, and relate these maps to telecoupling flows of agricultural and forestry products trade and financial investments from and to Mozambique, and to spatially-explicit data on protected areas, land use policies and different land tenure.

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Presentation cancelled by author



## **Towards sustainable human-wildlife coexistence: a social-ecological systems framework for ecosystem disservices and services (SEEDS)**

**(Oral)**

**Silvia Ceausu<sup>1</sup>✉, Rose A. Graves<sup>2</sup>, Alexander K. Killion<sup>2</sup>, Jens-Christian Svenning<sup>1</sup>, Neil Carter<sup>2</sup>**

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Abstract of this presentation is not public





## Bio-economic models to design viable agri-environmental schemes in France

(Oral)

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Significant declines in farmland biodiversity have been reported in Europe for several decades. Agricultural changes have been identified as a main driver of this erosion. Although different agri-environmental schemes have been implemented, their positive role on biodiversity remains in question. This raises the question as to how to reconcile farming production and biodiversity conservation in order to operationalize a sustainable and multifunctional agriculture. To deal with such issues, the present paper proposes a bio-economic model and an analysis based on a co-viability perspective. The co-viability approach intends to extend the Population Viability Analysis to bio-economic risk. The model couples stochastic dynamics of both biodiversity and farming land-uses selected at the micro level with public policies at the macro level based on financial incentives (taxes or subsidies) for land-uses. The co-viability approach makes it possible to evaluate bio-economic risks for these public incentives through the probability of satisfying a mix of biodiversity and economic constraints throughout time. The model is calibrated and applied to metropolitan France at the SAR (small agricultural regions) scale using a community of 34 common birds. We identify different public policies and scenarios with tolerable agro-ecological risk on the time horizon 2050. Our results suggest that some combinations of taxes on cereals and subsidies on grasslands could be relevant to develop a multifunctional agriculture. Moreover, the flexibility and multi-criteria viewpoint underlying the approach can be fruitful for decision makers in the context of adaptive management.

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## Marine Cadastre, Marine Spatial Planning and Marine Strategy: Effective tools to fight climate change and human impact on marine biodiversity.

(Oral)

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The Marine Spatial Planning Directive (Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014) refers to the process of allocating or developing a public allocation plan to distribute, spatially or temporally human activities (human impact) in marine areas.

By creating a framework for consistent, transparent, sustainable and evidence-based decision-making, Maritime spatial planning surely will contribute to the effective management of marine activities and the sustainable use of marine and coastal resources. Therefore, climate change can be fought if human impact on marine and coastal areas is prevented accordingly.

In this regard, by implementing a solid Marine Strategy Framework using satellite imagery data obtained using remote sensing techniques and creating Marine Cadastral Areas, ocean biodiversity could be given a chance to rebound from human impact.

At the moment, the escalating Human impact on marine mammals and marine life, in general, is brutal: Hunting, extermination programs, climate change, spread of diseases and exotic species illegal trade, deforestation, habitat fragmentation, urbanization, desertification, overfishing (depleted fish populations between 50 and 90%), overharvesting, altering food chains and marine mammal migration patterns, less sea ice (decline in seal and polar bear population) are taking us to disaster if things do not change.

We might face an unbearable marine extinction if triggering factors do not refrain from rising: Abrupt carbon isotope rising patterns / Ocean acidification (ongoing decrease in Earth's oceans pH (- 0.1), caused by the uptake of carbon dioxide (CO<sub>2</sub>) from the atmosphere is notorious. If 450 ppm is reached the then = point of no return)?. 30% Increase in Hydrogen. 2040 estimate deadline.

Humankind shall act now, tomorrow might be too late for some species.

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## Trade-off between economic performance and ecosystem service provision - Overview of modelling approaches

(Oral)

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„Trade-off between economic performance and ecosystem service provision - Overview of modelling approaches“

This contribution intends to give an overview of various approaches to model, identify and estimate possible trade-offs between economic performance and the provision of ecosystem services at field, farm or sectoral level. Different current modelling approaches (as e.g. microeconomic, linear programming based deterministic, biophysical, spatially explicit or land activity based) are reviewed and compared with respect to aim, structure, components, data needs, conclusions etc. Exemplary applications are provided as well as a concrete empirical application based on the production economic motivated multi-output distance function related modelling approach using microeconomic techniques at farm level.

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## Genome sequencing and SNP genotyping for the conservation and management of the Scandinavian wolverine population

(Oral)

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Maintaining and monitoring genetic variation in natural populations is of crucial importance for conservation and management. Reductions in genetic diversity may have short term consequences in terms of increased inbreeding depression as well as long term effects by reducing the evolutionary potential of the population and decreasing the resilience against environmental change. With the developments in high throughput sequencing and genotyping it has now become possible to identify and monitor adaptive and neutral genetic variation at a genome-wide scale. Scandinavian wolverine (*Gulo gulo*) populations are subjected to habitat fragmentation and high mortality from poaching due to conflicts with livestock herders. Genetic monitoring is already an important part of the conservation programmes for this population, but the resolution and applications of genetic data have been hampered by a lack of genomic tools. Our wolverine genome assembly and re-sequencing analyses revealed a genetic diversity among the lowest ever detected in a red-listed population. Demographic analyses indicate that there has been a long-term decline of the effective population size, starting well before the last glaciation. We also found strong genome-wide signatures of inbreeding, but this effect was not observed when analysing a set of highly variable SNP markers for extended genotyping, illustrating that such markers can give a biased picture of the overall character of genetic diversity. Population genomic analyses revealed significant population structure with implications for connectivity and conservation. We used an integrated microfluidic circuit chip technology to develop an SNP-array consisting of 96 highly informative markers that, together with a multiplex pre-amplification step, was successfully applied to low-quality DNA from non-invasively collected scat samples. This work will facilitate management, conservation actions and genetic monitoring of wolverines, and also serves as a genomic roadmap that can be applied to conservation monitoring of other endangered species.

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## Targeting conservation interventions. Understanding drivers of adoption of Wildlife Management Units (UMAs) in Mexico

(Oral)

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This study focuses on the Wildlife Management Units in Mexico (UMAs), a market-based policy instrument with coupled objectives of biodiversity conservation and rural development through the sustainable use of wildlife. UMAs have been a success story in terms of number of registrations at the national level, but adoption is unevenly distributed across the rural community in Mexico.

We use diffusion of innovation theory - the study of how, why and at what rate ideas and practices are adopted by individuals, groups, organizations, or countries [1]- as the theoretical framework to understand drivers of adoption of UMAs by the rural community in Mexico. We ask: what are the characteristics of UMAs that facilitate or hinder adoption of UMAs?; and do those characteristics vary depending on the target population? We triangulate information from three complementary sources: quantitative information from existing government statistics, qualitative information from a review of relevant literature, and qualitative information from semi-structured phone interviews with key informants. We use general elimination methodology (GEM) [2], a theory-based qualitative evaluation method that seeks to understand the social processes behind the observed outcomes. Theory-based qualitative evaluation methods have been developed in other fields to address attribution of cause and effect when sample sizes are small or there is limited baseline data [3]. Following GEM, we first identify as many as possible alternative explanations or factors influencing adoption of UMAs by reviewing available literature. We then interview key informants from expert groups involved on adoption and implementation of UMAs (e.g. government, NGOs). Finally, we systematically assess whether there is evidence to either validate or rule out each of the possible alternative explanations gathered from the interviews.

The results of this research help diagnose the issue of uneven distribution of UMAs across the Mexican rural community, guiding further research on UMAs adoption. This type of research enables practitioners to tailor UMAs to the target population and scale-up conservation through the sustainable use of wildlife where is most needed, and empowers conservation decision makers to achieve their policy objectives. We also hope to spark new directions in conservation research, highlighting the social processes that drive adoption of UMAs by using both an alternative theoretical angle and an innovative methodology within the conservation field.

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## In the shadow of coral bleaching

(Oral)

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Coral reefs are highly susceptible to climate change, as evidenced by extensive mass bleaching events over the past decades. Until solutions to reduce greenhouse gas emissions are implemented, pro-active unconventional approaches to conserve local reefs are required. Here, we demonstrate a management strategy aimed at reducing the magnitude of bleaching events over designated reef sections (thousands of square meters). Since high levels of solar irradiance induce coral bleaching, our goal was to technically test the feasibility of shading a shallow reef at the "Japanese Gardens", the highest-value reef in the Eilat Coral Nature Reserve (Israel, Red Sea). In practice, a buoyant shade cloth of 400m<sup>2</sup> was deployed on the sea surface over the shallow reef (ca. 6m deep) for a 24-hour period and irradiance, as well as water temperature, were continuously monitored in the shaded and the unshaded reef. The deployment was successful and was completed without causing any physical damage to the reef. In addition to decreasing the irradiance by 85.9% in average, the shade cloth eliminated wave lensing, which produces extremely high irradiance levels and is known to contribute to coral bleaching. Surprisingly, we also found that the water temperature on the shaded reef was up to ca. 0.5°C lower than on the unshaded reef. We propose that the reef shading management strategy can be applied to reefs worldwide and may be particularly valuable on spatially isolated locations. These "islands" of survivors may possibly function as source populations and accelerate the recovery of the destroyed region.

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Presentation cancelled by author



**The manipulation of habitat usage of the white rhinoceros *Ceratotherium simum* to reduce poaching risk through the design and evaluation of novel deterrent-based techniques.**

**(Oral)**

**Samuel Penny<sup>1</sup>✉, Angelo Pernetta<sup>1</sup>, Rachel White<sup>1</sup>, Dawn Scott<sup>1</sup>**

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Abstract of this presentation is not public




Presentation cancelled by author



## New study reveals a lack of social marketing skills in the conservation sector.

(Oral)

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Abstract of this presentation is not public

Presentation cancelled by author



## Changes in wildlife temporal niche should concern conservationists

(Oral)

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Abstract of this presentation is not public

Presentation cancelled by author



## Rights-of-way – a poorly exploited conservation resource

(Oral)

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## Disturbance ecology and management of temperate forests in Southeastern Europe

(Oral)

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Forest management that emulates the processes and structures that arise from a natural disturbance regime require a quantitative description of the regime for a given forest region. This has been particularly challenging in temperate forests of Europe because a long history of land-use has been the overriding driver of forest dynamics. This contribution presents a brief synthesis of the natural disturbance regime in temperate forests (beech and mixed beech-fir forests) of Southeastern Europe, with an emphasis on the range of natural variability of regime components for the main disturbance agents. Disturbance evidence was compiled from meteorological data, historical documents, studies from old-growth remnants, and salvage logging data from National forest inventories. Taken together, the results show that no single disturbance agent dominates the regime, and any given agent exhibits remarkable variation in terms of severity and spatial extent both within and among individual disturbance events [1].

The presentation then examines how the regime influences tree community dynamics and biological legacies. In general, traditional conceptual models of forest dynamics in the region supported a steady-state view of forests, disregarded the role of disturbances, and explained variation in tree species community composition as a function of site conditions. Recent work in old-growth forests highlights the non-equilibrium nature of forests and the important role of periodic disturbances in maintaining less shade tolerant canopy species [2]. Perhaps most important in the context of the Southeastern Europe, where the public often views natural disturbances as harmful, is the recognition that disturbances are an inherent part of forest dynamics and the damage they create in forests provides food and habitat for myriad species, especially those dependent on dead wood. This changing perception of disturbance is vital for reforming long standing management practices in the region, such as routinely salvage logging disturbed areas.

The presentation concludes with a brief examination of how the disturbance ecology of forests in the region compares with the ongoing practice of close to nature forest management, a form of continuous cover silviculture that has a long tradition in the region. While some aspects of the current form of management match the natural disturbance regime, other aspects require significant improvement, such as improving deadwood quantity and quality, and thinking beyond stand scales. One potential solution is to move away from the long tradition of integrated forest management toward a system that allows more segregation of economic and ecological functions, such as one that increases the area of unmanaged forest reserves, balanced with more intensive timber production in other areas [3].

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## Towards greater context for scholarly metrics

(Oral)

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This talk will discuss how most quantitative approaches to evaluating research do not yet fully capture the true disciplinary and public influence of science research. I suggest how machines can aid in human judgement and improve context for decision-making, in a scalable manner.

Counting citations in the peer-reviewed literature has long been used to understand a paper's influence on a field, usually as a complement to traditional peer review practices in evaluation scenarios such as promotion and tenure. Recently, field-normalized citation metrics [1] have been suggested as a more accurate way to understand disciplinary research performance.

However, quantitative approaches to understanding research impact are not without their critics. At best, research metrics have been suggested as an evaluation tool that can only “support, not supplant, expert judgement [of research]” [2]. At worst, it has been proposed that altmetrics and “other bibliometric nightmares” are “for people who aren't prepared to take the time (or lack the mental capacity) to evaluate research by reading about it” [3].

In this talk, I will briefly address some of the benefits and limitations of current attempts to improve quantitative scholarly impact indicators by providing numerical context. Though improvements over the status quo, these metrics by and large still do not:

Account for the content of discussions around research (e.g. citations that confirm or refute previous findings);  
Reflect the stakeholder groups discussing research (e.g. citations from policymakers using research to develop conservation laws); nor

Reflect the implicit values that drive research practices (e.g. metrics that accurately capture the impact of open source research software development)

However, outright rejection of all impact indicators also misses the mark. With the ever-increasing volume of published research, it is impossible to rely only upon expert peer reviewers to identify influential research. Clearly, evaluation practices must scale using thoughtful, humane machine learning approaches to aid in impact assessment.

I will conclude by sharing solutions to the above limitations from across academia and industry.

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**Presentation cancelled by author**



## **Favouring coexistence with large carnivores**

**(Oral)**

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Abstract of this presentation is not public





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## Changing attitudes towards wild predators, addressing fear

(Oral)

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The presence of large carnivores close to the built environment triggers strong emotions among the public. Some people may see the presence of these animals as a positive and rewarding experience, while other may respond with feelings of fear for themselves or their children and pets. Such feelings are associated with attitudes towards wildlife management and policy as well as human well-being and quality of life. The literature proposes four major groups of interventions that managing authorities may offer to people who feel fear of brown bears (and other large carnivores): information and education, exposure to animal and habitat, collaboration and participation, and financial incentives<sup>1</sup>. This presentation reports on a series of intervention studies with the overarching aim to develop tools, based on psychological principles, to reduce the public's fear of brown bear. The studies encompass information and/or exposure to brown bear habitat and have been carried out in collaboration with large carnivore information centres and wildlife parks in Sweden. It is concluded that the two types of interventions successfully can decrease feelings of fear of brown bear among persons who are motivated to participate. The change seems to be dependent upon the participant being given the opportunity to re-appraise the potential consequences of a brown bear encounter. This requires attention to the information content, and the social and environmental context.

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Presentation cancelled by author



## Practical application of disturbance based management in the forest company SCA in the northern part of Sweden.

(Oral)

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The forest owned by SCA is situated in the northern part of Sweden within the boreal zone. This session will describe how natural disturbance is emulated within practical forest management today and also present a historical overview of the development during the last three decades.

The focus is on how the ASIO-model has been applied within SCA, a model that is based on different levels of natural fire disturbance intensities. The soil moisture and vegetation types typically vary largely on a small scale within northern part of Sweden. Hence, the natural forest fire disturbance intensity varies largely from “extremely rare” on wet sites typically dominated by *Picea abies*, to “often” on dry sites, which typically is dominated by pine, *Pinus sylvestris*. The presentation will describe how this model has been applied in practical forest management depending on soil moisture and forest type. Parts of the ASIO-model referring to wet and dry sites has had large importance not only within retention forestry but more so in managing stands for maintaining or increasing biodiversity with high conservation values, for instance the set-aside areas.

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## Preaching to the Unconverted: The Human Benefits of Ecological Intensification

(Oral)

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Although ecological intensification methods have some demonstrable benefits to production and the potential to enhance long-term sustainability, farmers still face an uncertain trade-off by implementing them over more conventional farming methods. Measuring and demonstrating the benefits of ecological intensification has therefore often been suggested as a means of highlighting these benefits to farmers and policymakers. To date however, studies measuring these benefits have been largely illustrative, rather than demonstrative, and focused on short term impacts rather than long-term benefits, such as sustainability, resilience or consistency of crop yields. Furthermore, studies have tended to over-emphasise economic benefits to the point of using economic valuation to try to measure more abstract public benefits such as improved aesthetic and cultural values, if they have even measured them at all. However, many often very simple methods are available to measure the full suite of benefits from ecological intensification in a manner that is useful for decision making by both farmers and other stakeholders. In this talk we highlight the different valuation tools available to researchers and how they can be integrated into ecological research to provide information relevant to management and policy.

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## A circular bioeconomy in a Forest biorefinery: Oxymorons or viable sustainability strategies?

(Oral)

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Enhancing the bioeconomy is high on the political agenda of many countries and visible in the communications of companies in forest based industries. Bioeconomy promises to help reduce the use of non-renewable natural resources and contribute to reduced greenhouse emissions, but these promises are not always clearly validated. Another concept driven by global raw material pressures is the circular economy offering solutions for a system approaching a closed loop, where by design the products are reused, refurbished or recycled rather than disposed of as waste. In recent times, these two attractive concepts have been combined to circular bioeconomy, which emphasizes the need for sparing use of renewable resources.

Biorefineries are often seen as essential building blocks in a bioeconomy and even circular bioeconomy. However, a biorefinery only represents one single step in the production chain which can be either linear or circular depending on the later stages of the value chain. Therefore, it is oxymoronic to discuss circular economy in the context of biorefineries. On the other hand, there are potential developments in biorefineries which by design enhance their participation in a circular system.

Using existing cases in Finland and Sweden, we analyze the possibilities for biorefineries to become an increasingly important element of a circular bioeconomy, the barriers met and the policies needed to support the development.

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## Identifying global hotspots and conservation priorities for reptilian phylogenetic diversity

(Oral)

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As we face the current extinction crisis with extremely limited resources for conservation, it is important to consider how we can preserve as much of the tree of life as possible. To date, global assessments of phylogenetic conservation priorities have been conducted for amphibians, birds and mammals. However, a lack of data has previously precluded the incorporation of reptiles-which represent almost a third of terrestrial vertebrate diversity-into such analyses. Here, we present the first global analysis of reptilian phylogenetic conservation priorities. As reptiles are not comprehensively assessed by the IUCN Red List, we employ a combination of species-focused and spatial approaches to identify priorities at both scales. We use an EDGE approach to identify reptile lineages which represent a disproportionate amount of unique evolutionary history and are threatened with extinction. Using species range distributions and phylogenetic datasets for almost all described reptile species, we highlight global hotspots of imperilled reptilian Phylogenetic Diversity (PD) using a combination of established and novel approaches (e.g. Phylogenetic Endemism and Evolutionary Distinctness Rarity). We also introduce a method for prioritising regions for conservation of threatened PD which can account for both threats that affect all species in a geographic region (such as habitat destruction) and threats that affect a species in all regions (such as targeted hunting). Finally, we identify priority regions with imperilled reptilian PD and poor coverage of protected areas, which include Caribbean islands, Madagascar and the Philippines. Our work highlights the need for additional conservation actions to effectively conserve the reptilian tree of life into the future.

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## When the nature's contributions to people approach meets REDD

(Oral)

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The concept of Nature's Contributions to People coined by the Intergovernmental Platform on Biodiversity and Ecosystem Services, IPBES, recognizes the central role that culture plays in defining all links between people and nature. NCP also elevates the role of indigenous and local knowledge in understanding the diversity of relationships between nature and people beyond the dominant instrumental view of natural capital as provider of ecosystem services (Diaz et al., 2018). This can have notable impacts in understanding the design of far reaching conservation and land use practices/activities such as REDD, which was originally conceived with the idea that the most cost-effective way to reduce emissions and conserve and increase carbon stocks in forest, is to provide financial incentives to developing countries directly proportional to their performance in driving down rates of forest loss through a market system. Under REDD frameworks, climate regulation was generally "itemized", considered in isolation from any other contributions of forests to people, in order to facilitate translating such NCP into a commodity for the purpose of market exchange. Soon it was obvious that a broader framing via national policies and national dialogues across stakeholders, including indigenous people, including setting biodiversity and social safeguards, was necessary. New ways of understanding and operationalizing REDD+, beyond commodification, go hand in hand with emphasizing context-specific NCP. This could help conservationists and those interested in climate mitigation rethink their alliances with social scientists and other knowledge holders such indigenous people, and recognize that in so doing can re-equilibrate issues of social equity and political legitimacy viz-a-viz efficiency of incentive schemes, as emphasized by economists. In this way, the risk of crowding out intrinsic motivations for forest conservation by forest communities (Engel, 2016) may be lowered, and the barriers for sustainable land management by local forest users (Sanz et al 2017) reduced.

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## Endemic Avifauna in Caraga – the mining capital of Mindanao Island, Philippines: their preferred habitats and threats

(Oral)

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Caraga Region comprises most of the Eastern Mindanao Biodiversity Corridor in the Philippines which is known to be the center of endemism. However, it is popularly known as the “Mining Hub” in Mindanao Island where there is obvious overlapping of mining concessions with the remaining blocks of tropical rainforests. Habitat preference of endemic avifauna and their threats are least studied in the region. Hence, in this study, habitat characteristics across habitat types and responses of endemic birds to habitat alterations were assessed in four selected mining areas (Masabong and Philsaga in Rosario and Bunawan, Agusan del Sur and Claver, Surigao del Norte) using Canonical Correspondence Analysis, survival envelope, niche position and niche width analyses. High suitability areas in Caraga that potentially harbor viable populations of endemic birds and suitable habitats for the key forest-dependent endemic birds across the landscape were also predicted using species distribution modeling. Among the four selected mine sites in Caraga, Masabong and Claver are good representation of forest ecosystem, while Bunawan and Philsaga are dominated by agro-forests and cultivated areas. A total of 47 endemic birds were encountered in four selected key mine areas of Caraga. Fifty of which are Philippine-endemics (four are near-threatened, three vulnerable and one endangered) and seven of them are Mindanao-endemics (one near-threatened and three vulnerable). Most of the endemic birds prefer advance secondary forests especially the threatened endemics. Some can tolerate regenerating forests but not in the non-forest habitat e.g. cultivation and open, degraded areas which implies sensitivity to forest fragmentation. Most of the predicted high conservation value areas for forest-dependent endemic birds are overlapping with mining concessions and expanding perennial crop plantations. Failure to do effective policy reform and law enforcement in regulating land-use changes in Caraga will most likely compromise the niche requirements of the endemic bird specialists.

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## Assessing the status, threats and future conservation action for the critically endangered Chinese alligator in Southern Anhui Province, China

(Oral)

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Chinese ecosystems are facing intense biodiversity loss. Pressure on ecosystems is particularly severe in the Yangtze basin, a 220,000 km<sup>2</sup> area supporting 300 million people in eastern China. The Chinese alligator (*Alligator sinensis*) is one of two extant species of the genus *Alligator*. Whereas the American alligator is of least concern to conservationists, the Chinese alligator is Critically Endangered, clinging on to a small stronghold in south-eastern Anhui province within the Yangtze basin. Estimates of the number of remaining wild alligators are less than 130 individuals. They survive as isolated populations, in a 433 km<sup>2</sup> area - the National Chinese Alligator Reserve (NCAR). Despite its designation as a reserve, the NCAR is densely populated and dominated by agricultural activity, taking advantage of the fertile lowlands of the Yangtze floodplain and outcompeting the Chinese alligator. It has been estimated that half of the surviving wild alligators remain close to the main channel floodplain in marginal habitats directly adjacent to agricultural fields, where conflicts with humans occur. The remaining alligators have been displaced to even less favourable habitats at higher elevations to the south, in the valleys of tributaries draining the Huangshan mountains. Most conservation action to date has been directed towards the enlargement of captive populations, principally at the Anhui Research Centre for Chinese Alligator Reproduction. This captive population has more than 10,000 individuals. However, relatively little attention has been paid to the remaining wild population. Field data with which to assess the status and threats to the Chinese alligator, and to predict the effectiveness of management practices are limited, and therefore an alternative approach to standard ecological field techniques is needed. Here we apply local ecological knowledge to investigate the status and threats to the last remaining wild populations of Chinese alligator, using questionnaire-based surveys with inhabitants of villages throughout the NCAR. This research assesses the feasibility of strategies to support long-term coexistence of threatened megafauna, and human agricultural livelihoods in rural China. It also demonstrates the utility of novel questionnaire-based surveys, as robust sources of ecological data for informing conservation management practices.

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## Faith perspectives on human-nature relationships, sustainability and well-being in cities.

(Oral)

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Rapid urbanisation is one of the greatest sustainability challenges facing the planet. With an extra 2.5 billion people projected to live in cities by 2050 and 60% of this urban land yet to be developed, it is essential to understand human-nature relationships in cities and how these correspond with notions of sustainability and well-being. This presentation will explore the role of nature in achieving SDG 11 (sustainable cities and communities) through the lens of faith traditions. Religious perspectives are increasingly recognised as vital to conservation (Hitzhusen & Tucker, 2013), not least because 84% of the global population identify with a religious faith. First, the emerging concept of ‘relational values’ for nature (see Chan et al., 2016) will be explicated in an urban context. Second, notions of well-being rooted in religious thought will be introduced (e.g. shalom, saleem). Finally, results from interviews with religious leaders of different faiths and nationalities will be presented on the themes of (i) how ideas of nature and urban are conceptualised, and (ii) the role of nature in sustainable cities. Findings reveal a range of perspectives on what is deemed ‘natural’ in an urban setting. Further, while a variety of theological arguments are presented, there appeared to be a broad consensus that environmental integrity is related to well-being. These insights position religion as a potentially powerful influence in shaping sustainable and biologically-diverse cities and towns, with broad implications for human and planetary well-being.

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## Options for governance and decision-making across scales and sectors

(Oral)

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Chapter 6 of the IPBES regional assessment for Europe and Central Asia explores governance options and institutional arrangements for better consideration of biodiversity and nature's contributions to people in public and private decision-making. Biodiversity, nature's contributions to people, and good quality of life are relevant to a wide range of sectors and actors. Hence, addressing the underlying causes of biodiversity loss and ecosystem degradation requires a critical assessment of primary economic sectors such as agriculture, forestry and fisheries as well as energy and mining. The governance of these sectors and their management practices, and the way in which these impact on nature, call for implementing existing policies more effectively and improving the current situation through additional commitments. The assessment shows that there is considerable potential for more biodiversity-friendly, land-use practices, production methods and healthier consumer choices, for example through improved awareness raising, accounting tools, education and information-based instruments. This potential is also available to industries, manufacturing and the service sectors. However, mainstreaming biodiversity across economic sectors and different stakeholder groups requires joint efforts by public and private actors and strong public policies to enable implementation of appropriate strategies. Strengthening political support for environmental improvement is as necessary as building competent and effective environmental institutions, mobilizing finance for environmental and conservation priorities, monitoring progress and readjusting targets and integrating environmental policies into sectoral policies.

After providing an overview of major international, regional and transboundary environmental governance relevant to Europe and Central Asia, the focus of our chapter is on biodiversity conservation and environmental policies as well as major economic sectors affecting biodiversity and nature's contributions to people: What are the major policy objectives, predominant governance modes and instruments currently governing these sectors? What are key constraints or opportunities within these sectors regarding biodiversity and nature's contributions to people? Finally, major insights for mainstreaming and integrating biodiversity and nature's contributions to people within and across different sectors are synthesized.

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## Expanding the Environmental Value Scale: Understanding how Eudaimonia and Hedonia Influence Conservation Behavior

(Oral)

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Protected areas harbor ecologically diverse ecosystems, are imperative for human well-being, serve as vestiges of cultural heritage and attract tourism. How and why protected areas are valued by people is important because people's social values serve as motivators for conservation and environmental stewardship. However, most research attention is focused on quantifying the economic and ecological values of places. Social values, although underrepresented in conservation research and practice, can provide valuable insight on whether people will support changes in conservation policy which can highlight different preferences and visions for the future.

Previously, only egoistic values, focused on concerns for satisfying one's own interests, as well as altruistic and biospheric values, focused on concern for human and non-human species, had been explored. However, recent literature argues that hedonia and eudaimonia, which measure one's desire for short-term versus long-term pleasure attainment, are integral for explaining environmental concern and behavior (1,2). Although these value metrics have been discussed in previous research and carry relevance for decision-makers, no studies to date have empirically tested the relationships among all five value dimensions to better understand the factors that drive conservation behavior.

Using on-site visitor survey data from Denali National Park (AK, USA; n=667), we tested a five-dimensional environmental value scale. Using latent profile analysis to examine visitors' perceived qualities of places and intended conservation behaviors, four distinct classes were identified based on environmental values. Consistent with previous research, we observed that respondents who were younger, more educated and had higher incomes held stronger environmental values and behavioral intentions. Additionally, we found that strongest values varied across classes but that egoistic values were the consistently weak across all classes. Finally, our study suggests that even individuals with strong environmental values were less willing to engage in social environmentalism (i.e. volunteering) and environmental stewardship (i.e. donating money) across all classes than they were in conservation lifestyle behaviors (i.e. recycling or buying eco-friendly products). Our findings advance the conceptualization of values as motivators for conservation behavior and provide new insight on how to frame messages that align with multidimensional value structures.

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## The IUCN Green List of Species: An Optimistic New Vision for Conservation

(Oral)

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The International Union for Conservation of Nature's Red List of Threatened Species has become the global standard for assessing the risk of extinction each species on earth faces. However, conservation also needs an optimistic vision of species conservation that presents a road map on how to achieve recovery, and the IUCN is creating a new set of metrics to do just that. These new metrics, known collectively as the "Green List of Species," will be incorporated into the Red List in the coming years (note that this is a third, separate initiative from the Green Lists of Protected Areas and of Ecosystems). Like the Red List, the Green List of Species will rely on expert opinion informed by the latest available data, but will incorporate a more formal structured expert elicitation approach. The Green List of Species will evaluate species' recovery status in terms of function (is the species fulfilling its role, or functionally extinct?) and geographic distribution relative to its historical range. It will also assess how conservation actions have contributed to recovery status using counterfactual approaches. However, these metrics must be refined before rollout, considering the challenges presented by species with varying life histories and qualities of data. Here, we present the working Green List of Species assessment framework and invite feedback.

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## Using the IUCN Red List of Ecosystems to develop biodiversity indicators

(Oral and Poster)

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World leaders have committed to the 2020 goal under the Convention on Biological Diversity to improve the status of biodiversity. A suite of biodiversity indicators is currently used to monitor progress towards achieving these targets. Several indicators exist for measuring loss of species diversity and abundance, yet comprehensive indicators measuring change across ecosystems globally are lacking. We fill this gap by developing biodiversity indicators for ecosystems based on the data from the International Union for the Conservation of Nature's Red List of Ecosystems (RLE), the global standard for assessing the risks to ecosystems. Our indicators quantify spatial and temporal changes in risk status, area, and health of ecosystems across all biomes over recent, future and historical timeframes, using the Red List Index and Living Planet Index as models. Using the RLE biodiversity indicators, we quantify: (i) the overall risk of ecosystem collapse globally; and (ii) the proportional change in the area of the ecosystem and loss of ecosystem health to show progress through time towards ecosystem collapse (i.e. ecosystem endpoint). The RLE biodiversity indicators allow spatial comparisons of the relative risk of collapse and the type of change occurring among ecosystems from local to global scales. Our indicators synthesise complex information to highlight regions most at risk of collapse, and allow clear communication with decision-makers, managers and the general public. This information will inform progress towards the 2020 Aichi targets for the Convention of Biological Diversity, and the UN Sustainable Development Goals, and guide future policy and management prioritization.

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## Does our current environmental monitoring support adaptive management?

(Oral and Poster)

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European environmental and rural development policies require programmes of statutory monitoring using prescribed parameters - for example water quality parameters are monitored by all countries that implement the Water Framework Directive. These data are a significant resource that could potentially be used for adaptive (co-)management and governance. These approaches not only require the use of multiple forms of information to learn and update resource management, but can also imply a more holistic and participatory approach.

We have studied the monitoring regimes entailed for Water Framework Directive, Natura 2000 Directives and Agri-Environmental Schemes of the CAP Rural Development Programme across nine European cases in 6 member states and 3 regions. Building on established principles for monitoring socio-ecological systems (see Waylen et al. 2016), expert colleagues from across Europe have analysed published documents to see if the current monitoring schemes supported a move to the new paradigm of holistic, participatory and systemic management approaches.

Overall, data are focused on a narrow set of indicators that in turn enable only a partial perspective on ecosystem management. This matters because policy-driven monitoring may be the main source of information that can be used for formal statutory management. For example, social aspects or drivers of the socio-ecological system are nearly never monitored and incorporated into evaluation, particularly for older policies. The monitoring continues to describe the state of the environment -with great for some aspects - rather than assessing how an intervention has contributed to conservation or allowed sustainable use. This means we will struggle to understand socio-ecological systems, and learning from the effects of management actions. Furthermore, whilst the implementation of WFD, N2K and AES has evolved, there is no documented link to the use of the data in this process of change i.e. it is unknown if and how the monitoring programmes have influenced changed management. There were also positive findings - some member states offer open access to data; are working on integrated monitoring and reporting; and use citizen science to both monitor trends and engage people in learning about their environment.

Reappraising what is monitored could lead to a rebalancing of monitoring that could greatly assist future adaptive management. Many European policy-driven monitoring processes could be tweaked to make them more fit to improve ecosystem management. Our framing positions the work differently to the more conventional 'fitness' checks conducted recently: we can reflect on how our work contributes to these institutional evaluations in the discussion.

References:

Waylen, K.A. & Blackstock, K.L. In press. Monitoring for adaptive management or modernity? Lessons from recent initiatives for holistic environmental management *Environmental Policy and Governance*, DOI: 10.1002/eet.1758

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