

Sustainable Conservation

Bridging the gap between disciplines

*International Jubilee Conference
of the Royal Norwegian Society
of Sciences and Letters*

Trondheim, 15–18 March 2010

250 år
1760 – 2010



CCB

Centre for Conservation Biology



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Welcome!

Welcome to Trondheim and to the conference “Sustainable Conservation: Bridging the gap between disciplines”. We are delighted to see that so many established as well as young upcoming researchers from around the world are here to present and discuss the scientific basis for a sustainable conservation of natural resources. This will help us to achieve the central goal for the conference, which is to identify common principles for a sustainable management that also can ensure conservation.

We hope you will enjoy your time in Trondheim.

Professor Bernt-Erik Sæther and Professor Gunilla Rosenqvist
Centre for Conservation Biology (CCB)
Norwegian University of Science and Technology (NTNU)

Practical information regarding oral presentations

The meeting room will be equipped with a LCD projector and PC laptop.

Speakers are invited to upload their presentation at the speaker presentation room (located next to the meeting room), which will be open on Sunday–Wednesday from 17.00 to 20.00, and on Monday from 10.00 to 11.30. Audio-visual technicians will be present to help you upload your presentations, and will ensure presentations are available for your allocated presentation times. Please bring your presentation on a CD or a USB storage device. Except for speakers presenting on Monday, we ask that you upload your presentation no later than the evening before your presentation.

To ensure successful file transfers and avoid technical problems during the presentations, we encourage presentation files in PowerPoint (ppt) or Portable Document Format (pdf).

Should you have any questions, please do not hesitate to contact:

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Programme

Monday, 15 March 2010

11.00	LUNCH AND REGISTRATION
12.00–12.45	OPENING AND WELCOME SESSION Professor Bernt-Erik Sæther (NTNU) Rector Torbjørn Digernes (NTNU) Vice-Praeses Kristian Fosheim (Royal Norwegian Society of Sciences and Letters) Director Reidar Andersen (Norwegian Directorate for Nature Management)
12.45–17.05	Trends in biodiversity Chair: Gunilla Rosenqvist
12.45–13.30	Plenary speaker: Prof. Stuart Pimm (Duke University, USA) <i>Practical measures to prevent extinctions in South America</i>
13.30–14.00	Invited speaker: Prof. Steven R. Beissinger (University of California at Berkeley, USA) <i>Reconciling dichotomies in paradigms and modeling approaches for recovering endangered species</i>
14.00–14.20	Contributed: Dr. Mattias Waltert (Georg-August-Universität, Germany) <i>Habitat availability, hunting or poaching: what affects distribution and density of large mammals in western Tanzanian woodlands?</i>
14.20–14.40	Contributed: Dr. Annette Kolb (University of Bremen, Germany) <i>Habitat fragmentation, vital rates and population viability</i>
14.40–15.10	Invited speaker: Dr. Thomas Lovejoy (The H. John Heinz III Center for Science, Economics and the Environment, USA) <i>A wild solution for climate change</i>
15.10–15.30	COFFEE
15.30–15.50	Contributed: Dr. Jean-Baptiste Mihoub (UPMC-CNRS, Paris, France) <i>Assessing the viability of migratory species: the case of the vulnerable Lesser Kestrel, from the Mediterranean to the Sahel</i>
15.50–16.10	Contributed: Dr. Karen Mustin (University of Aberdeen, UK) <i>Exploring the mechanisms of past distributional change; Sylvia borin as a case study</i>
16.10–16.40	Invited speaker: Dr. J. M. Drake (University at Georgia, USA) <i>How do microcosms tell us about nature? Notes toward a mechanistic understanding of population extinction</i>
16.40–17.00	Contributed: Dr. Eva Rossmannith (University of Potsdam, Germany) <i>Responses of bird species to climatic and land use changes in African savannas towards an animal functional types approach</i>
18.15	RECEPTION: AT RESTAURANT "TO TÅRN"
19.00	CONCERT NIDAROS CATHEDRAL (30 MIN)
20.00	DINNER CONFERENCE PUB

Tuesday, 16 March 2010

07.00–09.00	BREAKFAST
07.00–09.00	ARRIVAL AND REGISTRATION, CONTINUED
09.00–09.15	PRACTICALITIES FROM LOCAL ORGANIZERS
09.15–14.00	Trends in biodiversity (continued) Chair: Bernt-Erik Sæther
09.15–10.00	Plenary speaker: Prof. Ilka Hanski (University of Helsinki, Finland) <i>Biodiversity and its conservation in fragmented landscapes</i>
10.00–10.30	Announcement: Rector Torbjørn Digernes (NTNU)
10.30–11.00	COFFEE
11.00–11.20	Contributed: Dr. Niels Blaum (University of Potsdam, Germany) <i>Coupled effects of land use and climate change on gene flow in a fragmented savannah landscape</i>
11.20–11.40	Contributed: Dr. Jörgen Rudolphi (Swedish University of Agricultural Sciences) <i>Substrate and landscape explain occurrence of logging-sensitive bryophytes and lichens in young spruce plantations</i>
11.45–13.15	LUNCH
13.15–14.00	Plenary speaker: Prof. Russell Lande (Imperial College, London, UK) <i>Adaptation and population persistence in an extraordinary environment by evolution of phenotypic plasticity</i>
14.00–17.20	Developing predictive tools for predicting changes in biodiversity Chair: Philip J. Devries
14.00–14.30	Invited speaker Prof. Stephen Ellner (Cornell University, USA) <i>Modeling and managing coral disease: within-host dynamics, individual demography, and population consequences</i>
14.30–14.50	Contributed: Dr. Vidar Grøtan (CCB, NTNU, Norway) <i>A parametric approach for estimating the similarity of communities</i>
14.50–15.20	Invited speaker: Dr. William F. Fagan (University at Maryland, USA) <i>Empirical estimation (and prediction) of population growth rates in data poor situations</i>
15.20–15.45	COFFEE
15.45–16.05	Contributed: Dr. Henrik Pärn (CCB, NTNU, Norway) <i>The effect of climate change on dispersal in a house sparrow metapopulation</i>
16.05–16.25	Contributed: Prof. Tim Caro (University of California, Davis, USA) <i>Conservation buzzwords: use and misuse</i>
16.25–16.45	Contributed: Dr. Petra Kaczensky (University of Veterinary Medicine, Vienna, Austria) <i>Why we measure what we measure: Understanding Asiatic wild ass (<i>Equus hemionus</i>) population size estimates in the Great Gobi B Strictly Protected Area, Mongolia</i>
16.45–17.15	Invited speaker (video presentation): Prof. David Tilman (University of Minnesota, USA) <i>Conserving biodiversity and its benefits: threats from agricultural intensification</i>
17.20–	Poster Session (Posters B1–B24)
20.00	DINNER
	CONFERENCE PUB

Wednesday, 17 March 2010

07.00–09.00	BREAKFAST
09.00–09.15	PRACTICALITIES FROM LOCAL ORGANIZERS
09.15–15.15	Developing predictive tools for predicting changes in biodiversity (cont.) Chair: Kjell Danell
09.15–10.00	Plenary speaker: Dr. Hugh Possingham (The Ecology Centre, Univ. of Queensland, Australia) <i>Optimal monitoring for conservation and wildlife management</i>
10.00–10.20	Contributed: Mr. Alejandro Ruete (Swedish Univ. of Agricultural Sciences) <i>Predicted climate-driven population dynamics of an epixylic moss using hierarchical modelling</i>
10.20–10.45	COFFEE
10.45–11.05	Contributed: Dr. Uno Wennergren (Linköping University, Sweden) <i>Populations struggling to exist when resources vary over space and time a challenge to model and asses.</i>
11.05–11.25	Contributed: Prof. Tomas Willebrand (Hedmark Univ. College, Norway) <i>Weak density-dependent mortality and large-scale redistribution of young grouse as an alternative to measurement errors when explaining uncertainty in population dynamics.</i>
11.25–11.45	Contributed: Dr. Johan Petter Dahlgren (Stockholm University, Sweden) <i>Extending Population Viability Analysis (PVA) to include continuous nonlinear effects of age and size</i>
11.45–12.15	Invited speaker: Prof. John M. Fryxell (University of Guelph, Canada) <i>Critical habitat, apparent competition, and the population viability of woodland caribou</i>
12.15–13.45	LUNCH
Chair: William F. Fagan	
13.45–14.05	Contributed: Prof. Johan Ehrlén (Stockholm University, Sweden) <i>Plant population dynamics in changing environments</i>
14.05–14.35	Invited speaker: Prof. Steinar Engen (CCB, NTNU, Norway) <i>Viability of age-structured populations in a fluctuating environments: concepts, estimation and prediction</i>
14.35–14.55	Invited speaker: Dr. Hal Caswell (Woods Hole Oceanographic Inst., USA) <i>Population consequences of climate change: a demographic approach</i>
14.55–15.15	COFFEE
15.15–17.00	Developing integrated management principles
15.15–15.35	Contributed: Dr. Lennart Edsman (Swedish Board of Fisheries) <i>Culture, consumption and conservation - crayfish fishery as a tool when preserving the native noble crayfish.</i>
15.35–16.55	Contributed: Dr. John Linnell (Norw. Institute for Nature Research) <i>Balancing theory and reality: operationalising genetic and demographic viability with ecological carrying capacity and social acceptance for large carnivores within the EU's Habitats Directive</i>
16.55–16.25	Invited speaker: Dr. Jane Reid (University of Aberdeen, UK) <i>Applying population ecology to conservation strategy for choughs in Scotland</i>
1630–	Poster Session (Posters A1–A27)
19.30	DINNER CONFERENCE PUB

Thursday, 18 March 2010

07.00–09.00	BREAKFAST
09.00–09.15	PRACTICALITIES FROM LOCAL ORGANIZERS
09.00–12.00	Developing integrated management principles (continued) Chair: John Linnell
09.15–10.00	Plenary speaker: Prof. William J. Sutherland (University of Cambridge, UK) <i>Improving the effectiveness of conservation</i>
10.00–10.20	Contributed: Dr. Brett Sandercock (Norw. Institute for Nature Research) <i>Is hunting mortality additive or compensatory to natural mortality? Effects of experimental harvest on the cause-specific mortality and hazard functions of Willow Ptarmigan in Norway</i>
10.20–10.40	Contributed: Dr. Petteri Vihervaara (University of Turku, Finland) <i>How does the current means of biodiversity conservation fit with the ecosystem services approach? Case study land use planning in Finnish Lapland</i>
10.40–11.10	Invited speaker: Prof. Kjell Danell (Swedish University of Agricultural Sciences, Umeå) <i>Adapting to changes – challenges for management and conservation</i>
11.15–11.50	Discussion and Conclusions: Bernt-Erik Sæther
11.50–12.00	Closing Remarks: Director-General Janne Sollie (Norwegian Directorate for Nature Management)
12.00	LUNCH

Abstracts

Contributed Talks

Coupled effects of land use and climate change on gene flow in a fragmented savannah landscape

Niels Blaum and Eva Rossmannith (Department of Plant Ecology and Conservation Biology, University of Potsdam)

Global changes in climate and land use are the most serious threats to biodiversity worldwide. A large number of recent studies analyse changes in biodiversity caused either by land use induced fragmentation or by climate changes. However, often, both processes occur simultaneously. While habitat fragmentation creates differences in habitat quality in space, climate change often affects habitat quality not only in space but also in time (e.g. temporal variability of rainfall). These effects can interact and thus amplify or mitigate each other. In this study we test the hypothesis that the amount and variability of rainfall affects the genetic structure of animal populations in fragmented landscapes. We use a process-based model simulating the population dynamics and genetic structure of hairy-footed gerbils (*Gerbillurus paeba*) in neighbouring fragmented savannah habitats. The model was validated with empirical data of gerbil population dynamics and genetic structure. In the model, we analyse how changes in rainfall variability (simulated as varying CVs of annual rainfall) for two scenarios of different rainfall amounts affects gene flow in fragmented savannah rangelands. Our results show that the effect of CV of annual rainfall on the genetic structure differs largely between the two rainfall scenarios and across CVs.

Conservation buzzwords: use and misuse

Tim Caro (University of California)

Many of us use surrogate species umbrella, flagship, indicator and keystone species - as conservation shortcuts without being clear as to their meaning or whether they have any real use in conservation. Confusion occurs because of loose definitions, relaxed application of these terms, multiple attributions of the same term, using the same species for several objectives, and hidden agendas. Here I summarize and clarify surrogate species terminology, and evaluate whether these conservation shortcuts have sound biological foundations. Increasing use of surrogate buzzwords in conservation biology requires us to understand whether decision makers can go on employing these concepts with confidence.

Extending Population Viability Analysis (PVA) to include continuous nonlinear effects of age and size

Johan Petter Dahlgren (Stockholm University), Maria Begoña García (Instituto Pirenaico de Ecología) and Johan Ehrlén (Stockholm University)

Integral Projection Models (IPMs), with continuous state variables, constitute more realistic tools for PVA than matrix models for many species. However, potential nonlinearities in vital rate relationships that are implicit in matrix models are not considered in IPMs parameterized using linear regression models. We propose using restricted cubic splines for modeling nonlinearity in IPMs. We illustrate the usefulness of this approach in an IPM of the extremely long-lived, rare plant *Borderea pyrenaica*, with vital rates dictated by nonlinear relationships with both age and size.

Culture, consumption and conservation - crayfish fishery as a tool when preserving the native noble crayfish

Lennart Edsman (Swedish Board of Fisheries)

Exploitation is usually thought as the main threat to preserving biodiversity. In northern Europe crayfishery has old and strong traditions and here the endangered native noble crayfish has steadily declined, mainly due to the lethal fungal disease crayfish plague. Apart from having an important role in freshwater ecosystems, crayfish also plays a social, cultural and recreational role, resulting in a high economical value. The North American signal crayfish was introduced to substitute the fishery lost, but turned out to be a chronic carrier of the plague, further enhancing the spread of the disease. For people with fishing rights the main interest is a good catch of crayfish, regardless of species. With alien species readily available, the largest threat is therefore illegal introductions of plague-carrying signal crayfish by man, not over-fishing. Exploitation, in the form of a sustainable fishery, is thus the key to successful conservation of the noble crayfish in northern Europe.

Plant population dynamics in changing environments

Johan Ehrlén and Johan P. Dahlgren (Stockholm University)

Many of the most serious threats to biodiversity are associated with directional change in environmental conditions. Still, deterministic temporal change, as opposed to stochastic variation, has only rarely been incorporated into demographic models to predict population viability. We present examples of how the dynamics of plant populations can be linked to climatic variation and changes in soil nutrients in three steps: (1) Documentation of associations between environmental conditions and vital rates through detailed demographic studies. (2) Assessment of trends in environmental factors. (3) Exploration of population dynamics and viability under different environmental conditions.

A parametric approach for estimating the similarity of communities

Vidar Grøtan, Steinar Engen and Bernt-Erik Sæther (CCB, NTNU)

Species diversity is an emergent property of communities that is of crucial importance for conservation of biodiversity as well as for the understanding of trophic interactions and ecosystem processes. The turnover of species composition in space or time is of large interest when deciding upon strategies for conserving biodiversity. Assuming a bivariate lognormal species abundance distribution subject to Poisson sampling, we show that the estimated correlation is a measure of similarity between two communities. We show how the correlation relates and differs to the classical Jaccard- and Sørensen-indices of similarity. Most importantly, the correlation is an approximately unbiased index of similarity even if sampling intensities among communities vary or are unknown. We do therefore propose the correlation as an alternative to the classical indices when estimating similarity of communities.

Why we measure what we measure: Understanding Asiatic wild ass (*Equus hemionus*) population size estimates in the Great Gobi B Strictly Protected Area, Mongolia

Petra Kaczensky (Research Institute of Wildlife Ecology, University of Veterinary Medicine, Vienna) and Stephanie Kramer-Schadt (Leibniz Institute for Zoo & Wildlife Research)

Little is known about the population size of the endangered Asiatic wild ass (*Equus hemionus*), and estimate reliability is hindered by confounding factors like topography and animal movement during the survey. We developed a simulation program reflecting the entire survey process based on actual landscape and biological features. The results can be directly fed into DISTANCE to assess what factors have the highest influence on the population estimates by comparing model scenarios with real survey data from the last 6 years. This critical analysis of survey methods will provide a significant step forward in designing future and interpreting past surveys.

Habitat fragmentation, vital rates and population viability

Annette Kolb (University of Bremen, Institute of Ecology), Johan Dahlgren and Johan Ehrlén (Department of Botany, University of Stockholm)

Negative effects of habitat fragmentation on individual performance are widely documented, but little is known about how effects on multiple vital rates translate into effects on population viability. We examined relationships between population size, vital rates and population growth rate (λ) in a perennial plant. Population size positively affected several vital rates but not λ . This was due to the impact of antagonists and the fact that λ was not sensitive to changes in the vital rates that varied with population size. Our results underline the importance of considering the complete life cycle when assessing fragmentation effects on populations.

Balancing theory and reality: operationalising genetic and demographic viability with ecological carrying capacity and social acceptance for large carnivores within the EU's Habitats Directive

John Linnell (NINA) and Luigi Boitani (University of Rome)

"In 2006-08 we worked with the EU's Habitats Directive to operationalise conservation policies for European large carnivores. The challenges were to (1) balance the biological needs for viability with the general unwillingness of the rural public to coexist with these species, (2) to develop principles that could cope with the diversity of European conditions, (3) to find legal mechanisms within the directive that allow the necessary freedom for management actions. We found an acceptable balance by focusing on biological populations rather than administrative borders, and the resulting document has been accepted as ""best practice"" guidelines by the Commission."

Assessing the viability of migratory species: the case of the vulnerable Lesser Kestrel, from the Mediterranean to the Sahel

Jean-Baptiste Mihoub (UMR 7204 MNHN-UPMC-CNRS), P. Pilard (Ligue Protectrice des Oiseaux) and F. Sarrazin (UPMC)

Conservation of migratory species is challenging, because those species face diverse sources of threats occurring in their different living habitats. Often conservation actions are restricted to regional scales, hence acting only on part of the life-cycle of migrant organisms. The Lesser Kestrel is a vulnerable insectivorous migrant raptor that has experienced a dramatic decline over the past few decades. Most management efforts have focused on its Mediterranean breeding areas in response to modifications of its agropastoral habitat. Yet, yearling survival is also strongly driven by rainfall in its Sahelian wintering grounds, and could then be threat by climate change. At the same time, Lesser Kestrels are dependent on locusts as prey during the winter, whereas locusts remain agricultural pests in the Sahel region and are controlled by farmers. Finally, Lesser Kestrels are colonial and gather at a few discrete resting places throughout the Sahel at densities up to a hundred or thousand individuals. We conducted a metapopulation viability analysis that included different environmental scenarios influencing survival and reproduction parameters at both local and global spatial scales, to provide an integrative conservation assessment for this species. Management recommendations are proposed at the international as well as national level and include the continuation of actions at Mediterranean breeding grounds paired with the sustainable protection of habitats surrounding winter resting places and a reasonable use of pest control in the Sahel.

Exploring the mechanisms of past distributional change; *Sylvia borin* as a case study

Karen Mustin (*University of Aberdeen*), **A. Amar** (*Royal Society for the Protection of Birds, Edinburgh*) and **S. M. Redpath** (*Aberdeen Centre for Environmental Sustainability*)

Climate change and habitat degradation are two of the major threats to biodiversity. Theory predicts that spatial variation in the landscape will be important in determining range changes in response to climate change, and has begun to consider the impacts of synergistic effects of global change drivers on range dynamics and ultimately species distribution. We relate this theory to a recently observed range shift in *Sylvia borin* in the UK, in relation to concurrent changes in climate and habitat. We conclude that understanding the mechanisms of past distributional changes can allow targeted management to mitigate against future climatic unsuitability.

The effect of climate change on dispersal in a house sparrow metapopulation

Henrik Pärn, **Henrik Jensen**, **Thor Harald Ringsby** and **Bernt-Erik Sæther** (*CCB, NTNU*)

Dispersal is an important ecological process and is a crucial determinant of the distribution and viability of wild populations. Still, potential effects of climate change on the dispersal process remain poorly understood. We used data from a long term study of a house sparrow metapopulation, subject to an increase in spring temperature, to investigate trends in the onset of breeding and its effect on dispersal. We found spatial variation in the advance of laying dates. Furthermore, the probability of dispersal was larger for offspring hatching early in the season. Our findings may have important implications for population dynamics and conservation.

Responses of bird species to climatic and land use changes in African savannas towards an animal functional types approach

Eva Rossmannith (*University of Potsdam*), **Niels Blaum** and **Florian Jeltsch**

Understanding mechanisms of changes in abundance and diversity of species is a key challenge in ecology for predicting effects of land use and climate change. The need to transfer knowledge gained from single species to a more generalized approach has led to the development of categorization systems where species similarities are classified into functional traits. While this approach has a long tradition in plant ecology, its application to classify animals remains challenging. We developed a functional trait approach for animals in an African savanna where climate changes and intensive land use substantially change habitat composition. Animals differ strongly in their responses to changes in habitat structure depending on a variety of different traits such as the use of vegetation structures (e.g. for nesting or sheltering), reproductive output, spatial scale (e.g. home range size, dispersal abilities) etc. We developed a generic spatially-explicit and process based population model for bird functional types and will present model results of which traits, trait combinations and trade-offs make a functional type sensitive to land use and climate change induced modifications in habitat structure.

Substrate and landscape explain occurrence of logging-sensitive bryophytes and lichens in young spruce plantations

Jörgen Rudolphi (*Swedish University of Agricultural Sciences*), **Toni Berglund** (*Sweden*) and **Lena Gustafsson** (*Department of Ecology, Swedish University of Agricultural Sciences*)

In young boreal forest plantations we found the richness and abundance of redlisted bryophytes and lichens to be as high as in the adjoining old stands, when taking the amount of available substrate into account. The area of old forests and wetlands in the surrounding landscape were the most important drivers for these species. We conclude that young forests may provide habitat for rare and endangered species, provided that the distance to areas with high diversity is not too great and that structures from the previous forest generation are left at regeneration felling.

Predicted climate-driven population dynamics of an epixylic moss using hierarchical modelling

Alejandro Ruete (*Department of Ecology, Swedish University of Agricultural Sciences*), **Karin Wiklund** (*Västmanlands County Administration, Sweden*) and **Tord Snäll** (*Department of Ecology, SLU, Sweden*)

We present a Bayesian hierarchical model for the inter-annual population variation of the epixylic moss *Buxbaumia viridis*, which is prioritised according to EUs Habitat Directive. The model was fitted to data on population abundance collected 1996-2003. It was validated by comparing the population size predicted for 2008 with field data collected in that year. The dynamics are driven by not only the population abundance of the previous year, but also by spring temperature and precipitation. We run simulations with weather scenarios for the area. We show the benefits of hierarchical modelling to predict the effect of climate change.

Is hunting mortality additive or compensatory to natural mortality? Effects of experimental harvest on the cause-specific mortality and hazard functions of Willow Ptarmigan in Norway

Brett Sandercock, Erlend B. Nilsen, Henrik Brøseth and Hans Chr. Pedersen (NINA)

A central question in wildlife management is whether harvest is additive to natural losses or offset by compensatory survival. We tested the effects of experimental harvest on survival of Willow Ptarmigan in a 3-year experiment on a 122 km² study area in central Norway. Five hunting estates were randomly assigned to harvest treatments of 0%, 15% or 30%, and survival rates of 193 radio-marked birds were monitored for 269 bird-years. Annual survival of ptarmigan was highest under 0% harvest (0.54), intermediate at 15% harvest (0.47), and lowest at 30% harvest (0.30). Cause-specific mortality rates showed that hunting mortality increased linearly across the harvest treatments (0%: 0.08, 15%: 0.27, 30%: 0.42). In contrast, natural mortality rates were highest without hunting (0%: 0.38) and lower under harvest (15-30%: 0.25-0.28). Cause-specific hazard functions indicated that risk of natural mortality was greatest during early fall and late spring, which coincided with periods of juvenile dispersal, territorial activity, and raptor migration. Partial compensation for harvest mortality was 30% across all treatments, with evidence of thresholds in compensatory survival. The implications for ptarmigan management are that hunting mortality is more likely to be additive during late autumn or if harvest rates are >15%.

How does the current means of biodiversity conservation fit with the ecosystem services approach? Case study land use planning in Finnish Lapland

Petteri Vihervaara (University of Turku), M. Kettunen (Institute for European Environmental Policy), T. Kumpula, A. Tanskanen (University of Joensuu) and B. Burkhard (Christian Albrechts University Kiel)

The concept of ecosystem services (ES) provides new possibilities for conservation. Since ES were launched as a major conceptual tool in the Millennium Ecosystem Assessment (2005), interest in them has been increasing. ES concretize how human well-being is depending on ecosystem functions and biodiversity. The concept can be used beneficially also in sustainable landscape planning. A key issue in the current environment discussion is: are the existing nature conservation areas and other means of biodiversity protection sufficient for the provision of ES? The role of ES has been recognized in international environmental policy and there are agreements that they are crucial for the development of sustainable societies. We assessed, how ES are taken into account in regional level, and will discuss how implementing of them in landscape planning may affect on biodiversity. In the case study of Finnish Forest Lapland, we analyzed by using European CORINE land cover database, expert evaluation and GIS modeling, how the current land cover affects on the production of ES and how different land use patterns impact on them. We assessed how current conservation programs and protection areas influence the distribution of selected ES. Various types of protected areas are located in the study area, e.g. a national park, nature parks, wilderness areas, protected bogs and mires, and areas of the European Natura 2000 network. Finally conclusions can be drawn on how current national and European environmental policies and standards of land use planning might influence on the provision of ES.

Habitat availability, hunting or poaching: what affects distribution and density of large mammals in western Tanzanian woodlands?

Matthias Waltert (Georg-August-Universität), Britta Meyer (Katavi-Rukwa Conservation and Development Programme, Tanzania) and Christian Kiffner (Department of Conservation Biology, Centre for Nature Conservation, Georg-August-Universität, Department of Forest Zoology and Forest Conservation incl. Wildlife Biology and Game Management, Bösigen-Institute, Georg-August Universität Göttingen)

Game reserves in Tanzania have been found to support similar or lower densities of large mammals compared to National parks. But since these areas usually differ considerably not only in regard to management but also to environmental factors, we assessed the relative importance of vegetation cover, species-specific habitat preferences and legal (trophy hunting) and illegal off-take for observed differences in species-specific densities. In the Katavi ecosystem, open habitats were characteristic elements of Katavi National Park (NP) while Rukwa Game Reserve (GR) was dominated by miombo forest. In an inter-specific comparison, density differences were moderately correlated with preferences for open habitats, and with estimates of combined legal and illegal off-take but not with either one, legal nor illegal, off-take. In a multiple linear regression, open habitat preference was found to explain 39.6 % of the density differences between the two protected areas. This analysis suggests that the broad scale pattern of most species distributions is governed by differing vegetation cover but that several species appear to be overexploited by illegal (elephant, giraffe, buffalo, bush pig, warthog) or combined off-take (hippopotamus, eland, waterbuck), thus emphasising the need for quota readjustments and a more efficient anti-poaching control. The study provides some guidelines for the management of large scale ecosystems in Tanzania and introduces a region where people-centred conservation and protection regimes are combined.

Populations struggling to exist when resources vary over space and time a challenge to model and assess

Uno Wennergren, Frida Lögdberg, Tom Lindström, Sara Gudmundson and Nina Håkansson (IFM, Theory and Modelling, Linköping University)

The existence of a population, or a food web, is mainly determined by the amount of resources and to what extent they are utilized. The spatio-temporal variation of resources is a three-dimensional problem including correlations within, and between, space and time. We introduce a set of methods that applies to both theoretical and empirical studies using spectral analysis. We also apply a unifying model of dispersal kernels. These methods reveal the possibility to make, theoretical and empirical, in-depth studies of invasion, extinction risks, biodiversity and geographic ranges. Empirical examples are given by analysing tree distribution data and dispersal of insects.

Weak density-dependent mortality and large-scale redistribution of young grouse as an alternative to measurement errors when explaining uncertainty in population dynamics

Tomas Willebrand, Maria Hörnell-Willebrand and Lasse Asmyhr (Hedmark University College)

Conservation policies will depend on assumptions on the mechanisms of population regulation, as the limits for a sustainable harvest and extinction risks at low population levels. Grouse (Tetaronidae) are a group of well studied species but where population regulation is still not completely understood. Here we use results on willow grouse, capercaillie and black grouse demographics which show a large annual variation in proportion of young in late summer and small variation in adult survival between years, and a large potential for natal dispersal of females. Local counts sometimes shows unrealistically high population growth rates or discrepancies between production of young, adult survival and population change. Part of this is probably due to measurement errors but here we propose that a weak density-dependence and large-scale redistribution of young grouse probably add a biological explanation to the unexplained variation in the analysis of count data.

Posters

Farmland biodiversity - in the hands and minds of farmers **A1**

Johan Ahnström (Lund University Department of Biology), Jan Bengtsson (Swedish Univeristy of Agricultural Sciences), Åke Berg (Swedish Biodiversity Centre), Lars Hallgren, Wiebren J. Boonstra and Johanna Björklund (Swedish Univeristy of Agricultural Sciences)

Nature conservation agreements will not affect biodiversity unless there is an agent, in the case of agricultural landscapes the farmer, that manages the land. Thus to succeed with conservation of farmland biodiversity the farmers attitudes to and knowledge about nature need to be understood since these factors affect their farm management. In this study we found that farmers interest in nature was important to explain our biodiversity measures (species richness of weeds, carabids, bumble bees, bees and birds). Our interdisciplinary approach, where inventories and interviews stand side by side, gives us new insights into how to design future nature conservation.

Predicting population dynamic consequences of spatially restricted dispersal in a heterogeneous world **A18**

Debora Arlt, Marie Nevoux, Ken Norris (Centre of Agricultural Research, University of Reading) and Hanna Kokko (Department of Biological and Environmental Science, University of Helsinki)

In most species dispersal is spatially restricted. For the Mauritius kestrel it has been shown that spatially restricted dispersal reduces population growth at low densities. Thus, populations will be less buffered against perturbations. The precise impact of the reduced spatial density-dependence will depend on the specific spatial pattern of environmental change (spatial heterogeneity, spatial distribution of individuals). We employ a spatially explicit individual-based model to predict the impact of this reduced spatial density-dependence under scenarios relating to different habitat composition and distribution. Our model is a useful tool to evaluate the links between habitat heterogeneity, spatial processes and population persistence.

Factors determining bag size of individual willow grouse hunters **A19**

Lasse Asmyhr (Hedmark University College), Maria Hörnell-Willebrand and Tomas Willebrand

We are convinced that understanding of hunter efficiency and preferences will greatly improve conservation and harvest management. We tested the efficiency of similarly experienced hunters in four different areas during two consecutive days during two years. Half the number of hunters had detailed experience from the most recent grouse count in their area. We estimated the importance of factors as grouse density and breeding success, sex of hunters, distance walked, number of encounters and consecutive hunting day, and year. Density of grouse and previous knowledge of grouse distribution in the area were less important than hypothesized before the experiment. Hunters were significantly less efficient the second day although their effort did not decline proportionally. Females bagged significantly fewer grouse despite the same effort and encounter rate.

Scoring with biodiversity: novel approaches to enhance conservation in agriculture **A2**

Oliver Balmer (Research Institute of Organic Agriculture, FiBL), Simon Birrer, Markus Jenny (Swiss Ornithological Institute) and Lukas Pfiffner (Research Institute of Organic Agriculture, Switzerland)

Agriculture affects close to 40% of the Earth's land surface and is intimately linked to biodiversity. Modifying agricultural practices therefore harbours a big potential to benefit biodiversity on a large scale. In Switzerland, direct payments on average constitute 25% of the farmers' agricultural revenue. This makes direct payments a very powerful tool because the rules governing their allocation can be changed more easily than most other factors influencing farmers' decisions. If these payments are linked more efficiently to requirements benefiting biodiversity, strong improvements are likely. This approach is sustainable because tax payers are willing to spend such large amounts of money to support agriculture but they increasingly demand conservation efforts in return. We present an 8-year collaborative project spanning ecology, agriculture, economics and social sciences. We have developed a field-applicable point system to score the performance of individual farms for biodiversity and are testing how well the scores correlate to measured farm-wide biodiversity on 100 farms in the Swiss lowlands. The point system is intended as a measure used to allot direct payments. Further, we are testing the effect of a novel counselling approach. Advisors provide whole-farm solutions optimizing ecological and economical aspects for individual farms, emphasizing that only locally adapted measures be taken that efficiently contribute to biodiversity. We are verifying the success of the approach by tracking the development of biodiversity and income over seven years.

The credit point system: a market approach to enhance biodiversity on farmland**A3***Simon Birrer (Swiss Ornithological Institute), Peter Althaus and Markus Jenny*

Farmland intensification is one of the major threats to biodiversity in Central Europe. Therefore, many countries have adopted agri-environment schemes to enhance biodiversity on farmland. New economic incentives must now be provided to producers, guaranteeing an outlet for their wildlife-friendly products and ensuring green-box subsidies in the long run. In 2008, IP-SUISSE, a farming organisation representing a quarter of Swiss farmers, changed their guidelines towards wildlife-friendly agriculture. Switzerland's largest super market chain sells most of the IP-SUISSE products (business volume of ca. 1 billion Swiss francs). The labelled wildlife-friendly products are well-received by consumers who are willing to pay more for products with an added value. Farmers benefit from bonus payments and a better public image. The degree of wildlife-friendliness is measured by a credit point system. This system also serves as an indicator of biodiversity at the farm scale. Farmers can gain points from 32 different measures, most of which are designated options of the Swiss agri-environmental scheme, but go further than minimal conditions and account for quantity, quality and spatial distribution. Additionally, points can be scored with specific arable and grassland measures such as in-field arable options or rotational mowing. Farmers are free to decide which measure they want to implement on their farms. They fill out the credit point system as a self-declaration, but from 2010 onwards, it will be randomly checked on farm inspections. We are currently evaluating the credit point system on 100 farms (2009-2010) within the project Scoring with biodiversity. One condition for farmers to join the programme is that they reach a minimal point score by 2013. In 2008, only one third of IP-SUISSE farmers reached the minimal score. The rest will have to (substantially) improve their ecological performance. First surveys suggest that most farmers are willing to make this effort. This will clearly improve the situation for farmland biodiversity in Switzerland.

Measurement of epistasis in outbreeding depression by line-cross analysis**A20***Geir H. Bolstad (CCB, NTNU), Donald V. Griffin (Florida State University), Thomas F. Hansen (CEES, University of Oslo) and Christophe Pélabon (CCB, NTNU)*

Epistasis is regarded important in the decline of fitness in hybrid populations through Dobzhansky-Muller incompatibilities. Classically, epistasis is measured as additive by additive, additive by dominance, and dominance by dominance epistasis. However, the meaning of these measurements are often not easy to understand, and little theory on epistasis has a direct connection to them. We, therefore, develop a new set of models to study the genetic architecture of Dobzhansky-Muller incompatibilities by line-cross analysis.

Inbreeding and genetic variation in the immune system **A27**

Åsa Alexandra Borg, S. A. Pedersen (NTNU), H. Jensen (CCB, NTNU) and H. Westerdahl (Department of Ecology, Lund University)

Small populations are likely to have low genetic capacity for disease resistance due to inbreeding and genetic drift. Theory predicts that parasite-mediated selection should maintain variation at genes in the major histocompatibility complex (MHC) even in populations that have little variation at other loci. We evaluated inter- and intrapopulation variation in MHC and neutral microsatellite genotypes in an inbred and an outbred house sparrow population. The level of genetic variation at MHC loci was high for both populations, whereas neutral variation was lower in the inbred population, suggesting that selection have maintained genetic variation for pathogen resistance in both populations.

Sample size, precision and accuracy in population viability analysis **A21**

Martin Cravener (Södertörn University College), Patrik Dinnézt, and Kari Lehtilä

PVA, one of the quantitative IUCN Red list techniques used to assess the threat status of a species, is in pressing need of clarity in how much demographic data is required to obtain the precision and accuracy to make reliable assessments, while avoiding waste to over-sampling. Taking samples of the herbaceous perennial *Saxifraga cotyledon* from 80 to 500 000 individuals, iterated simulations produced key parameters such as the stochastic growth rate, r_t value, the probability of quasi-extinction and deterministic elasticities. These were tracked to find points at which the cost of sampling exceeded the net gains in precision and accuracy.

Increased commonness is common for the common, but rare for the rare **B1**

Patrik Dinnézt (Södertörn University) and Börje Ekstam (Linnaeus University)

The most likely plant species response to loss of wetlands is decrease in abundance, but there exist also species that increase their spatial distribution. Due to a more competitive environment and natural succession following ceased management and habitat loss, the fraction of rare, as well as the fraction of common species, may increase. This process can also have a carry over effect to newly restored wetlands. We have analyzed wetland species abundance data from Southern Sweden from two different time periods, 1938 1975 and 1987 2006, in a comparison with colonization patterns from 35 newly constructed wetlands in the same region. Regional distribution patterns were weekly bimodal for both time periods and the degree of bimodality increased from mid 20th to late 20th century. Colonisation pattern of newly established wetlands is also bimodal and the most successful colonizers are species that also increased in regional abundance during the second half of the 20th century. This indicates that even if some rare species succeed to colonize the new habitat it is more common that common species become more common, and that the rare become even rarer.

Multi agent modelling as an integrative tool for species and ecological service conservation: the case of scavengers and livestock farmers **A4**

Helene Dupont (UMR 7204 MNHN-CNRS-UMPC), S. Bobbe (CETSAH) and F. Sarrazin (UPMC-UMR 7204)

Feeding vultures can be seen as a beneficial activity both preserving these flagship species and maintaining ecological recycling of carrions. This conservation practice can be particularly relevant to restore links between vultures and livestock farmers. We developed a multi-agent system including explicitly vultures daily feeding behavior and population dynamics and farmers carcasses disposal practices. We investigated the effects of various resources distributions resulting from types of farming and perception of these scavengers on both vulture population and service efficiency. This generic model offers an interesting tool to better understand relationships between social choices and vulture population dynamics.

Extinctions at The Boarder of the Arctic Fox Distribution Exploring Explanations **B2**

Nina E. Eide (NINA)

A complex of changes in alpine ecosystems causes the extinctions of arctic fox populations. The dynamic of rodent/lemming cycles has changed dramatically in Fennoscandia. Extinctions overlap with collapse in rodent/lemming cycles. The red fox compete with arctic fox for the same habitat and prey. The expansion of the red fox relates to global warming as well as human alteration of habitats and active management of species. First small, small populations risk inbreeding, getting smaller and further isolation. Understanding the driving mechanisms underlying these extinctions is detrimental for management of the arctic fox both in Fennoscandia, and on the arctic mainland.

Predicting wolf distribution by means of historical data **A22**

Kristin Evensen Gangås, Harry P. Andreassen, Barbara Zimmermann and Petter Wabakken (Faculty of Forestry and Wildlife Management, Hedmark University College)

One big challenge in management of human-wildlife conflicts is the lack of predictability of where large carnivores will establish in the future. Without such forecasts it is impossible to know where to introduce preventive actions to decrease conflicts. In Scandinavia, we have longitudinal monitoring data on the establishment of the Scandinavian wolf population since late 1970s. We will develop models based on Kernel density distributions to predict the future establishment of wolf populations. In a second stage we will combine this with spatial distributions of economic and social factors to improve spatial management of large carnivores.

The effect of forestry and moose management on the small rodents community in Norway **B3**

Lucrezia Gorini, Simen Pedersen, Karen-Marie Mathisen, Morten Odden (Hedmark University College), Erlend B. Nilsen, Manuela Panzacchi, John D. C. Linnell (NINA) and Luigi Boitani (University of Rome 'La Sapienza')

Intensified forestry in Norway has been linked to the observed decline and changes in the small rodents community which is regarded as the heart of boreal ecosystems. Moose density, on the other hand, has increased following the spread of young even-aged stands and local winter feeding. We trapped rodents in a harvested forest and at moose feeding stations to investigate potential indirect effects between different trophic levels. Preliminary results suggest the existence of a link between the composition of the rodents community, forestry and moose management which may have further consequences on the overall biodiversity.

Spatially structured food webs in coloured environments **A23**

Sara Gudmundson, Frida Lögdberg and Uno Wennnergren (IFM, Theory and Modelling, Linköping University)

Ecological theory states that complex food webs are unstable and extinction-prone but yet species rich food webs do exist. Our analysis of the diamond-shaped food web indicate that single measures of stability ($1/CV$) could be misleading, not reflecting significant changes in mean densities. Increased environmental variance increased rare species and decreased most abundant species. Stabilisation of environmental variation decreased with increased redness. Increased reality, by linking environmental variation to spatially subdivided populations, increased the stabilising effect. Spatial and temporal components, jointly included and analyzed with care, may become a basis for explaining the existence of large and diverse food webs.

Genetic discontinuities in a continuously distributed population of a highly mobile ungulate **B8**

Hallvard Haanes (CCB, NTNU), K. H. Røed (Norwegian School of Veterinary Science), E. Solberg (NINA), I. Herfindal and B.-E. Sæther (CCB, NTNU)

Many species have populations with histories of geographic range shifts or successive shifts between fragmentation, growth, spatial expansion and a continuous distribution. The genetic effects are of great concern, given the present major shifts in many species. We assess the distribution of genetic variation of 15 microsatellite loci in the abundant and continuous Norwegian moose population, which has a history of colonisation and recent fragmentation. Bayesian clustering methods both without and with spatial information suggests that genetic discontinuities divide the population into at least three subpopulations along a latitudinal axis, separated by convergence zones of high admixture. Approximate Bayesian Computation estimates suggest the structure is old, and that postglacial colonisation has followed both southern and northern routes.

Effects of 100 years of landrace crop conservation**A5***Jenny Hagenblad (NTNU) and Matti Leino (Swedish Museum of Cultural History)*

With the development of modern plant breeding the vast majority of landrace crops went extinct, and with them both valuable genetic material for future crop improvement and information about the major source of sustenance for humans throughout history were lost. We have compared genebank material of four different species with 113-year-old seed samples from the same geographic areas to elucidate the effects of 100 years of conservation on genetic diversity. We find both loss of diversity and genetic differentiation, but with large species-specific differences. These findings should be highly relevant also for the conservation of wild species.

Ground-icing and winter forage accessibility on a high-arctic ungulate range: recent changes and future predictions**B4**

Brage Bremset Hansen (CCB, NTNU), R. Aanes (Norwegian Polar Institute), I. Herfindal (CCB, NTNU), J. Kohler (Norwegian Polar Institute) and B.-E. Sæther (CCB, NTNU)

The concern that arctic herbivores may more often face ice-locked pastures owing to rainy future winters lacks empirical support. We examined past (2000-2008) and predicted future (down-scaled climate projections) ground-ice faced by Svalbard reindeer. Locked pastures are already common; on average two-thirds of vegetated patches were ice-covered. Icing increased with winter-rain, which increased in previous decades and in future projections. Because icing decreased with elevation and slope, reindeer sought steep mountains where forage is extremely sparse and probably non-sustainable. The results provide an early warning of how global warming may change arctic herbivores food accessibility, range use and carrying capacity.

Individual and demographic differences interact with environmental influence on reproductive performance in goshawk**B5**

Ivar Herfindal, Bernt-Erik Sæther (CCB, NTNU), Martijn van de Pol (Australian National University), Jan Tøttrup Nielsen Sindal (Denmark) and Anders Pape Møller (Université Pierre et Marie Curie)

To understand the ecological consequences of climate changes we need knowledge about environmental influence on individual performance. Individuals can vary in their response to environmental variation, due to variation in resources, quality and demographic attributes. We evaluated reproductive performance in goshawks in relation to environmental variation, with respect on differences in resource base, individual quality, and demography. Individuals varied considerably in their response to environmental variation. This was explained by quality differences between females, and by age and breeding experience. Because individual characteristics affect populations' response to environmental conditions, and fluctuate temporally, they should be included in population dynamic predictions.

The evolution of antler size in the moose (*Alces alces*) and its impact on sustainable development of the Swedish moose population **A6**

Lars Hillström and Henrik Österdahl (Academy of Technology and Environmental Science, University of Gävle)

The Swedish moose population has during the last 60 years been going through rather drastic changes in numbers. Recently there also seemed to have been a shift towards males with less and less developed antlers, which is an important problem for the moose population breeding. The aim with the present study was to study how antler size in the moose is related to age, body mass and population density. Information on the antler and body mass characters was obtained from 425 males that were shot during the annual moose hunting in October between the years 1999-2006. Age and body mass were the variables that explained most of the variation in antler size in this study. A residual of antler points over age, demonstrated a positive correlation between residuals and carcass, such that males with larger antlers for their age, was on average heavier than other males. There was also a significant negative correlation between population density and carcass. The high mortality rate of older males have lead to that few males reach an age where the horns are fully developed and the age distribution has moved to younger ages. As a consequence of this fact the males start to reproduce at younger ages. As the rutting behaviour is a very energy demanding activity, the younger males body growth will be constrained and there will be a large cost to come in rutting stage early. As the percentage of males and male age is having an impact on the reproduction of the population, this is an important problem which should be considered in order to give the right prerequisites for a more productive population of moose with big males that have well developed horns.

Development of Bayesian animal models to estimate heritable genetic variation in fitness-related traits in natural populations **A24**

Anna Marie Holand, I. Steinsland and H. Jensen (CCB, NTNU)

Having accurate estimates of the genetic contribution to observed phenotypic variation in fitness-related characters is of fundamental importance to predict evolutionary responses to selection and thereby the viability of populations facing for example human-induced changes in the environment. Here we utilize the advantageous properties of a new approximation (INLA) in a Bayesian animal model to compute approximations of the additive genetic variances and heritabilities of fitness-related traits in natural house sparrow populations. Our approach is beneficial because it is fast, gives accurate estimates, and it can be extended to quantify non-additive sources of variation and genetic changes across generations.

Effects of the parasitic gapeworm (*Syngamus trachea*) on survival in house sparrows (*Passer domesticus*) **B6**

Håkon Holand, Thor Harald Ringsby, Henrik Jensen and Bernt-Erik Sæther (CCB, NTNU)

We investigated the consequences of being infected by the parasitic gapeworm (*Syngamus trachea*) on the probability of survival in four insular populations of house sparrow (*Passer domesticus*) in northern Norway. We measured parasitic infection in terms of counting eggs of *S. trachea* in faecal samples of sparrows and found no significant pattern of reduced annual survival probability. However, sparrows which were heavily infected by *S. trachea*, recognized by showing gaping- behaviour, had a significantly lower annual survival rate. Understanding the role of parasites in natural populations may prove crucial in order to understand population dynamics and protect vulnerable species.

Red-listed fungal species require connectivity at three spatial scales **B7**

Jenni Hottola (University of Helsinki)

Many species of dead-wood dependent fungi have declined because of forest management. We show that connectivity at the local, landscape and regional scales is important especially for the highly specialized species, many of which are also red-listed. It is thus likely that small habitat patches contribute only marginally to protection of red-listed species, especially if habitat quality is not substantially higher than in ordinary managed forest, as is the case with e.g. woodland key habitats. Our findings highlight the importance of protecting well-connected, large and high-quality forest areas instead of small fragments distributed across the landscape.

Genetic variation and inbreeding in an insular house sparrow metapopulation **B9**

Henrik Jensen, A. Billing, A. M. Lee, S. Skjelseth, Å. A. Borg, E. Myre Bremset, H. Pärn, T. H. Ringsby and B.-E. Sæther (CCB, NTNU)

Despite the potentially huge impact of inbreeding on population viability and evolutionary processes, especially in small populations, quantitative demonstrations of genetic and demographic effects of inbreeding in natural populations are few. In an insular house sparrow metapopulation we found that genetic variation (multilocus heterozygosity H) decreased when individual levels of inbreeding (F) increased. Furthermore, when relating fitness to F and H we found that inbreeding depression was associated with a reduction in genetic variation. Interestingly, the results also suggested inter-population variation in inbreeding and its effects on biodiversity. Possible mechanisms for the population-specific levels of inbreeding were evaluated through simulations.

Partridges in Sweden - wild or not?**A7***Annelie Jönsson (Biology, Lund University)*

Grey partridges *Perdix perdix* have declined severely across Europe during the past decades. In Sweden the majority of the remnant population is located in the southernmost county Scania. Here we have started a project focusing on improving the habitat in favour of the grey partridge but also of other farmland biodiversity. The question remains though whether this is actually a wild viable population, or whether it is sustained by releasing for shooting and for bird dog training. These are activities that may be more widespread than previously realised. Answers are needed to determine the best way forward in managing this species.

Can population declines be detected in the genetics of Finnish house sparrows?**B10***Jaana Kekkonen (University of Helsinki) and Jon Brommer*

House sparrows have dramatically declined in the last decades throughout Europe. In Finland, the species' abundance is now only a third of what it was two decades ago. I have data from 13 Finnish house sparrow populations from the 80's and I collected new material from these same locations in 2009. In a previous study I found very little genetic differentiation between the populations two decades ago. The aim of this study is to compare the levels of genetic diversity within the populations and the level of genetic differentiation between the populations before and after the drastic declines.

Plenty of prey, few predators: what limits lions *Panthera leo* in Katavi National Park, western Tanzania?**B11**

Christian Kiffner (Büsgen-Institute, Dept. of Forest Zoology and Forest Conservation), Britta Meyer (Katavi-Rukwa Conservation and Development Programme, Tanzania), Michael Mühlenberg and Matthias Waltert (Department of Conservation Biology, Centre for Nature Conservation, Georg-August-Universität Göttingen)

We provide empirical evidence that the lion population in Katavi National Park is very low. Lions generally avoided areas of up to 3 km from the Park boundary and were not observed outside the Park. Based on observed lion demography, an evaluation of hunting quotas in adjacent hunting blocks, and anecdotal information on traditional lion hunting, we hypothesize that anthropogenic mortality of lions outside Katavi National Park is reducing lion abundance within the Park. Additional to direct persecution, natural and indirect anthropogenic edge effects contribute to the low lion density.

Successful restoration of freshwater pearl mussel population in a Norwegian river by means of liming **B12**

Bjørn Mejdell Larsen (NINA)

The freshwater pearl mussel (*Margaritifera margaritifera*) is a rare and threatened species throughout its range, and is the subject of recovery programmes in many countries. Liming activities are a prerequisite for the survival of many Scandinavian mussel populations. In River Ognå in southwestern Norway the mussel population was nearly extinct due to acidification. Only a scattered population of old individuals (length 110-135 mm) was found in the 1980s. From 1991 onwards, the river was limed. The effects of liming on the water chemistry, juvenile stocks of Atlantic salmon (*Salmo salar*) and the freshwater pearl mussel were assessed. Prior to liming the mean annual pH level was 5.2-5.8. Liming resulted in a gradual mean annual increase in the pH level to 6.6 in the late 1990s. Simultaneously the density of salmon fry increased more than four times. Finds of a few young mussels (less than 40 mm) in 1997-1999 indicated that recruitment was in a stage of recovery. In 2002, the number of young mussels increased to 36%, and in 2005 and 2008 about two thirds of the mussels were found to be younger than 15 and 18 years respectively (less than 95 mm). But the watercourse is still sensitive to acid water and continues to be dependent upon a continuous liming. Poster only

Mating systems, demographic stochasticity and extinction risk **A25**

Aline Magdalena Lee, Steinar Engen and Bernt-Erik Sæther (CCB, NTNU)

Demographic stochasticity influences the growth of small populations, and consequently their extinction risk. We have used a stochastic pair formation model to investigate how mating system, sex ratio, and population size affect demographic stochasticity and extinction risk. We show that it is not mating system alone, but combinations of mating system and sex ratio that are important for the extinction risk of populations. Specifically, polygyny has the potential to give a high demographic variance, thus shortening the time to extinction, but the outcome is dependent on the operational sex ratio. The influence of population size is also discussed.

Extinction risk as a consequence of variations in time and space **A26**

Frida Lögdberg and Uno Wennergren (IFM, Theory and Modeling Linköping University)

Metapopulation theory has clarified that biodiversity and extinctions should be studied in their spatial and temporal settings. Yet, methods to generate and measure such settings have been limited. Space invokes synchrony between patches which is correlation across space. We use a two-dimensional spectral approach when generating temporal noise and synchrony to assure independence and possibility to expand the dimensionality. Landscapes are also generated and analyzed by a spectral two-dimensional method. This novel method reflects real world aggregation of patches. The approach reveals that extinction risks and biodiversity relate to straightforward processes linked to simple measures as means and variances.

The Ecology and Management of Ecosystem Services Provided by Insects in Agriculture **B13**

Ola Lundin, Riccardo Bommarco, Maj Rundlöf (Department of Ecology, Swedish University of Agricultural Sciences) and Henrik Smith (Department of Animal Ecology, Lund University)

As a consequence of agricultural intensification, functionally important species groups such as natural enemies to crop pests and pollinating insects have declined, but the effects on the ecosystem services provided are not well explored. I address how local (field) and landscape scale habitat modifications affects communities of beneficial and pest organisms and their multiple functions (pollination, herbivory and parasitism) using clover seed production as a model system. The expected outcome is a scale calibrated management scheme for multiple ecosystem services in agriculture.

Cost-effective age- and geographical distribution of boreal forest reserves **A8**

Johanna Lundström, Lena Gustafsson (Swedish University of Agricultural Sciences), Karin Perhans (University of Queensland), Mikael Rönnqvist (Norwegian School of Economics and Business Administrations) and Karin Öhman (Swedish University of Agricultural Sciences)

Establishing reserves is the most common way to mitigate the negative effects of forestry on biodiversity. We investigated the possibility to make reserve selection more efficient. Our hypothesis was that young forest is a cost-effective selection option since the acquisition price is low but yet the biodiversity potential is relatively high. Analyses using budget and area constrained optimization models with National Forest Inventory data on tree and stand structures, supported the assumptions. Geographical differences were also analysed. These results highlight the importance of integrating economic knowledge and emphasises the overlooked biodiversity potential of young forests.

Is heavy browsing a threat to biodiversity in a boreal ecosystem? **B14**

Jos Milner and Karen Marie Mathisen (Hedmark University College)

Herbivore numbers have been increasing across Europe and North America in recent decades, with implications for whole ecosystems including impacts on biodiversity. Moose populations in Scandinavia are no exception, leading to intense browsing of commercially important boreal forests. We examined the impact of moose browsing on species richness and abundance of 4 functional groups of plants (grasses, forbs, dwarf shrubs and canopy trees) and 2 functional groups of passerine birds (seed-eaters and insect-eaters) along a browsing gradient from sites of heavy browsing around supplementary feeding stations to light browsing at control sites. Both positive and negative effects were recorded.

Human impact on the spatiotemporal dynamics of a generalist predator in the boreal forest**B15**

Morten Odden (*Høgskolen i Hedmark*), *E. B. Nilsen*, *J. D. C. Linnell* (*NINA*), *P. Wegge* (*UMB*), *M. Panzacchi* (*NINA*), *H. Andreassen* (*HIHM*), *I. Herfindal* (*CCB, NTNU*) and *P. Wabakken* (*HIHM*)

An increase in the densities and distributions of small and medium sized carnivores due to human influences on ecosystems has been reported from several parts of the world during the last decades. It is currently a matter of great concern due to its potentially detrimental effects on animal communities. In this poster we will present data suggesting that the spatiotemporal dynamics of a medium sized generalist predator, the red fox, is linked to human activities in two main ways: High and temporally stable populations of foxes were observed in areas of human habitations and where large numbers of moose were shot during the hunting season. Probably, garbage and remains of shot moose are important resources for foxes during the winter.

How to make the wolf pay conserving a perceived problem species by turning it into an economic resource**A9**

Simen Pedersen and **Torstein Storaas** (*Faculty of Forestry and Wildlife Management, Hedmark University College*)

The Scandinavian wolf is a controversial species, and conserving it just as much a social challenge as an ecological challenge. The wolf preys on livestock, hunting dogs and game species, and it is also a symbol of the urban dominance over rural areas. Here we suggest an alternative management system to increase the acceptance of wolves and thereby improve the conservation of Scandinavian wolves by adding value to a perceived problem species. We suggest that the government should pay municipalities and landowners for housing wolves.

Functional traits complementary to species diversity**A10**

Zlatko Petrin (*NINA*)

The concept of functional diversity has recently received increased attention in community ecology. An important question is whether functional traits may be suitable in environmental impact assessment. Using functional traits rather than species diversity in environmental assessment would be particularly helpful in freshwater ecology, as the representatives of some macroinvertebrate taxa are difficult to identify. The analysis of comprehensive survey data suggests, however, that functional traits provide complementary, rather than similar, information when compared to species diversity. The results imply that functional traits might be used to infer likely effects of environmental impacts on the ecological functioning of freshwater ecosystems.

Bridging co-management and protected area: implication for conservation of forest resources and balanced livelihoods in north-east Bangladesh **A11**

Md. Parvez Rana (Shahjalal University of Science and Technology)

The Government of Bangladesh (GoB) recently adopted community-based natural resource management (CBNRM) in five of its protected areas (PAs) as part of a pilot programme in collaborative management including Rema-Kalenga Wildlife Sanctuary (RKWS). The main focus of this study is to assess the effectiveness of alternate income generating activities (AIGAs) which is provided by the Nishorgo Support Project under co-management program. AIGAs is a tool for reducing dependence on forest resources by people living in and around RKWS and also play effective role in forest conservation. This study compares the socioeconomic condition and forest dependency before and after implementation of co-management activities in RKWS. Study findings shows that peoples income sources and dependency on protected forests have noticeably shifted away from forest areas in the last year. Study also reveals that after being implementation of the co-management activities the average income levels of the studied villages have rises on 18 US\$/households. Further more, many of the illegal loggers became forest protector, which make their life more secured. Although gradual, peoples participation seems to be changing the direction of future forest conservation in Bangladesh. It was also found that peoples of the study villages are now actively engaging in forest management activities and it is the only hope for conservation and restoration of forest resources not only in RKWS but also in other protected areas of our country. We conclude that bringing a larger number of people under various income-generating schemes, clearly defining the rights and responsibilities of the local people in PAs and ensuring more effective governance should be the next steps for the future of participatory management in the country.

Population consequences of prospecting behaviour **B16**

Irja Ida Ratikainen (CCB, NTNU) and Hanna Kokko (Department of Biological and Environmental Sciences, University of Helsinki)

Even though dispersal is a very important determinant of population performance, there is still little understanding of how natural selection on this behaviour may affect population-level traits. While individuals could benefit from avoiding the risks of dispersal, population performance may depend on individuals dispersing. We have used an individual-based simulation model to show that when costs of prospecting are high populations would do better without natural selection. Populations are larger, more sites are occupied and fewer populations go extinct in non-evolving populations. This shows that constraints on the evolutionary process can, under some circumstances, help rather than hamper population persistence.

**Disturbance of resident populations by introduction of foreign individuals:
implication for reinforcement programs** **A12**

Alice Rémy, Louise Riotte-Lambert and Harry Peter Andreassen (Faculty of Forestry and Wildlife Management, Hedmark University College)

Introduction of foreign individuals into small, potentially endangered populations, may disturb the social organisation with detrimental effects on demography. Reinforcement programs which do not consider the sex ratio of the introduced individuals or resident population may induce a higher mortality of residents and disturb the population, which is far away from conservation goals. This project aimed at experimentally studying the impact of male or female immigrants into small rodent populations (*Microtus agrestis*), by using radio-telemetry and population survey. We found that only resident females were affected by the introduction of animals and that intruders seemed to be excluded from populations.

From science to practice: the Swiss Recovery Programme for Birds **A13**

Spaar Reto, Verena Keller (Swiss Ornithological Institute Sempach), Ueli Rehsteiner, Werner Müller (BirdLife Switzerland) and Bruno Stadler (Swiss Federal Office for the Environment)

The national Red-List status (extinction risk) and the significance of the national population compared to the European population (national responsibility) were used to select the Species of National Conservation Concern. We evaluated then for each species whether the protection of sites or general habitat improvement measures were sufficient or whether a species action plan was necessary. 120 out of the 195 bird species regularly breeding in Switzerland are of national conservation concern, among them 50 which need specific action plans. - In 2003 we launched the Swiss Recovery Programme for Birds, to stimulate specific conservation actions for these 50 species. We facilitate applied research where gaps in knowledge hinder sound conservation measures. For most species, present know-how allows to propose effective conservation measures. We already established national action plans for seven species, and conservation projects are in progress for many others. - The main aim of the programme is to reduce the factors limiting the species survival and to stop negative population trends on a short term. This comprehensive approach will hopefully help to recover viable bird populations on a longer term.

Spatial variation in density-dependent dispersal in a house sparrow-metapopulation**B17**

Thor Harald Ringsby, Bernt-Erik Sæther, Henrik Jensen and Henrik Pärn (CCB, NTNU)

We examined the relationship between probability of natal dispersal and population size among 12 island populations in a metapopulation of house sparrows in northern Norway. At the inner islands, where the sparrows were living on dairy farms, there was a negative density dependent probability of dispersal. In contrast, at the outer islands, the probability of dispersal was strongly positively density-dependent. Here no farms were present and sparrows were living among houses in small settlements. This demonstrates substantial spatial heterogeneity in density dependent responses of dispersal to changes in population size within a limited range of a species geographical distribution.

Assessing the role of instruments in a policy mix for biodiversity conservation and ecosystem services provision: a review of some challenges in spatial analysis**A14**

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Spatial targeting, i. e. determining which land uses provide the biggest incremental biodiversity benefit is fundamental to determine the cost-effectiveness of conservation decision-making. The science of systematic conservation planning (SCP) provides a framework to quantify the marginal contribution of an area to biodiversity representation and ecosystem services provision. However, the fact that the various instruments in a conservation policy-mix have different scales of spatial representation imposes challenges to the applicability of SCP in this context. We discuss the challenges that remain to be solved before SCP methods can be effectively integrated into policy design and evaluation.

Effects of climate change on biodiversity at the population and species level: a global interspecific analysis of an ecological guild**B18**

Hanno Sandvik (CCB, NTNU)

For a growing number of populations, the effect of climatic variability on population dynamics is well understood. Few studies have quantified the effect of climate across populations for an entire taxon or guild, however. The results presented here are based on data from seabirds from all oceans and climate zones. Analysing these global data interspecifically, renders it possible to quantify the importance of climate change as a threat to seabird biodiversity. It does not only identify the most vulnerable species, but also whether their proportion is a larger fraction of this ecological guild than could be expected by chance alone.

Long-term influence of mowing on population dynamics in the rare orchid***Dactylorhiza lapponica*****B19**

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Many orchids are currently red-listed due to changes in land use, and conservation programmes often apply aspects of traditional use, like mowing, as a management strategy. Mowing is commonly believed to favour orchids through increased survival and reproduction of established individuals, but management regimes are rarely based on experimental studies that explicitly test the effects of mowing through the whole life cycle of the concerned species. In the present study we used data from 16 years of demographic monitoring combined with a seed bank experiment to study how mowing affects population dynamics in 2 populations of the rare orchid *Dactylorhiza lapponica*. The traditional regime of mowing every second year strongly increased recruitment and reduced seed production in both populations, but had moderate effect on adult survival, growth rate and flowering probability. Traditional mowing significantly increased growth rate in both populations, and LTRE analyses revealed that this primarily was a result of increased recruitment. Our results indicate that survival and reproduction of established individuals may be insensitive to traditional management, and emphasize the importance of seed production and recruitment to maintain population growth in this long-lived species. Though managing for high survival seems intuitive in a long-lived species, our results points to the value of considering the entire life cycle in conservation planning, and suggest that *D. lapponica* would benefit most from traditional mowing performed after seed dispersal in the study areas.

Cessation of livestock grazing leads to loss of alpine ecosystems**B20**

James Speed, Gunnar Austrheim (Museum of Natural History and Archaeology, NTNU), Alison Hester (The Macaulay Institute, Aberdeen) and Atle Mysterud (CEES, University of Oslo)

Anthropogenic land use shapes many landscapes. Above the treeline, alpine ecosystems are thought to be threatened by global warming. However, changing land use across Europe has lead to decreasing densities of livestock being extensively grazed in upland habitats. Using a landscape-scale and replicated sheep grazing experiment in the Norwegian mountains, we demonstrate that in the absence of sheep, tree recruitment above the treeline is dramatic, whilst even low densities of livestock can prevent the encroachment of trees above the treeline. Thus, alpine ecosystems and biodiversity may well be at greater risk from changes in land use than changes in climate.

Monitoring of hotspots for threatened species in Norway **A15**

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The project Survey and monitoring of red-listed species was initiated by the Norwegian government, and focuses on the meeting point between conservation biology research and nature management. One of the aims in the project is to pinpoint nature types with a disproportionally high occurrence of red-listed species compared to average Norwegian nature (hotspots), and to survey and test monitoring schemes for such areas. Seven hotspot-habitats are addressed, namely hollow oaks, calcareous lime forests, open sandy areas, calcareous dry meadows, calcareous lakes and grazed, seminatural grasslands. The poster presents general challenges faced in this work, as well as preliminary results.

Long-term Browsing Impact around Diversionary Feeding Stations for Moose in Southern Norway **A16**

Floris Van Beest, Hege Gundersen, Karen Marie Mathisen, Jos Milner and Christina Skarpe (Faculty of Forestry and Wildlife Management, Hedmark University College, Norway)

In areas where wildlife management and commercial timber production should produce benefits at similar spatial scales, supplementary feeding of herbivores may be a useful management practice. We quantified spatiotemporal browsing patterns of moose around 30 feeding stations after 15-20 years of winter feeding in south-east Norway and compared results with those from the same stations 10 years earlier. Our study indicates that long-term winter feeding may lead to resource depletion around feeding stations and increase the size of sacrifice areas if feeding is practiced in fixed locations. This highlights the importance of considering the appropriate time frame when initiating winter feeding.

Effects of climate change on population dynamics and extinction risk in a long-lived shorebird **B21**

Yngvild Vindenes, M. van de Pol, B.-E. Sæther, S. Engen (CCB, NTNU), B. J. Ens, K. Oosterbeek (SOVON Dutch Centre for Field Ornithology) and J. M. Tinbergen (Animal Ecology Group, University of Groningen)

Based on a long-term study of the demography of a declining Eurasian oystercatcher population, we quantified the effect of changes in mean and variance of winter temperature on all vital rates across the life cycle. Then, using a structured stochastic population model, we predicted how these changes would affect the extinction risk. Our results suggest that the population dynamics of oystercatchers are more sensitive to changes in the mean than in the variability of climate. This study illustrates the importance of using individual-based data to predict effects of climate change. Unfortunately, this is not available for most threatened populations.

Effect of forest area and edge length on plant species number and coverage B22
Tiina Vinter, Patrik Dinnézt and Kari Lehtilä (Södertörn University)

Recovery of Damaged Ecosystems: days, decennia or delusion? B23
Anke Weber (NINA)

In a set of 240 independent studies ecosystem recovery capacity was studied. I analyzed recovery times and study durations of non recovered systems including the factors ecosystem type and type of disturbance [1]. Only 30% of the damaged ecosystems recovered fully, 27% did not recover at all. Recovery capacity depends on both ecosystem type and type of inflicted damage. Land-based ecosystems and disturbances have a significantly longer recovery time (Forrest: avg. 44 years; Agriculture and Deforestation). The shortest recovery times were found for the disturbances Trawling (avg. 1 year), Invasive species (avg. 3 years) and Oil spill (avg. 3 years). In an optimistic recovery scenario, 90% of the non recovered systems might recover within the order of few centuries. In a pessimistic scenario, however, some ecosystems may need several centuries to recover, if they recover at all.

An education model for future managers to improve sustainable conservation efforts A17

Barbara Zimmermann, Tomas Willebrand (Hedmark University College) and Gregor Torkar (University of Ljubljana)

Sustainable conservation is put into action by different stakeholders and managers at the local, regional, national and international level. A multidisciplinary framework in the education of future managers is therefore crucial for the success of conservation projects. We present an educational model that does not only include the ecological in-depth knowledge, but also the human dimension, the ability to cooperate, and the international perspective. In a Nordic-Baltic joint effort financed by Nordplus, we organized an intensive course with students from ten universities. Mixed student groups were studying a conflict regarding natural resources by means of literature research and qualitative interviews of stakeholders. Students had a high learning outcome.

Functional response in Scandinavian wolves: implications for sustainable management of a conflict species B24

Barbara Zimmermann (Hedmark University College), Håkan Sand (Grimsø Research Station, SLU, Sweden), Petter Wabakken and Harry P. Andreassen (Hedmark University College)

We estimated the functional response of 12 wolf packs interacting with moose and roe deer as prey in 16 winter studies in Scandinavia. Wolves showed a strong predator dependent functional response. While large packs killed just about the amount of prey required to cover the daily requirements, smaller packs had higher per capita kill rates, and pairs exceeded by far their daily requirements. If wolves are controlled to keep the impact on moose below a certain threshold, this may be more successful by limiting the establishment of new packs rather than removing individuals from already established packs.

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