Absence of differences in fluctuating asymmetry (FA) between small populations of the narrow endemic Aquilegia thalictrifolia (South-Eastern Alps, Italy). Increased FA of morphological traits occurs under environmental and genomic stress, being linked with heterozigosity, population size and performance, and environmental factors. The aim of this work was to analyse such relationships in Aquilegia thalictrifolia, a narrow endemic plant species, occurring in 15 small populations in the Garda Lake area. We studied differences in FA between all the populations, measuring 1830 leaves and petals of 150 flowers. Relationships between FA and performance, population size, density and degree of isolation were analysed. According to other studies, leaf and flower asymmetry were only slightly correlated. FA did not differ between populations, and also between the core area of distribution and two very far disjunctions. We found no significant relationships between FA and performance of the populations, and between FA and population size and density. The lack of significant results concerning FA variation differs from most of the known literature. This could be explained by considering that environmental conditions and genetic diversity are affecting homogeneously the FA through the whole species range. A further step of our work will be the analysis of the heterozigosity on the same individuals measured for the FA, with the aim of understanding if, despite the lack of significant FA, genetic diversity varies among populations of A. thalictrifolia. This information may provide further insights into the evolutionary history and conservation status of this recent endemism.
Developed nations intervened in conservation policy across in Africa during the 20th Century to address perceived needs to protect species and biodiversity. By the 21st Century, conservationists in Africa have revised that perception and begun the process of identifying conservation priorities from an African perspective, and in consideration of Africans’ priorities. While foreign conservation interveners struggled to identify mechanisms to which local people would respond, African conservationists are now demonstrating how to integrate the continent’s unique socio-economic circumstances into efforts to protect biodiversity. In Africa, effective conservation policy must include the generation of wealth, reduction of disease and hunger and support of traditional land use practices.

**Integrating Top-Down with Bottom-Up Conservation Policy in Africa**

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**Bird monitoring to conservation el Salitre wetland in Bogota: strengthening local conservation efforts**

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Bogota Savannah was greatest Lake Humboldt 20000 years ago. Early XX century, there were 50000 ha of wetlands in Bogota, but at time this area has reduced to around 800 ha, due principally human activities like industry, city-planning expansion, and agriculture. Actually, there are 13 wetlands and 2 associated lakes in Bogota. El Salitre wetland is aquatic area that contains migratory and resident bird’s species. Around this wetland, there are some urbanization and recreational areas that affect this natural habitat. Due city-planning expansion District Administration wanted to build a greatest area to realize massive events on El Salitre. At date, we have realized bird monitoring and we have registered this region is very important for birds like core habitat, since this site offer them food and protection. Migratory species like Vermivora peregrina, Porzana carolina, Porphyrio Martinica, Actitis macularia, Piranga rubra, Contopus cooperi inhabit this area. Birds in El Salitre wetland use primarily the area for feeding and resting, and we have registered presence of eggs and chicks. This way, with these results, we demonstrated this area is very important for migratory and resident birds, and El Salitre wetland was declared like that a few months ago. However, conservation and educational efforts should take in consideration the protection and conservation this wetland.

**Past, present and future of wild ungulates in relation to changes in land use**

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In recent decades, Mediterranean landscapes have been experiencing more rapid changes in land use than usual. These relatively rapid changes have affected the ecology of the species inhabiting this biodiversity hotspot. Some studies have assessed the effect of such changes on biodiversity, but most of these were diachronic studies of population dynamics, or synchronous studies of species habitat selection, whereas few studies have simultaneously taken into account temporal changes in habitat composition and changes in species distribution. The present study analyzed the effects of land-use changes on the evolution of the distribution of wild ungulates (Iberian wild goat, red deer, roe deer and wild boar). Thus, we i) describe the environmental determinants of ungulate distribution in past scenario (1960s) but also in present one (1990s), ii) assess the biogeographical differences between scenarios, and iii) model land use for 2040 to forecast future species distributions. Our results show that, with the exception of wild boar, which drastically altered its distribution between both scenarios, natural vegetation has more explanatory power in models of the present, but crops were more relevant in models of the past. Generally, areas favourable to the species studied will continue to increase in the future. The results are discussed from the perspective of the socio-economic relevance of wild ungulates in relation to some unfavourable areas of Mediterranean regions.

**Applying choice modeling to design payment programs for off-reserve conservation in the Northern Territory, Australia**

Adams, VM*; Pressey, RL; Stoeckl, N; James Cook University; vanessa.adams@jcu.edu.au

The need to integrate social and economic factors into conservation planning has become a focus of academic discussions and has important practical implications for the implementation of conservation areas. However, to date the focus has been only on selection of areas for strict reservation. With limited resources, progressive degradation of habitats, and rising expectations about the necessary extent of conservation management, it is increasingly likely that other conservation actions such as stewardship agreements or conservation covenants on private land will be necessary. We conduct a survey in the Daly Catchment, Northern Territory, to estimate the current land management costs for landholders associated with current conservation actions and threats. The Daly Catchment is a national priority for biodiversity conservation but also highly suitable for intensified extractive uses. We use choice modeling to assess the probability of success of three conservation actions by land parcel: acquisition for reservation, payments to support a Conservation Management Agreement, and payments to support a Conservation Covenant. We produce a spatially explicit map of areas that have a high probability of success for the various conservation actions. Additionally, we assess the current costs of conservation for the catchment and use regression techniques to estimate the budget required to support the various conservation actions under consideration.

**P1.5**

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Past, present and future of wild ungulates in relation to changes in land use

**P2.80**

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Bird monitoring to conservation el Salitre wetland in Bogota: strengthening local conservation efforts

**P23**

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Applying choice modeling to design payment programs for off-reserve conservation in the Northern Territory, Australia

3-7 July 2010, Edmonton, Alberta
Climate Change Modelling of an Ancient Endemic: a Koala Case Study.

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Ongoing concern about climate change and its effects on species distributions and global biodiversity has seen the increasing utilisation of numerous predictive modelling approaches. Species distribution modelling is now a tool that has become an essential component in biodiversity conservation and management. Australia's endemic folivorous marsupial, the koala, is increasingly threatened by the synergistic threats of primarily, habitat fragmentation and loss, drought and heat waves. Using a range of distribution modelling techniques, we investigated the future distribution of koalas under projected climate change scenarios and incorporated these models into a reserve selection framework. We found significant range contractions from their western arid and semi-arid range towards rapidly urbanising eastern and coastal regions, suggesting population declines and local extinctions of western populations under a projected hotter climate. Our reserve selection modelling identified priority future habitat refugia for koalas, information that can feed into a broader land use planning decision-making process. We recommend that koala conservation policies urgently develop systematic conservation strategies that aim to reduce the contemporary land use pressures on extant koala populations and help buffer against the projected impacts of climate change. Such strategies are essential if this flagship species is to survive in the wild.

Biogas plants promote forest conservation in India

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Biogas plants promote forest conservation in India

Over 80% of the total energy consumed in rural India comes from biomass fuels such as firewood, crop residues and livestock dung. This paper presents data on household biogas plants successfully established in remote tribal villages of western India with an emphasis on their impact in enhancing local ecology. Between January and June 2007, 125 biogas plants in Gujarat, Rajasthan and Madhya Pradesh States were visited to record data on their impact on the local ecology and community. The annual average use of firewood was 638.3 kg/household, which dropped drastically from 1,048.9 kg before launching the biogas plants to 410.6 kg afterwards. An annual total of 79.8 tons of firewood from the forest was saved by the 125 households, which showed the enormous potential of household biogas plants in relieving ecological stress in forest areas of rural India. Similarly, the usage of kerosene (from an average of 120.7 to 46.3 l/year) and chemical fertilizer (from an average of 472.2 kg/year to 235.5 kg/year) was also drastically reduced after the launch of the biogas plants. Therefore the eco-friendly biogas technology deserves serious attention.

Cavity-nest site selection by Syrian woodpecker (Dendrocopos syriacus) in Yazd province, Iran

The Syrian Woodpecker is a resident breeding bird from southeastern Europe east to Iran. We studied tree features influencing cavity-nest site selection by this species in an forest oasis in semi-arid central Iran. Habitat features of the detected cavity-nests were compared with randomly selected control trees by quantifying a number of habitat variables including height, diameter and canopy cover of the selected trees. All the nests have been selected on pistachio (Pistacia atlantica) trees, while other tree species such as Amygdalus scoparia and Acer cinerascens have not been chosen. The most important factors influencing cavity-nest selection was tree species and the diameter of trees. The mean tree diameter at base of 40 selected pistachio trees by Syrian woodpecker was 7.2 cm ± 1.16 SD, which was significantly larger (P

Effects of weeding and fencing on the regeneration of native sapling communities in Mauritius.

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Invasive alien species impair the regeneration of native forests in Mauritius. I investigated the effects of two management practices, weeding and excluding (via fencing) of alien taxa, on the regeneration of native sapling communities at two sites. A managed (weeded, fenced) and a controlled (non-weeded, non-fenced) plot were surveyed in 1998/9 and re-sampled in 2008 at each site. All woody saplings (20-130 cm tall) were identified and counted. Communities at each site were compared using two-way ANOVAs and diversity derived from Shannon Index. Wilcoxon tests were used to investigate changes in density and importance value (IV) of the ten most important species in 1998/9 with their paired value in 2008. Sapling recruitment in the managed plots increased by 122% and 234% whereas sapling recruitment in the control plots increased by 81% and 32% respectively. ANOVA results confirmed that management had a significant positive effect on recruitment at both sites (p
The Northern Great Plains (NGP) is an ecoregion of high conservation value. Grasslands in this region provide essential ecosystem functions such as preventing soil erosion, filtering ground water, cycling of nutrients, and sequestering carbon. Although preservation of these ecosystem services is vital to human society, conservation of the NGP ecoregion is often neglected due to high developmental pressure from agriculture and oil production. The expansion of agriculture and oil production results in habitat loss, habitat fragmentation, invasive species, and increased pollution. In the NGP, conversion of grassland to cropland is between 68 and 80 percent in Alberta, Saskatchewan, and Manitoba and between 50 and 67 percent in North Dakota, South Dakota, and Montana. In Manitoba, Saskatchewan, North Dakota, and South Dakota alone there are nearly 38,000 actively producing oil wells. A recently revised estimate of undiscovered oil reserves in the NGP indicate a 25-fold increase over previous estimates. Consequently, the impact of oil development is likely to increase substantially. Given existing and emerging threats to conservation on the NGP, public policy initiatives that explicitly value functional, resilient ecosystems are paramount. Sustainable development of the NGP requires that state/provincial, federal, and international policies promote multifunctional landscapes that maintain ecosystem function while concurrently providing economic benefits.

Using Australian avifauna as a case study, our research aims to examine how the values of wildlife to Australian society affect conservation programs. We discuss how different bird species are represented in Australian society through a social values framework. Value (a relative worth, merit or importance) cannot be observed directly but only through expression in the form of attitudes and behaviours. Socio-psychological techniques can be used to measure fluctuating attitudes and behaviours and link them to underlying aesthetic, utilitarian, intrinsic and other values. Alternatively the economic techniques can be employed to assess use, option, existence or bequest values. Although much of the world’s population is urbanising, non-human animals remain vitally important: examples can be found in everyday symbolism, imagery and language as well as the products we buy, the organizations we join and the nature documentaries we enjoy. In this presentation, we hope to engage the audience in a broader discussion about the social values of birds, how these values can be assessed, and how different values influence conservation effort.

Rising sea-level due to climate change is likely to alter the amount and suitability of habitat for species dependent on coastal areas. To investigate these effects on Snowy Plover (Charadrius alexandrinus) in the Florida Gulf coast where it is state-threatened shorebird, we used a novel approach of integrating forecasts of land-use change and effects of sea-level rise with a spatially explicit demographic model for the species. We parameterized the demographic model using data from ongoing population surveys. We used the Sea-level Affecting Marshes Model (SLAMM) to forecast the effects of sea-level rise on the habitat types used by Snowy Plovers (inland fresh marsh, salt marsh, beach). We used species distribution models to estimate a habitat function. We then projected suitable habitat based on three IPCC climate change scenarios, and incorporated other habitat suitability characteristics, including land-use trends. Other effects of climate change (frequency of rainy days and storms) were incorporated as effects on the demographic rates. Thus, several effects of climate change were considered to evaluate the spatial distribution of Snowy Plovers and the risk of extinction and decline of their populations as a function of future climate change. Our analysis focused on Snowy Plover population dynamics on military installations and in the Gulf coast region, resulting in recommendations for conservation management in light of changing habitat and land use.
How to reconcile the science-policy gap in implementation of critical habitat under ESA and SARA? A panel discussion.

Many scientific challenges exist in the identification of critical habitat for endangered species, including definition of the words ‘critical’ and ‘habitat’, determination of the appropriate scale(s) for assessments (individual, population, geographic), and appropriate incorporation of demographic processes into the spatial delineation of critical habitat. Many of these challenges were highlighted in case studies of individual species presented in this symposium, and evaluated in the assessment of approaches in conservation science to addressing critical habitat. Moreover, once critical habitat has been identified based on ecological criteria, implementing critical habitat designations through existing policy and legal frameworks represents another set of challenges that has rarely been addressed, particularly in Canada, where federal legislation (SARA) has only recently been enacted, and related policy is still under development. Here, identifying the institutional impediments to effective conservation and management of critical habitat, to support the recovery and long-term persistence of species at risk, is key. In this panel discussion, we involve participants in the symposium in a round-table discussion aimed at identifying and reconciling science-policy gaps when implementing critical habitat provisions under ESA and SARA.

Independent Effects of Habitat Loss, Habitat fragmentation and Structural Connectivity on the Distribution of Vertebrates: When Should We Increase Hedgerows?*

Disentangling the different processes often included in the term ‘habitat fragmentation’ is crucial, since different conservation actions are required depending on whether a species is sensitive to habitat loss rather than habitat fragmentation per se. Nevertheless, few studies have evaluated their independent effects on the distribution of vertebrates and none has evaluated the independent effect of changes in structural connectivity (e.g., decrease of hedgerows in the landscape). We carried out a landscape-scale mensurative experiment, using an experimental design that allowed separation of the independent contribution of these three processes, to examine the distribution of 11 forest-dependent vertebrates (3 species of arboreal rodents and 8 species of birds). Habitat loss, rather than habitat fragmentation per se, was the major driver of distribution patterns for 7 species. Structural connectivity (hedgerow networks) played an important role in determining the distribution of 5 species. Our empirical findings indicate that implementation of structural connectivity must never be carried out regardless of the amount of habitat in the landscapes: with less than 10% of forest cover in the landscape the implementation of a hedgerow network, even if extensive, may prove ineffective. The key message is, therefore, that before investing resources in the implementation of landscape linkages, their efficacy for the given level of habitat amount should be assessed.

Hybridization and Genetic Extinction of Native Cutthroat Trout

Human-mediated hybridization is a leading cause of biodiversity loss worldwide. How hybridization affects fitness and what level of hybridization is acceptable pose difficult conservation questions with little empirical information to guide policy and management decisions. This is particularly true for westslope cutthroat trout (Oncorhynchus clarkii lewisi), where widespread introgression with introduced rainbow trout has often created hybrid swarms over extensive geographical areas resulting in genomic extinction. Recent results indicate that small amounts of hybridization markedly reduced fitness of male and female trout, with reproductive success sharply declining by approximately 50 per cent, with only 20 per cent admixture. However, hybridization may spread even when hybrids have severely reduced fitness because the production of hybrids is unidirectional—that is, all the progeny of a hybrid will be hybrids. However, such short-term increases in fitness may disrupt important long-term adaptations of native populations. Thus, rapid spread of hybridization could result in the loss of local adaptations in native populations of westslope cutthroat trout and decrease their probability of long-term persistence.

Identification of habitat necessary for survival or recovery of imperilled species is critical for future conservation, yet quantitative understanding of resources required for a viable population is not available for most species. For Greater Sage-Grouse (Centrocercus urophasianus) populations in the U.S. and Canada, there is a considerable base of knowledge that includes detailed, quantitative understanding of habitat selection across scales and life stages, and assessment of the effects anthropogenic and abiotic drivers. Capitalizing on existing quantitative models to provide a credible analysis of critical habitat poses many technical challenges, including: (i) the need to extrapolate beyond original models to different time and space; (ii) comparable geospatial datasets for predictor variables are not readily available across the area of interest; (iii) there is a paucity of independent data with which to validate the habitat identification; (iv) habitat model results need to be classified in a meaningful way to represent critical habitat; and (v) propagation of spatial and statistical uncertainty need to be evaluated. We highlight recent work to identify critical habitat for Sage-Grouse in Canada. Lessons learned have high relevance to future efforts to identify important habitat for Sage-Grouse throughout its range, and for other endangered species in general.
A 250-year Index of First Flowering Dates and its Response to Temperature Changes

Widespread concerns about global biodiversity loss have led to a growing demand for indices of biodiversity status. Today, climate change is among the most serious threats to global biodiversity. Although many studies have revealed phenological responses to climate change, no long-term community-level indices have been developed. We derived a 250-year index of first flowering dates for 405 plant species in the UK for assessing the impact of climate change on plant communities. The estimated community-level index in the most recent 25 years was 2.2 to 12.7 days earlier than any other consecutive 25-year period since 1760. The index was closely correlated with February-April mean Central England Temperature, with flowering 5.0 days earlier for every 1 °C increase in temperature. The index was relatively sensitive to the number of species, not records per species, included in the model. Our results demonstrate how multi-species, multiple-site phenological events can be integrated to obtain indices showing trends for each species and across species. This index should play an important role in monitoring the impact of climate change on biodiversity. Furthermore, this approach can be extended to incorporate data from other taxa and countries for evaluating cross-taxa and cross-country phenological responses to climate change.

The widespread decline of farmland birds is currently a major issue in conservation biology. The Barn Swallow Hirundo rustica is a flagship species for biological conservation owing to its aesthetic and cultural value and to the sharp decline observed in several populations. Based on a long-term monitoring project on a declining population in a protected area in Northern Italy, we here demonstrate that the extent of pastures and hayfields within as few as 200 m from the colony positively influences colony size and therefore reduces population declines. This effect is significant even when presence of livestock farming, that is considered the major determinant of barn swallow colony size, is taken into account. New conservation strategies based on these findings have been planned in the protected area where the study was conducted.

**SP9.8** Amirhossein Khaleghi Hamidi*, Arash Ghoddousi; Taher Ghadirian; Plan for the Land Society; a.h.khaleghi@gmail.com

**A Flagship Species Based Conservation Program in the Middle East: Persian Leopard (Panthera pardus saxicolor) Conservation in Bamu National Park, Southern Iran**

The long-term prospects for conservation of ecosystems in the Middle East are not feasible without support from local communities which are traditionally involved in domestication, agriculture and hunting. This project brings the Persian leopard as a conservation icon for local people whom respect this powerful animal in order to promote their involvement in conservation. After extinction of the Caspian tiger and the Persian lion, it is the biggest surviving cat in the region listed in the 2009 IUCN Red List of Threatened Species as "Endangered". We initiated our project in Bamu National Park (Fars Province, Southern Iran) which is known by relatively high leopard density coupled with quite intense prey poaching, habitat degradation and poacher-warden conflicts. The first step was to assess the species status, estimate the population size, identify the threats to tackle and propose the focused conservation measures. As a result of intensive camera photo-trapping in eastern Bamu (September 2007 - May 2008, 360 km2, 2024 trap-nights), we obtained 72 leopard pictures, including 31 independent ones, from which we identified 7 individual leopards: 1 adult male, 1 sub-adult male, 1 female with cub, 2 adult females and 1 cub. Based on this information, 1200 schoolchildren aged 10-14 years living in 10 villages around the park were educated. As a result, a female leopard (14% of local population) with two cubs was saved from poisoning by one of those children. The process of awareness-raising and capacity building among local people is ongoing, having chosen the Persian leopard as a symbol of conservation and control over anthropogenic impacts on Bamu National Park.

**20.3 AMOS, NEVIL*; Pavlova, Alexandra; Jim Radford; Jim Thomson; Matt White; Graeme Newell; Ralph Mac Nally; Paul Sunnucks; School Of Biological Sciences, Monash University; Deakin University, ARIER, DSE, Vicotria Australia; nevil.amos@rci.monash.edu.au

**Does Structural Connectivity Matter For Woodland-Dependent Birds? Genotypic Datasets For Eight Bird Species Explore Landscape Connectivity Models**

Structural connectivity is often used as a proxy for functional connectivity in conservation planning and assessment, but the relationship between structural and functional connectivity largely is unknown. Functional connectivity, for eight south-eastern Australian woodland-dependent bird species, was predicted with isolation-by-resistance models in which resistance varied with land-cover. The birds differed in mobility and included species that were â€œdeclinersâ€ exhibiting disproportionately large decrease in occurrence with habitat loss - and â€œtolerantâ€ species where decrease is in proportion to habitat loss. Local-(1-10km) and regional-scale (20-200km) population and individual based genetic distances were estimated from microsatellite genotypes of > 3000 individuals sampled from 60 sites in 12 landscapes with 10 –80% tree cover. These estimates of effective functional connectivity and recent dispersal were used to test the fit of the connectivity models. Functional connectivity was high both for â€œtolerantâ€ and mobile â€œdeclinersâ€ even where fragmentation was severe. The absence of these â€œdeclinersâ€ from apparently suitable habitat is not due to their inability to reach isolated habitat. Other more sedentary â€œdeclinersâ€ show decline in functional connectivity with structural connectivity. Their absence from patches in low cover landscapes may be due to constraints on their dispersal. Landscape management strategies must accommodate these different responses.
A Global System for Monitoring Tropical Mammal Communities

We describe the first pantropical, standardized monitoring network for tracking the changing state of tropical mammal communities and the drivers of those changes. The network spans representative environmental and anthropogenic gradients and currently comprises 16 sites in Africa, Asia and Latin America, and will expand to 40 sites by 2012. The system for monitoring mammal diversity is part of a broader monitoring effort: The Tropical Ecology, Assessment and Monitoring (TEAM) Network. The design of the network facilitates comparisons of tropical mammal diversity and trends with the diversity and trends of other taxonomic groups, e.g., tropical trees. All of the data from the Network, including camera trap images (~ 10,000 images per site per month) and metadata, are freely available in near real time at www.teamnetwork.org. We describe the underlying sampling design and its statistical power to detect change. To illustrate what we can learn from this system, we present some initial data sets characterizing tropical mammal communities at five sites and compare mammal diversity with tropical tree diversity. Our system, which tracks trends in real time at www.teamnetwork.org. We describe the underlying sampling design and its statistical power to detect change. To illustrate what we can learn from this system, we present some initial data sets characterizing tropical mammal communities at five sites and compare mammal diversity with tropical tree diversity.

Assessing willingness to dedicate tax funds to nongame conservation in North Carolina

Biodiversity conservation is underfunded on global and local levels. The current economic crisis illustrates the need for consistent, government-based funding. Prior to 2008 most U.S. states relied on State Wildlife Grants to fund conservation of nongame species, however, the match requirements for these grants have since tripled. We surveyed 3,000 randomly selected North Carolina (NC) residents to evaluate whether they would be willing to increase state tax allocations to fund nongame species conservation (and meet the match requirements). Respondents were asked whether taxes should be dedicated to nongame conservation. More than three quarters of NC residents supported a tax increase for biodiversity conservation. On average respondents were willing to pay additional $33.25 in taxes annually to support nongame conservation. Virtually all respondents who were unwilling to pay a tax increase reported they were opposed to any tax increases, regardless of the beneficiary. An additional sales tax on outdoor recreation equipment was the most preferred method for generating tax revenue for biodiversity conservation. When asked how they would reallocate the state budget to support nongame conservation, respondents selected prisons as the preferred source to receive less funding. Our study suggests there are high levels of support for biodiversity conservation funding through tax revenues, and that these taxes will be most supported if they are perceived as user-based.

Engaging Children in Biodiversity Issues to Engender Support for Nature Conservation

Since the industrial revolution, human activities have dramatically reduced the diversity of life on Earth. Although this massive loss of life has weakened the very systems that sustain humanity, public support for nature conservation is generally lacking. We believe, as do many other researchers, that one of the best ways to renew humanity’s devotion to nature is by engaging children in biodiversity issues. Through our interactive program, Bring Back the Wild (BBtW), children will witness the wonder of nature, learn about the impact of human activities on the natural environment, play a role in protecting wildlife, and develop a lasting conservation ethic. We anticipate that within five years, more than 500,000 Canadian children will participate in BBtW and, in doing so, protect approximately 2,500 hectares of wilderness in Canada each year.

Community-based Conservation and Ecological Restoration: Integrating Indigenous Knowledge and Science

Environmental challenges faced by the Port Gamble S’Klallam Tribe (Washington State) and its approaches to meeting them reveal how indigenous ecological knowledge (IEK) and science can contribute to the development of innovative conservation strategies and ecological restoration programs. Located in the northern Puget Sound, increasing water quality problems in Port Gamble Bay (pollution, ocean acidification etc.) are reducing the availability of key tribal cultural and economic resources. The Bay’s marine sediments are ranked among the most contaminated in Puget Sound and reflect problems affecting the wider regional ecosystem. In addition, climate change impacts on water temperature/availability have negatively impacted tribal shellfish, finfish and plant resources, and are posing other threats to this coastal community and its resource base. Our interdisciplinary research project is documenting the significance of indigenous knowledge for: 1) understanding and planning for environmental change, and 2) adaptive management for resource restoration and sustainable management. The project information will be incorporated into a data management system that can be used by other tribal and non-tribal programs for community-based conservation and restoration in northern Puget Sound. This integrated sociocultural-ecological systems research approach addresses the context in which environmental challenges have developed, and now must be addressed.
SY72 Andy Dobson*; Jennifer Dunne; Susan Kutz; EEB, Princeton University, Santa Fe Institute, School of Veterinary Biology, Calgary; Dobson@princeton.edu

Y2Y2Serengti: How do foodwebs collapse as parks get smaller?
A handful of large national parks on each continent contain almost complete faunas. The ultimate goal of conservation biology is to maintain these parks as fully functioning natural ecosystems. How useful are food-webs in determining how species interact and how the webs of life in each park will unravel. We will use data on food-webs from Serengeti and the Y2Y project to illustrate the different ways that food-webs might collapse as species are lost from (or added to) relatively intact natural systems. The work questions currently held perceptions about keystone species, wildlife monitoring, and what to protect.

SY33 Anna Kuparinen; University of Helsinki; anna.kuparinen@helsinki.fi

Selectivity of fishing and its implications on targeted populations
During the past decades the genetic impacts of fishing have become a matter of concern, with particular attention paid to identifying potential evolutionary responses to fishing. In contrast, less attention has been directed to identifying and quantifying the processes through which fisheries induced selection arises. These can be roughly grouped into ‘fish availability to a fishing gear’, ‘fish contact with the gear’ and ‘fish retention by the gear’. Here, I focus on identifying traits targeted by commonly applied fishing gears and sketch through two case-studies how selectivity associated with fishing practices might affect targeted populations. The first case-study illustrates how spatial aggregation of fishing (availability selection) can affect effective size of a spatially structured Atlantic salmon (Salmo salar) population, while the second case looks at the shifts in the phenotype distribution of Baltic cod (Gadus morhua) caused by alternative gears. The analyses stress the importance to consider the multiple ways in which selectivity of fishing might affect populations and suggests that shifts in phenotype distributions generated by fishing might at least partly be avoided by allocating fishing effort between gears with differing (or opposing) selectivity patterns.

P2.65 ANJALI MATHUR*; ANUJ SAXENA; Govt. Raj Rishi College, Alwar (Rajasthan), Department of Science & Technology, Government of Rajasthan, Jaipur; anuj_anjali@yahoo.co.in

Changing agricultural landscape is a global phenomenon as agriculture has increased its ecological footprint. Indian agricultural landscapes hold a vast arena of biodiversity conservation and therefore pay special attention towards ecoagriculture approach to embrace agriculture production, biodiversity conservation and rural livelihoods. Increased crop yield demand for pest management strategies, associated with conservation of insect pests of high value crop like eggplant (brinjal) a cash crop, native to India. Leucinodes orbonalis Guenee, eggplant fruit and shoot borer (EFSB) is a primary and most destructive pest of eggplant. Indiscriminate use of chemical pesticides in past has led to pest resurgence and resistance. Prospects of transgenic crop, Bt brinjal to combat EFSB may also face chances of developing Bt resistance. This has shifted our focus towards Integrated Pest Management (IPM) approach for sustainable agriculture. Our research included studies on life table for timing of crop harvest and on farm trials of newer IPM modules using biopesticides and botanical oils under semi arid ecological conditions. The results show a significant correlation between developing stages and temperature/RH. As compared to check (Endosulfan) IPM modules gave significant effective results to manage EFSB in fields. We conclude that IPM modules should be promoted and tailored according to landscape ecology for effective ecoagriculture systems.

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Intellectual Property Rights, Traditional Knowledge and Biodiversity Conservation: An Indian Perspective
In the developing world we are now seeing the emergence of ‘Traditional Knowledge’ (TK) and knowledge industries. Convention on Biological diversity (CBD) highlighted the need to promote and preserve TK, access and benefit sharing. We therefore consider the relationship between intellectual property system and the access and benefit sharing principle of the CBD in context of Indian TK and biodiversity which is inextricably linked with the means of daily survival (food, health, shelter, energy etc.) of about 70% of India’s population and thus to the rights of the communities. The cross border flow of genetic material in the age of globalization may help to build strong data base on biodiversity for global market share but in the absence of legal rights for traditional innovators and the collective rights of the communities as owners of biodiversity’, bioprospecting may degenerate to ‘biopiracy’. To prevent this we need to move towards TRIPS with ethics and equity. Establishment of a sui generis law protecting plant varieties (PVP) and framing of TK Digital Library are steps taken for stronger IP system, a subject that was before considered essentially a matter of science & technology now is regulated by the amount of commercial profits that it can protect. Therefore, stronger IP protection is required to reap the full benefits of knowledge industries.
An Urgent Application of Conservation Measures for Endangered Semi-Desert Ecosystem of Armavir region, Armenia

Armagir region is located in southern west of Armenia, and has some of the richest and most fertile land. However this land is actively used for agriculture (wine-growing). Almost all the land (90% of valley) is in private hands and converted. Unfortunately, there are no specially protected areas. We have conducted inventory of plants, fungal and animals’ diversity to outline the most vulnerable sites for establishment of wildlife conservation, design of a breeding center (ex-situ conservation) at the base of Private Armavir Zoo. We also organized eco-educational activities among local people. The research site is characterized by the richest biodiversity of flora and fauna (at least 3 species of vascular plants, 17 species of vertebrates are listed in the Red Book of Armenia and 8 are currently in the IUCN Red List of threatened species among them 3 species are critically endangered). Our research has been indicated the wild area (approximately 24 hectares) proposed for conservation. It is located in Armagir region, between villages Vanand and Talvorik. On basis of obtained data we create the Action Plan for conservation activities of local government, NGOs etc.

Facing Chichamoch canyon conditions: Behavioural strategies of the endangered Chestnut-bellied hummingbird in Colombia

The chestnut bellied hummingbird is a global endangered species endemic of the Chichamoch canyon in Colombia. Studies about its ecological requirements are scarce to understand and predict its necessities in order to protect it. Hence, this study pretends to establish the main behavioural strategies of the endangered Chestnut bellied hummingbird to face current seasonal changes in the Chichamoch dry forest. Additionally, to determine how the seasonality affect its competitors (hummingbird community) during the year. Seven male territories were located in a recently created natural reserve in the Chichamoch canyon Colombia. For each male was measured territory area, flower density, and time budgeting (ethograms) during two rainy and two dry periods. Besides, the abundance of nectarivorous bird species was estimated with line transects. Results showed that A. castaneiventris increases aggressiveness in the second dry season related to the two rainy seasons. In the rainy season, it depends on insects and in the dry season on flowers. Territory areas remain stable during the year, but in the driest season this species migrates. Seasonality affects hummingbird community abundance. Results are critical to protect not only A. castaneiventris’ habitat in the Chichamoch canyon, but also its habitat in the places where it migrates, and to understand possible future changes in its range and its ability to adapt to the driest conditions as a consequence of global warming.

Stratigraphic Analysis of Decodon Pond Wetland

This study is a stratigraphic examination of core sediment samples collected from Decodon Pond in Alley Pond Park at Queens, New York on January 30, 2008. We examine paleoecological changes of vegetation and fire patterns in the area of the pond over time. Decodon Pond was chosen because it is one of a series of unusual, intact 15,000 year old kettle ponds within the New York City limits. Alley Ponds are geological features left in the glacial moraine after the last Ice Age ended. As ice broke from the glacier it was subsequently covered with soil; holes left by the melted ice exist today as a series of depressions in the ground allowing surface water to accumulate. A team of student researchers retrieved two pond sediment cores from Decodon Pond that measured two meters each. These cores represent over 2000 years of organic and inorganic sedimentation within Decodon Pond. A spruce needle found at the depth of 200cm. Since today spruce does not naturally grow in Queens, NY, 2000 years ago the climate would have had to have been cooler and dryer for the area to support spruce.

Integrated disturbance ecology: from the impact of outdoor winter sports on Alpine wildlife to the creation of winter preserves

The steady spread of tourism and leisure activities exerts huge impacts on biodiversity. Rapidly developing outdoor winter recreation such as free-riding is threatening wildlife of mountainous ecosystems, with traditional networks of nature reserves being insufficient for effectively mitigating disturbance effects. We studied the impact of outdoor winter sports on the Black grouse, a threatened bird whose timberline habitat largely overlaps with snow sports in the Alps - the main winter tourist destination of Europe - with the idea to propose corrective measures. We could first quantify (wide-range comparative approach plus flushing experiments) the detrimental physiological (stress and energetics) and behavioural responses of Black grouse subjected to anthropogenic disturbance in winter. Second, we modelled the winter habitat of three different "species" (Black grouse, skiers - including snowboarders and snowshoers) from aerial photographs: this enabled recognizing and predicting main areas of conflicts between Black grouse and winter snow sports, especially free-ride activities. The resulting maps allowed setting priorities for delineating optimally located winter preserves in the "Swiss Alps, where public steering measures will be implemented (forbidden access in winter). The methodology developed can be used for other wildlife submitted to anthropogenic disturbance in other areas where winter recreation represents a potential threat to biodiversity.
The idea of assisted colonization - i.e. translocating species outside their historic ranges in anticipation of climate change - is extremely controversial. Opponents rightly point out that there are huge uncertainties involved and that introductions of species outside their historic ranges have often been disastrous in the past. Proponents rightly point out that regardless of the uncertainties, the “do nothing” option isn’t necessarily the sensible default position. The solution is surely to develop a decision framework with a clear objective function, but doing this will be fiendishly complex. Research in all of the following areas is relevant, if not essential: 1) climate change modeling; 2) predicting how habitat characteristics such as hydrology and vegetation will track climate change; 3) species-habitat modeling, allowing changes in distributions of suitable habitat suitable for species to be predicted based on predicted changes in habitat characteristics; 4) predicting the degree to which species will adapt to changing habitat through evolution or phenotypic plasticity; and 5) dispersal modeling, allowing predictions about which species will naturally track shifts in habitat distribution and therefore don’t need to be moved. I suggest that decision making should be based on a framework that incorporates uncertainties in all of these areas, and that the data used to inform those decisions needs to combine broad comparative analyses with intensive research on specific model systems.
Ecological changes associated with urbanization may reduce avian survivorship throughout the annual cycle. Specifically, increased abundances of predators and invasive exotic shrubs may have negative impacts on breeding birds. We predicted that avian survivorship would be acutely impacted during the post-fledging period when behavioral limitations make juvenile birds especially vulnerable to predation. Further, we hypothesized that Amur Honeysuckle (Lonicera maackii), an abundant invasive shrub in our system, would either 1) exacerbate predation by drawing fledglings closer to the ground, or 2) deter predation by providing protective cover. During 2008 - 2009 we used radio telemetry to track 45 Northern Cardinal (Cardinalis cardinalis) and 31 Acadian Flycatcher (Empidonax virescens) fledglings in a network of riparian forest fragments embedded within an urban-to-rural landscape gradient in central Ohio. In contrast to the frequent assumption that high mortality rates contribute to avoidance of urban areas by sensitive species, cumulative survivorship was higher for the birds especially vulnerable to predation. Further, we found that urban forests contained more predators and that honeysuckle influenced patterns of habitat selection, neither factor was associated with survivorship of the avian life cycle as predicted.


This research illustrates how the mechanistic approach of individual based modeling (IBM) provides a productive framework for constructing comprehensive population viability analysis (PVA) models that address a wide variety of conservation and management issues. The individual-based perspective facilitates pedigree analysis and the calculation of individual kinship coefficients and other genetic measures, permitting immediate evaluation of inbreeding depression and loss of adaptability, important viability considerations. The approach, when coupled with spatially explicit landscape data, permits direct linkage of a population's viability with geographic attributes, such as important food resources and human-related mortality risk; and consequently, facilitating evaluation of landscape changes. Hence, PVA can be effectively extended as a tool to guide site-specific conservation and landscape management decisions. Grizzly bear behavior and ecology can be directly included in the model, as can historic climate data. Inclusion of climatic data produces a temporally dynamic model that simulates relevant phenological events influencing grizzly bear movement; and when joined with bear behavior, allowing the model to potentially be linked effectively with vegetation succession and climate change models to explore the impacts of future climate scenarios on grizzly bear populations. Such a model was developed for the grizzly bear population inhabiting the Cabinet-Yaak area of northwest Montana/Idaho Panhandle.

Predators, Prey and Agriculture: Wild Ungulate Responses to a Re-Established Cougar (Puma concolor) Population in the Canadian Prairies

Return of a large predator is expected to create changes for both the ecosystem and humans inhabiting the area. Re-establishment of carnivore populations can rapidly affect ecosystems by changing the abundance and distribution of prey. Such a trophic cascade is to be expected in the island, forested habitat of Cypress Hills Interprovincial Park in southern Alberta and Saskatchewan, where cougars have recently re-established a very dense population in a region with plentiful prey and no competing predators. Reports from local ranchers informed us that wild ungulates were increasingly using agricultural areas outside the park boundaries. We examined data from aerial surveys conducted between 2000 and 2009 and GPS data from radiocollared cougars in 2008-2009 to evaluate ungulate distribution since the cougar population has rebounded. We created maps showing the density and distribution of ungulates and the locations of ungulates killed by cougars to detect patterns consistent with those reported by local ranchers. The return of a native carnivore can have beneficial effects by restoring ecosystem structure and function, but can also create conflicts with ranchers due to risk of livestock depredation and from wild ungulates displaced onto private lands.
The deteriorating demographic status of the endangered Hawaiian monk seal has motivated renewed and expanded proposals for conservation action, including translocation of seals to improve their survival. Over the past three decades, numerous monk seal translocations have been conducted with a variety of objectives, including rebalancing adult sex ratios, reducing human-seal interactions, etc. Here, we analyze our cumulative experience with translocation of Hawaiian monk seals to identify factors that influenced outcomes. We found that the time seals remained in the vicinity of the release site was inversely proportional to the elapsed time between weaning and translocation. Recently weaned pups (with little or no at-sea foraging experience) exhibited high fidelity to release sites commensurate with that shown by un-translocated pups to their birth location. In contrast, juvenile and adults seals tended to stray from their release locations. Nevertheless, when 21 adult male seals were moved over 1,000 km between Laysan Island, Northwestern Hawaiian Islands (NWHI), to the main release site. These findings will be essential for informing successful larger-scale translocation plans in the future.
Beyond biodiversity - protected areas' ability to conserve species and contribute to climate change mitigation

Protected areas have been shown to be one of the best tools to protect against the loss of biodiversity, but how do they contribute to other ecosystem service benefits? In 2001 the Global Conservation Fund was established to create and expand the global protected area network and to ensure effective management and long-term financial sustainability for these sites. Earlier analysis demonstrated that the selection of GCF protected areas focused on important areas for biodiversity (83% of sites are in confirmed Key Biodiversity Areas) and were better than a null model at protecting gap species. We conducted analyses to determine whether these sites contribute additional benefits beyond biodiversity conservation. Using forested sites in the portfolio (90/122) we estimated the total amount of CO2e stored to be ~28.5 Gt. By calculating background rates of deforestation in a 20km buffer zone around these sites, and assuming that the sites are 75% effective at reducing the rate of deforestation, we predicted the annual emissions avoided to be ~0.13 Gt CO2e. GCF sites show annual forest emissions rate of 0.44% compared to the global average of 0.22%, indicating the disproportionate role these areas can play in mitigating climate change and meeting country REDD+ targets. Using these results, we outline criteria for portfolios focused on protected areas to best identify and invest in sites important both for biodiversity and climate change mitigation benefits.

Assessing Payment For Environmental Services Program Effectiveness Using Spatial Biodiversity Estimates From Forest Change And Natural History Surveys

This study aims to characterize the distribution of biodiversity samples that form the core of the Costa Rica National Biodiversity Institute (INBio) and the country's internationally recognized program on payments for Environmental Services. In the context of this program, biodiversity is one of four key services but has not yet been evaluated in terms of effectiveness. A natural history dataset of species observations across Costa Rica was assessed for suitability producing species richness maps and to test their distributions relative to bioclimatic life zones, conservation areas and forest deforestation/regeneration from 1960-2005. The species data was characterized by uneven sampling densities and was resampled at 5km & 1km grid cells. Richness estimates were produced from co-kriging of sample richness and ancillary layers. These estimates were highly spatially-autocorrelated, increasing with grid size. Standard errors of some estimates peaked orders of magnitudes faster than others. We assessed whether no-take zones designed using biodiversity pattern and connectivity modeling. These results were central to a multi-million dollar, multi-agency/NGO implementation program. Much work remains to realize the full vision, and future work will focus on improving connectivity analyses to account for projected ecological responses to climate change.

Advancing Marine Systematic Conservation Planning Through Regional Time Series Analyses of Patch Dynamics

Conservation planning has focused mainly on biodiversity pattern (e.g., habitats and species records that can be mapped and regarded as static). Planners have done less well at identifying the spatial requirements of a myriad of biodiversity processes operating across a range of temporal and spatial scales. Understanding and incorporating such dynamics into conservation is particularly important if we are to mitigate biodiversity losses due to climate change. We describe recent work to include a class of processes - patch dynamics - into marine conservation planning, using the Great Barrier Reef as a case study. We analyzed time-series data depicting one type of patch dynamics - risk of coral bleaching - and measured its spatial and temporal parameters from satellite data. We found that climate change trends are already evident, and that some parts of the Great Barrier Reef are warming faster than others. We assessed whether no-take zones designed using biodiversity pattern would meet conservation objectives related to coral bleaching. We found that no-take zones have the same frequency distributions of high-temperature anomalies as the whole Great Barrier Reef Marine Park. Areas with less frequent high-temperature anomalies could act as temperature refugia, so additional management precautions in these areas might be warranted. Our approach will serve as a basis for simulating potential future patch dynamics, considering climate change, to provide options to managers.
Coral reef ecosystems around the world face a multitude of threats, most of which are ultimately - if not proximately - anthropogenic. These threats include: ocean acidification, increasing coral bleaching, disease, outbreaks of crown-of-thorns starfish, terrestrial sedimentation, eutrophication, and pollution. These stressors are potentially exacerbated by increasing human population, economic development, and increasing human use of coastal areas. Managers of coral reefs face considerable uncertainty around the ways in which multiple stressors interact (e.g., synergistically, antagonistically). Managing the protection of coral reef ecosystems will therefore require new approaches to adaptive management that, under uncertainty, can minimize climate change impacts by managing localized proximate stressors according to their interactions with pervasive climatic stressors. We demonstrate how this can be done through spatio-temporal modelling of the effects of combined stressors upon the ecosystem state of the Great Barrier Reef under various scenarios. Qualitative loop modelling is a promising technique that can be applied to this seemingly intractable problem of modelling the effects of multiple stressors with extremely limited information. Applying this technique, we found that a limited number of stressors could be altered to produce large overall impacts on ecosystem state. Using these results in adaptive management, management under uncertainty can be facilitated.

Climate change is considered to be one of the most serious threats to human health, food security, natural resources and physical infrastructure especially in mountainous country like Nepal. Adaptation to the climate change is one of the best coping strategies. Thereby, the country is in the process of making such strategies. The coping strategies that the indigenous people are practicing for years could be crucial information in making national strategies. However, there is limited information on such indigenous practices at national level. To bridge this gap, this study aims to explore such strategies of indigenous Chepang community of Dhading district. Empirical data were collected through household interviews, group discussions, key informant interviews. Meteorological data of 30 years was used to supplement the primary information. The results show that the people have modified their daily life practices to cope up frequent incidence of hail-storm. In addition, they have constructed small ponds in their home garden to conserve their kitchen waste water to be used in home garden. Similarly, they have started harvesting and storing rain water for human and animal consumption. Likewise, they were practicing less tillage technology in agriculture on sloppy land, to reduce soil erosion.
The Key to Successful Invasive Species Management: A Meta-analysis of Research Concerning Stakeholder Perspectives of Invasive Species

There is an ever-increasing need for managers and policymakers to anticipate how people will respond to invasive species management programs. But while this need has been stated extensively within ecological and social scientific literature, few empirical studies have been conducted to understand stakeholder perceptions of invasive species or identify factors that might lead to social acceptance of or conflict with proposed management. To test an heuristic model containing multiple predictor variables, we conducted a meta-analysis of available empirical studies on stakeholder perceptions of invasive species. We found few studies that directly addressed stakeholders and those that did focused on conservation managers and experts and largely ignored key stakeholders such as indigenous groups and the general public. Moreover, few studies dealt with stakeholder issues in Northern regions. As the pace of global climate change continues to accelerate in Northern climates and elsewhere, there will be a greater need to manage invasive species, and success will depend upon the cooperative efforts of a wide range of stakeholder groups. We outline directions for continued research needed to identify pathways to stakeholder cooperation in the detection and control of invasive species.

Conservation challenges for protecting endangered Greater Adjutant Leptoptilus dubius in Assam, India

Greater Adjutant Leptoptilus dubius is currently facing extinction threat. Assam population of the Greater Adjutant is considered as the last stronghold for this endangered bird. Almost all of this population resides outside the State owned protected area network and mainly nests on the privately owned trees. The future of this bird depends on basically the wishes of these tree owners. These tree owners on the other hand are very poor and many times they cut the nesting trees to earn their livelihood. The bird also makes the campus of the nest tree owners dirty by throwing rotten foods, dead chicks etc and thus it irritates the tree owners. In this critical situation a conservation initiatives have been made to encourage the tree owners for their support to save this bird. Celebrities and media houses were roped in to highlight the tree owners’ involvement for saving this endangered bird. For long term sustainability of this initiative lobbying has been done for a State owned compensation schemes.
Killer whales and critical habitat in Canada and the US: different paths, similar endpoints.

Killer whales live in small sympatric or parapatric populations, are highly mobile, have no predators, and tolerate wide ranges of water temperature, salinity, turbidity, and depth. They therefore present two challenges to conservation managers: delineating management units and identifying critical habitat. The endangered southern resident population straddles the Washington/British Columbia border and affords an opportunity to compare the application of the US Endangered Species Act and the Canadian Species at Risk Act (ESA and SARA).

In the US, recognizing the population as a ‘distinct population segment’ took several years and a court decision. Following this, critical habitat was defined with few further delays in 2006. In Canada, the distinctiveness of the population was formally recognized without controversy, prior to the US decision, and a draft recovery plan with a description of critical habitat was completed in 2006. However, the Canadian government undertook a series of measures, each one of which, if not subsequently withdrawn, would have relieved it of legal requirements to define or protect critical habitat. The final measure was rescinded in 2009 after environmental groups filed suit. At the present time, the situation in both countries is similar: the effect of the ESA and SARA decisions has been a marked increase in conservation-oriented research. No broad-reaching plan to protect critical habitat has yet been developed in either country.

Decommissioning of mature oil fields and artisanal fisheries: The case of Todos os Santos Bay, Brazil

Decommissioning of mature oil fields and artisanal fisheries: The case of Todos os Santos Bay, Brazil. Consequences of decommissioning oil fields on artisanal fishing activities are still little known in the literature. This paper is intended to shed some light on a process of dismantling and sinking of oil and gas structures in shallow waters, with severe disturbing impacts on low income artisanal fisher activities. From a socio-economic perspective, the relationship of oil industry with local communities is described, with the main perceived problems pointed out by local fishermen leadership perspective. The notions of ‘damages’ and ‘mitigation’ taken by the oil industry towards fishermen are discussed in connection to the expansion of installations during the past 20 yrs. A comparative view of decommissioning of oil fields in Europe and Brazil over the late 1990's suggests the need to review transparency and social commitment standards which are far less prominent in this Brazilian case. We believe that the Brazilian oil industry has acquired a social and environmental debt towards the whole society, as far as it has not been able to establish a clear and effective process for decommissioning their oil installations within artisanal fishing areas in the Todos os Santos Bay. Furthermore, the discussion of fair and specific compensations has been avoided, which would be instrumental to regain local economic conditions found among fishermen just few decades ago.
Inclusion of biotic interactions in species distribution models improves predictions under climate change: the northern bettong, its resources and a competitor

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Species distribution models (SDMs) are often used to predict where suitable habitat for a given species may occur in altered climate conditions. The inclusion of biotic interactions in SDMs is rare because it requires detailed ecological knowledge of the species. We examined the influence of biotic interactions on predicted current and future distributions of an endangered marsupial, the northern bettong (Bettongia tropica). Climatic models were developed independently for each of the northern bettong, two of its food resources, and a likely competitor. To determine how the inclusion of biotic interactions altered predicted distributions, northern bettong models were augmented by including estimates of climate suitability for the food resources and competitor, and then compared with those of the climate-only model. Differences in predictions were quantified with a `global' metric to test whether predictions were significantly different, and a `local' metric to identify where they differed. Inclusion of biotic interactions improved model performance and provided the most ecologically realistic distributions. Below 3.0 °C increase in climatic warming predicted northern bettong models differed only in the margins of their predicted distribution, but beyond this level, predictions of models that incorporated biotic interactions diverged from those which did not. This study highlights how the use of ecological knowledge is essential for developing useful models.
Many studies on the effects of human land-use on boreal songbirds have been conducted. However, most are at local scales, focused on one land-use, and use different statistics for reporting effects. The lack of a coordinated framework for reporting has slowed our ability to make effective conservation decisions about boreal songbirds. The Boreal Avian Modelling project has integrated all point-count information in the boreal into a single database and used standardized statistics to estimate density estimates for all boreal songbirds in Canada. Distance sampling and bootstrapping provide density estimates that predict current population size and uncertainty. These density models have been linked to land-use simulators and suggest that in areas like NE Alberta proposed land-use plans could result in population declines of up to 70% for the Black-throated Green Warbler in the next 50 years while the White-throated Sparrow could increase by 30%. Current and future population sizes for all boreal species are important for evaluating risk to species. However, such a fine-filter approach has limitations and we suggest that incorporating these population estimates into community similarity indices will provide a more useful tool for managers.

The same land-use plan suggests that the overall similarity of boreal bird communities will change by 40% and we discuss whether such a change is in the range of natural variation that might be expected due to natural disturbance.

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**Farmlands in Europe: the Geographical Distribution of Biodiversity, Evidence, and Support for Nature Friendly Management**

Europe is a highly diverse continent regarding biodiversity, research evidence and available resources to fund extensive, nature friendly habitat management. Half of the continent is farmland, which harbors a rich wildlife and several globally endangered species, like the Great Bustard, which have adapted to the centuries long extensive land use. In the 20th century intensification of agriculture resulted in sharp decline of many farmland species. The changes, however, and the recent distribution of diversity varies: depauperated areas exist mainly in the western half, while large ones in the eastern half of the continent. This pattern contrasts to the distribution of existing research evidence that is necessary for wise conservation, and contrasts to the available funding for nature friendly farmland management. In addition, the supported nature friendly farmland managements had mixed effect on biodiversity, partly due to lack of local research evidences. Therefore, less intensive regions, mainly in the eastern half of the continent should get more attention, as conserving farmland biodiversity would be more effective there. In addition, management should be monitored and supervised by conservation biologists to improve success. The present evaluation has messages on the importance of balancing, and shows that extrapolation of research evidence may be misleading at the continental scale conservation.

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**How Environmental Impact Assessment Can Contribute to the Conservation of Biological Diversity**

This presentation will focus on how environmental impact assessment (EIA) generally, and the National Environmental Policy Act specifically, can contribute to the conservation of biological diversity. The discussion will be applicable to citizens of countries that have ratified the Convention on Biological Diversity as well as those that have not. Key components of EIA's value are requirements to identify reasonable alternatives to a proposed action and to analyze the direct, indirect and, importantly, the cumulative effects of the proposed action and reasonable alternatives to it on the affected ecosystem. These analytical requirements combined with opportunities for interagency coordination and meaningful public involvement can lead to the selection of an alternative that minimizes adverse effects on biological diversity, or in some cases, the decision not to move forward with a proposed action. These requirements can also help shape needed adaptations in the face of climate change and minimization of a project's contribution to climate change. An effective mechanism for citizen enforcement is an important component to ensure implementation of EIA and has been a major characteristic of the process in the United States under the National Environmental Policy Act.

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**US Department of Defense: New Partners to Address Conservation and Sustainability in the West**

The Western Regional Partnership's (WRP) mission is to provide a framework for Federal, State and Tribal leadership at the senior-policy level to proactively and collaboratively address common goals, identify potential conflicts and develop solutions that protect our natural resources, while promoting sustainability, homeland security and military readiness in the states of Arizona, California, Nevada, New Mexico and Utah. The WRP was initiated after DoD's first successful regional partnership: Southeast Regional Partnership for Planning and Sustainability (SERPPAS). There are many issues in the West and a scarcity of resources; working together improves chances of long-term success. WRP combines an effective working relationship supported by a robust geographic information system with value-added benefits to all Partners. WRP Committees are working to better improve cooperation among States and agencies on the following critical Western regional issues: Border; Disaster Preparedness; Energy; GIS; Land Use; and Wildlife Corridors, Critical Habitat, and Threatened and Endangered Species. WRP Committees provide a forum for information exchange and a clearinghouse for focus areas across the five-state region. Committee participation includes WRP Partners (States, federal agencies and Tribal leadership) and non-governmental organizations working collaboratively. This presentation will provide an overview of the WRP including updates on pilot efforts.
Regional Conservation Planning: Contrasting Optimization Methods for Forest Birds with Incompatible Habitat Requirements

Spatially explicit conservation planning involves a variety of trade-offs, between for example, land cover management for species with contrasting habitat requirements. Two approaches that accommodate such trade-offs are heuristic algorithms and mathematical optimization. Heuristic algorithms are logical iterative processes that use stepwise rules and the progress toward certain goals is checked at each step, while mathematical optimization precisely identifies the optimal solution set. Spatial optimization of conservation objectives can be complicated when potential habitat, rather than current condition habitat models are used. Our goal was to 1) identify areas of greatest conservation value over a large landscape in northern Wisconsin, for 16 forest bird species, while solving habitat incompatibility conflicts, and 2) to evaluate the strengths and weaknesses of the two approaches to this problem. Both methods were used to find the spatial arrangement with the highest conservation value, which were parametrized to minimize the area needed to meet species-specific population objectives, and to maximize habitat connectivity. The heuristic algorithms, developed the 20% highest ranking area, approximately 1 million hectares, which if managed appropriately would provide enough resources to meet the minimum habitat needs for 15 species. However the heuristic approach had to be followed by post-hoc adjustments to resolve conflicts among 30 species pairs with overlapping potential habitat. In contrast, mathematical optimization yielded comparable results while resolving habitat conflicts between species optimality. The computational capacity required for the mathematically derived solution was considerably greater.

Spatially explicit conservation planning involves a variety of trade-offs, between for example, land cover management for species with contrasting habitat requirements. Two approaches that accommodate such trade-offs are heuristic algorithms and mathematical optimization. Heuristic algorithms are logical iterative processes that use stepwise rules and the progress toward certain goals is checked at each step, while mathematical optimization precisely identifies the optimal solution set. Spatial optimization of conservation objectives can be complicated when potential habitat, rather than current condition habitat models are used. Our goal was to 1) identify areas of greatest conservation value over a large landscape in northern Wisconsin, for 16 forest bird species, while solving habitat incompatibility conflicts, and 2) to evaluate the strengths and weaknesses of the two approaches to this problem. Both methods were used to find the spatial arrangement with the highest conservation value, which were parametrized to minimize the area needed to meet species-specific population objectives, and to maximize habitat connectivity. The heuristic algorithms, developed the 20% highest ranking area, approximately 1 million hectares, which if managed appropriately would provide enough resources to meet the minimum habitat needs for 15 species. However the heuristic approach had to be followed by post-hoc adjustments to resolve conflicts among 30 species pairs with overlapping potential habitat. In contrast, mathematical optimization yielded comparable results while resolving habitat conflicts between species optimality. The computational capacity required for the mathematically derived solution was considerably greater.

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Involving hunters in research programs to protect wolves

In Russia, every spring takes place the den hunting of wolves (Canis lupus). After the fladry, hunting at the den is the second more used technique. Hunters able to find wolf dens empty them to get a bounty per wolf pup (about 50US$) or to sell the pups as pets to private people. Hunters have a high knowledge about wolves and the forest, which can be used to save wolf pups and stop illegal traffic. Since 2000 we have involved hunters of Tyre region in our wolf research work. They have worked as guides for eco-volunteers, helping in tracking and howling survey. In return, they stopped hunting wolves, saving up to 10 wolf pups per year per hunter. The data collected allow us to draw a yearly map of wolf population in the district (den location, pack number, reproductive rate, movements, proximity to villages, potential attacks on livestock). In 2010 the program will be spread to 3 regions (Novgorod, Smolensk and Pskov). We conclude on the benefits of participation of local hunters for wolf conservation and public education. We suggest that encounters between hunters and eco-volunteers may lead to better understanding of each side.

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Conserving the stage, not the actors: using land facets to conserve connectivity in a changing climate

Human-caused climate change during the next century will threaten many wild populations and species. One conservation response is to link protected areas to support range shifts by plants and animals. Ironically, most wildlife linkages are based on today's vegetation communities, which will be reassembled by climate change. Some scientists try to design linkages to support range shifts by chaining highly uncertain models (emissions, air-ocean circulation, biotic response), with high risk of error propagation and compounding; furthermore, the map outputs are too coarse for conservation decisions. Instead, we advocate designing for diversity and interspersion of land facets - landscape units with uniform topographic and soil attributes. This coarse-filter approach would conserve the arenas of biological activity, rather than the temporary occupants of those arenas. Because topography, soils, and (changing) climate determine biodiversity, conserving a diversity of land facets should conserve biodiversity. In particular, a linkage strand with high interspersion of land facets should support ecological processes and range shift, and continuous strips of different land facets should support continuous strips of future vegetation communities and species associated with them. We illustrate this new approach for 3 topographically diverse regions in Arizona. This approach is not biased toward data-rich areas, and can be applied where no maps of land cover exist.
Planning for connectivity includes 4 tasks that follow a logical hierarchy (but that need not be applied in sequence): (1) Defining natural landscape blocks throughout a state or region and developing a map of 'fuzzy' linkages between neighboring blocks. The Western Governors’ Association recently mandated such ‘decision-support maps’ for each state. I describe lessons learned from my work on the Arizona Wildlife Linkage Assessment (2006) and California Essential Habitat Connectivity Project (2010). (2) Prioritizing linkages for detailed planning and conservation action. Having participated in several prioritization efforts, I find this is inevitably a political decision. I argue that is just fine, and that scientists should simply help investors make data-informed decisions. (3) Developing optimum linkage designs (implementable plans) for priority linkages. I offer insights from my experience developing 27 linkage designs in California and Arizona. (4) Evaluating practical alternatives to the optimum linkage design. Because the optimum design (#3) will rarely be fully implemented, I developed tools to help decision-makers identify biologically good compromises. I describe use of these tools in one linkage near Tucson, Arizona, USA. Science-based approaches have the following virtues: they makes assumptions explicit, they can be improved as underlying data are improved, and they help implementers focus on desired conservation outcomes rather than other constraints.

**Forecast of submerged islands and biodiversity loss due to sea-level rise**

A general rise in sea level is one of the unavoidable consequences of global warming. Since 1900, sea levels have risen by more than 20 centimeters. The current estimates suggest a sea-level rise of one to three meters by 2100. With such dramatic increases, the risk of having entire islands submerged by seawater seems inevitable, which would be catastrophic for biodiversity given the very high level of biodiversity on insular ecosystems. We present the first quantitative estimate of the loss of islands worldwide due to sea level rise of 1, 2 or 3 meters taking into account increase regional variability. This estimate is based the study of a database of the height and location of the 2,000 French islands present all over the globe and which are deemed representative of the world islands. French islands represent 20 % of the global atolls, contain 3,450 plant and 380 vertebrate endemics and encompass 4 of the 25 biodiversity hotspots. Our results indicate that the potential loss of worldwide islands and biodiversity due to sea level rise could be considerable under some scenarios.

**Assessments of effects of climate change on species’ ranges have been limited by use of historical surveys of short time spans with low spatial resolution, by confounding effects of land use change, by false absences due to limited historic sampling and inability to control for changes in detectability between sampling periods. We repeated a detailed, early 20th century surveys of small mammals and birds across elevation gradients spanning the long-protected landscapes of Yosemite National Park (YNP), Lassen National Park (LNP) and Kings-Canyon-Sequoia National Park. Climate change over the past century was variable at these transects, ranging from a 3C increase in average annual minimum temperate at YNP to cooler, wetter conditions at LNP. Using occupancy modeling to control for variation in detectability, we show substantial (1,500m on average) upward shifts in elevation limits for half of 28 small mammal species monitored. Ranges of formerly low elevation species expanded and high elevation species contracted, leading to changed community composition at mid and high elevations. Responses were idiosyncratic among closely-related and ecologically-similar species. Nearly 50% of 70 bird species moved upward in elevational range, 10% moved downward, and 40% showed no change. Local colonizations and extinctions of birds followed the trends predicted by their climatic niche based on long-term temperature and precipitation shifts.**

**Replanting and restoration of vegetation is being undertaken in many regions where excessive loss of natural habitats has occurred. Generally, it is assumed that this will reverse faunal decline and reinstate the original biota. We examined the species richness and composition of woodland-dependent birds in 43 landscapes, each 8 km2 in size, across an agricultural region in southern Australia. These were selected as sets of landscapes in which wooded cover was either: a) primarily remnant natural vegetation; b) a mixture of remnant and replanted vegetation; or c) primarily replanted vegetation. In each set, wooded vegetation cover ranged from**
Tourism is often touted as an important livelihood option and conservation incentive for communities that are located near parks and protected areas. Proponents suggest that gateway communities can benefit significantly from the development of tourism through, for example, increased employment, financial gains, infrastructure creation, cultural revitalization, and environmental protection. Yet, tourism has not often been the panacea for protected area communities that it was originally made out to be. In the context of protected area communities, the development of a local tourism industry has often failed to deliver significant economic, social, cultural, and environmental benefits. Clearly defined frameworks for maximizing the benefits from tourism development for protected area communities are needed such that tourism can more directly support both community development and conservation efforts. This paper forwards a framework for supporting tourism development in protected area gateway communities based on the idea of building seven capital assets (i.e., natural, physical, financial, political, social, cultural, and human). The authors utilize research from several Canadian indigenous communities near protected areas in the development of this framework.

**A Capitals Framework for Supporting Tourism Development in Protected Area Communities**

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Knowledge about the causes and consequences of natural system degradation is increasing, but losses in biodiversity continue to rise largely because of where and how we design communities. I first discuss the major benefits of land use planning when applied to bio-conservation, and then why communities fail to enact effective planning programs to prevent biodiversity losses. I then review major empirical research findings and examples from local planning practice about five sets of critical choices that land use planners, elected officials, and the public can make to advance land use planning for bio-conservation including: 1) the design of state planning programs aimed at motivating local action; 2) the design of local public participation programs for visioning and goal setting; 3) how to incorporate green community design concepts into land use plans; 4) the formation of plan implementation strategies based on choices among local regulatory, incentive, and infrastructure investment powers; and 5) the design of local plan monitoring and evaluation programs. The final part concludes by examining the implications of placing these choices at the core of recommendations for guiding future research on a strategic choice theory of integration of bio-conservation science information into land use planning. I also offer recommendations for policy formation aimed at creating more ecologically sustainable communities.

Global climate change and biological invasions are among the most important drivers of the current rapid decline of biodiversity. However, the link between those two threats remains largely unexplored. Global warming can enhance the invasiveness of many species by altering the climatic conditions of an ecosystem. For example, non-native species which are currently unable to colonize higher latitude regions because of physiological constraints (e.g., too low temperatures) could become invasive within the next century due to warming temperatures. Our aim is to make spatial predictions about future invasion risks by ants in Europe based on their species characteristics (mostly physiology) and future climate scenarios. We show, with the combination of spatial models of predicted temperature increases (IPCC mapped data) and of field experiments with invasive Argentine ants to what extent the species’ distribution is currently limited to the Mediterranean region by temperature and how this might drastically change in a warming climate. We used ants as model species to explore the link between climate change and invasions because of their role as key stone species in many ecosystems and the huge impact of ant invasions on ecosystem functioning. But global warming is likely to favour numerous biological invasions threatening biodiversity.

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Understanding habitat use is essential for effective management and conservation. Mobile organisms in a community choose habitats in response to a variety of underlying factors including availability of resources, protection from predators, competition for space, and topographic dispersal barriers. This study investigates patterns of habitat use by the diverse ungulate community within the savanna ecosystem of Serengeti National Park, East Africa. Densities of ungulates were estimated for sample locations 5 km apart. Habitat use within the area is explored by identifying hotspots and coldspots of diversity across space in relation to habitat characteristics. Habitat features were selected to incorporate principal environmental and human influences. Specific regions of the park, as well as locations outside the park boundary, support higher diversity. These are locations of potentially greater interactions among species and importance in management. The patterns of diversity appear consistent over time. However, use of space can vary with changing conditions, for instance following a strong El Nino that resulted in wet season floods. Identifying potential critical areas and characteristics of preferred habitat will contribute to our ability to predict how the ungulate community will respond to changes over time such as shifting rainfall patterns associated with climate change.

Dynamics of Hybridization between Sauger and Introduced Walleye in Montana

We used three diagnostic allozyme loci to study hybridization between native sauger (Sander canadensis) and introduced walleye (Sander vitreus) in Montana. In Fort Peck Reservoir, 10% of the Sander samples (n=158) were hybrids, and 69% were walleye, and 21% sauger. In the Yellowstone River below Miles City, 10% were hybrids, 62% were sauger, and 23% were walleye (n=46). A majority of the hybrids from both locations (>90%) were post-F1. The samples showed a bimodal distribution for genotypes representative of sauger and walleye, and, therefore, did not appear to have come from hybrid swarms. These and previous data suggest hybrids between the species are common in the Missouri and Yellowstone River drainages and represent a conservation threat to native sauger. Further interpretation of the results is limited, however, by the fact that samples did not come from spawning aggregations and only three diagnostic loci were used. To address these issues, we have examined 20 microsatellite loci; three of these loci are diagnostic, and seven are informative to distinguish between these species. Allele frequency differentiation between the species at these ten loci is high: FST=0.25, RST=0.69 (n=48 sauger and 63 walleye). Bayesian analysis with STRUCTURE assigns sauger and walleye with 100% confidence (cutoff = Qi > 0.9) with these 10 loci. We are now using these markers to examine the conservation threat of introgression by sampling discrete spawning aggregations in Montana and Wyoming.
P2.52 Blanco, Gabriela S.*; Morreale, Stephen J.; Paladino, Frank V.; Spotila, James R.; Department of Biology, Drexel University, Philadelphia, PA 19104 USA.; Department of Natural Resources, Cornell University, Ithaca, NY 14853, USA, Department of Biology, Indiana-Purdue University, Fort Wayne, Indiana 46805-1499, USA.; gbs22@drexel.edu

Urgent action is needed during the migration and internesting periods to conserve eastern Pacific green turtles nesting in Northwestern Costa Rica

The Pacific coast of Costa Rica hosts important nesting sites for endangered eastern Pacific green turtles (Chelonia mydas). We studied migration, inter-nesting movements and behavior of turtles that nest on Nombre de Jesús and Zapotillal beaches using satellite telemetry. Turtles remained in the vicinity of the nesting beaches, using depths between 5 and 10 m (89%) during internesting. Post nesting movements showed different migration routes and foraging areas: 3 turtles stayed in nearby Papagayo Gulf (Costa Rica), 3 moved to Santa Elena Gulf (Nicaragua) and 3 migrated 400 km north to Fonseca Gulf (El Salvador). We also identified threats to the population that require urgent attention for its protection. The majority of the north pacific Costa Rican nesting beaches have no enforced protection, which facilitates illegal egg recollection and uncontrolled tourism. Additionally, we observed incidental capture of turtles by artisanal fisheries that operate in waters surrounding the nesting beaches. Our findings suggest that green turtles inhabit waters off the coasts of El Salvador, Nicaragua and Costa Rica during their entire reproductive life; which also makes them vulnerable to fishing activities in these areas. Urgent action is needed both on land and at sea.

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Global change vulnerability assessment of conservation targets and its implications for nature conservation management - a case study from eastern Germany

Any proactive and strategic nature conservation management should be based on a thorough vulnerability assessment of its targets, such as populations or ecosystems. Global change is increasingly exposing conservation targets to a diversity of stresses, both directly and in interaction with other anthropogenic stresses. We therefore propose an index of ecosystem vulnerability to global change in order to facilitate the identification of adaptive conservation strategies. The methodology of this study is based on a concept of vulnerability as a function of change in exposure, sensitivity and adaptive capacity. In terms of exposure changes, we consider regional climate projections and dynamic trends of current threats (e.g., land use pressure). Sensitivity and adaptive capacity are factored in both by community and habitat aspects and their interactions. The indicators are rated semiquantitatively, resulting in discrete ecosystem vulnerability classes. Highly global change-vulnerable ecosystems in eastern Germany are water dependent ecosystems such as peat bogs and mesic forests, threatened by increasing temperature, altering precipitation and droughts as well as increasing land use pressure. The vulnerability of goal and target setting is part of a vulnerability assessment of conservation systems and therefore contributes to a strategic and adaptive management in the face of global change.

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The Impact of Poverty on Deforestation in Indonesia

Forest conservation has gained more attention recently from the climate change dialogue of carbon financing. Satellite technology has enabled remote estimates of forests and deforestation. The Forest Monitoring for Action (FORMA) system provides estimates of deforestation in Indonesia from 2000 to October 2009, producing monthly “time-lapse” maps from December 2005 to the present, currently at approximately 1km spatial resolution. In addition to potential carbon gains from forests, tropical forests have high global biodiversity significance and play a crucial role for many poor people. This analysis elucidates a typology of deforestation areas according to socio-economic and physical characteristics including: suitable soils, economic density, and near and far travel distance from major cities. The results display a series of deforestation characteristics maps over time.

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The impacts of energy development noise playback on lek attendance and behavior in greater sage-grouse

The spread of human development has caused a dramatic increase in noise across the landscape. Recent studies suggest that noise may negatively impact wildlife, yet little is known about the causes and consequences of this impact. Further, most previous studies have not been designed to isolate noise impacts from other confounding factors. This study is investigating the impacts of energy development noise on greater sage-grouse (Centrocercus urophasianus), a species of management concern across western North America. Sage-grouse are declining in areas of energy development and circumstantial evidence suggests that noise is a cause of this decline. To test this hypothesis, control leks and leks with experimentally-introduced energy development noise were monitored for three seasons. Noise playback resulted in immediate and drastic declines in lek attendance by male sage-grouse relative to paired controls. Additionally, males remaining on noise leks had elevated levels of fecal corticosterone, suggesting that noise exposure has both physiological and behavioral impacts. This is the first long-term playback experiment investigating the chronic impacts of noise on any wild population, offering a unique opportunity to experimentally address noise impacts on avian behavior and breeding site selection while informing conservation efforts for this species.
Habitat loss is undoubtedly one of the greatest threats to species persistence and a predictive tool that links habitat loss to extinction risk would be invaluable to conservation. For the past three decades the Species-Area Relationship (SAR) has been this tool, providing the basis for countless conservation priority setting analyses. However, it has rarely been tested with data on real extinction rates; it ignores threats to biodiversity other than direct habitat conversion; and it assumes that species are uniform in their susceptibility to habitat loss. We developed alternative models to the classic SAR to describe the relationship between the proportion of species that are threatened with extinction and the proportion of their individual ranges that has been converted from its native state. The models take into consideration threats other than habitat loss (a multi-threat SAR model), or variation in a species’ ability to live in areas partially modified by human use (a differential susceptibility SAR model). We tested these models at the global-scale using data on amphibians, mammals and birds and found that the traditional SAR model never provided the best fit to observed patterns. The results strongly suggest that in order to make more accurate predictions of species extinction risk, the classical SAR model needs to be adjusted to incorporate additional data on multiple-threats and differential susceptibility.

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Ecotourism Benefits and the Role of Non-Governmental Organisations at Yankari Game Reserve, Nigeria

An investigation ecotourism at Yankari Game Reserve in Sudan Savanna of Northern Nigeria and one of the country’s most visited protected areas focused ecotourism benefits and the role of Non-Governmental Organisations in promoting conservation awareness. Interviews, participant observation and archival research were used to investigate the role of Non-Governmental Organisations, residents attitudes, toward Yankari Game Reserve and ecotourism as a method of protected area and rural development. Many factors make Yankari Game Reserve a prime ecotourist destination, including the possibility of viewing easily its endemic species, such as Waterbuck. The Game Reserve has a strong Non-Governmental Organisation involvement and currently combines conservation and development through a programme that returns a portion of tourism revenue to local communities. Actual benefits received from the Game Reserve, including ecotourism revenues were found to influence the positive and negative perception of Yankari Game Reserve held by residents in the Game reserve periphery. However limitations on ecotourism development include infrastructure and political instability. KEY WORDS: Ecotourism, Conservation, Yankari Game Reserve, Local Communities, Rural Development

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Development and Application of a Computer-Assisted System for Photographic Mark Recapture Analysis

Photographic mark-recapture is a cost-effective, non-invasive way to study populations. However, to effectively apply photographic mark-recapture to large populations, computer software is needed for efficient image manipulation and pattern matching. We created an open source application for the storage, pattern extraction, and pattern-matching of digital images for the purposes of mark-recapture analysis. The resulting software package is a stand-alone, multi-platform application implemented in Java. We applied this system to a population of giraffe (Giraffa camelopardalis) in the Tarangire Ecosystem in northern Tanzania. Over 1200 images were acquired in the field in three primary sampling periods, Sept.-Oct. 2008, Jan.-Mar. 2009, and Dec. 2009. The pattern information in these images was extracted and matched resulting in capture histories for over 600 unique individuals. These histories were then analyzed with Cormack-Jolly-Seber models to estimate survival rates and closed population models to estimate population sizes. Our program employs the SIFT operator (Scale Invariant Feature Transform) which extracts distinctive features invariant to image scale and rotation. This was advantageous in this application as it allowed reduced preprocessing of images and accepted a greater range of image quality with low matching error rates. This new tool allowed photographic mark-recapture to be applied successfully to this relatively large population.
A New Software Application for Photographic Mark Recapture Analysis

Photographic mark-recapture (PMR) is a cost-effective, non-invasive way to study populations. However, to effectively apply PMR to large populations, computer software is needed for efficient image manipulation and pattern matching. We have created an open-source application for the storage, pattern extraction, and pattern-matching of digital images for the purposes of PMR. Our software is a stand-alone, multi-platform application implemented in Java that employs the SIFT operator (Scale Invariant Feature Transform) which extracts distinctive features invariant to image scale and rotation. In this poster we present a validation of the application for two species with distinct markings, wildebeest (Connochaetes taurinus) and giraffe (Giraffa camelopardalis). We used ROC curves (Receiver Operator Characteristics) to characterize the trade-off between false negative and false positive error in the photo-matching process and to identify the best performing scoring procedure. Because false negative error was of greater concern than false positive, we selected scoring thresholds that minimized false negative error. For wildebeest, the best procedure generated false negative error rates of 14% while yielding a 130-fold labor savings over an unassisted matching process. For giraffe, errors rates were negligible and labor savings even greater. These results suggest that this software should be useful to other researchers employing PMR.

Rehabilitation and release of young captive-born carnivores

For the most threatened populations, the last chance relies on stocks of captive animals in zoological parks. But release of captive-born animals demands special handling. Most species of mammals rely on learning as juveniles for their survival. Moreover, released carnivores should not be a danger to human and its livestock. Between 1994 and 2010, we raised and released 20 grey wolves (Canis lupus), 10 brown bears (Ursus arctos), 3 Eurasian lynx (Lynx lynx) and 2 Eurasian otters (Lutra lutra) born in Russian zoos. Raising methods are different from one another. Bears and lynx need rehabilitation in steps and soft-release. Wolves and otters can be hard-released after one year old. Lynx are the most difficult to rehabilitate because of a lack on hunting experience; it remained unsuccessful. Wolves have tendencies to socialize with human and must be taken from the parents after 6 weeks old, or raised under adults. Bears are rehabilitated well, provided they have no close contact with human and have possibilities to experience foraging. We discuss the opportunities of this work for conservation biology, and especially to re-introduce rare and extinct species and subspecies, and to re-enforce small populations.
Social and Environmental Implications of the Chan-75 Dam in Bocas del Toro, Panama

The Chan-75 dam, under construction on the Changuinola River, is affecting terrestrial and aquatic biodiversity in Bocas del Toro, Panama. The Ngäbe people of Panama rely on natural resources provided by the river and the surrounding forests of Palo Seco Protected Reserve. Four communities must relocate due to inundations caused from damming the river. Many more families will no longer have access to farms, trails, and trade routes. I will conduct semi-structured interviews in communities surrounding the dam site to understand how stakeholders view effects of the Chan-75 dam on natural resources in the Changuinola watershed. This research is critical because more dams are planned for the region. Data collected through this research will assist with planning and implementing these future projects.

Assessing biodiversity change: monitoring programs that measure true progress

The 2010 target of the Convention on Biodiversity "to achieve a significant reduction in the current rate of biodiversity loss" serves as a rallying point to conserve the World's natural biotic diversity. However, if the target is to be more than a simple public relations exercise, we need scientifically credible ways of measuring true progress. Therefore, monitoring biodiversity change is important and there been much recent debate over how best to do this. Biodiversity monitoring programs tend to fall in two camps, those who think that to be effective biodiversity monitoring must be based on research or management programs that are strongly rooted in a priori questions, versus those who advocate programs designed to specifically track broad-scale changes in species, habitats, and ecosystems. In this talk we show how the former research-based monitoring programs provide flawed information regarding how the world's biodiversity is changing in the face of global warming and human activities. We also outline why the alternative approach based on broad systematic monitoring provides the scientific information capable of measuring true progress toward reducing biodiversity loss.

How Do Habitat Connectivity and Dispersal Rates Affect Population Dynamics of an Imperiled Freshwater Fish?

The effects of habitat fragmentation on population size, connectivity, and dispersal are important impacts to understand for metapopulations of fishes that occupy stream networks. Using a patch framework, we assessed how habitat connectivity and dispersal affected both population size and trend for an imperiled freshwater fish (bull trout, Salvelinus confluentus). First, using GIS, we interpolated between known water temperature points to delineate patches of potentially suitable habitat within a large watershed. Next, we developed a metapopulation model using estimates of population size and growth based on empirical studies, and connectivity based upon the patch delineation, to investigate the effect of dispersal rates on population persistence over time. The GIS analysis indicated that patch size was the single best predictor of occupancy. Results of the metapopulation model indicated that dispersal significantly decreased patch extinction probability, and even very small rates of dispersal helped mitigate negative effects of stochastic variability on population size. When considered together, these results suggest that in some systems, the trade-off between protecting habitat size vs. connectivity should not be an either/or decision, but that management should be prioritized to enhance connectivity between critical habitat patches while simultaneously maintaining adequate habitat patch size.

An unconventional artisanal fishing activity of large sharks in Southern Brazil: Implications for conservation and urgent needs to investigations

An unconventional artisanal fishery targeted to large sharks in state of Paraná, Southern Brazil (25°3′39″S, 48°26′26″W) was observed from June 2006 to January 2010. In this community the fishery is executed only by two fishermen with a 24 Hp motorized canoe, with a baited bottom gillnet (40 cm mesh-size between opposite knots). Were recorded 60 sharks in different reproductive stages including pregnant females, females post-partum, adult males and juveniles, belonging to the species: Carcharias taurus, Cararcharinus limbatus, Cararcharinus obscurus, Galeocerdo cuvier, Sphyra lewini and Squatinia guggenheim. This fishery, which captures pregnant females with high reproductive potential and fecundity in a costal nursery area, may influence the population dynamics and species turnover rates locally and regionally over time. Therefore, a constant and effective monitoring about local and regional fisheries is urgently necessary to provide information on the specific target and effort employed. These measures are crucial to develop and implement efficient conservation actions and sustainable artisanal fisheries. It is also imperative to conservation and sustainable fisheries management that the catches data will be recorded species-specific and considers what is the target species intend by fisherman, differently as it is done today, where official statistical reports since categorized in a general category like "shark".
Understanding the ecological mechanisms that lead to extinction is a central goal of conservation. Can understanding ancient extinctions help us to predict extinction risk of modern birds and mammals? Using classification trees trained on both prehistoric and historic extinctions from continental and island settings, I found that ecology, including endemism, large body size, and slow life-history, has been tightly linked with human-caused extinctions. For birds, species ecology, along with phylogeny, was a better predictor of extinction risk through time than extrinsic or abiotic factors. Although human impacts on species and habitats have changed through time, modern endangered species share many of the same ecological characteristics as victims of previous extinction waves. Detailed predictions of extinction risk were used to identify species potentially in need of conservation attention, demonstrating the utility of paleoecology for modern conservation biology.

Global-scale evidence that environmental degradation worsens human health

A compelling argument for protecting natural ecosystems is that environmental degradation damages human health. Although there are many examples of how pollution and other forms of environmental degradation negatively affect human health at a local scale, no global evidence yet exists. I examine the relationship between some key indicators of human health (Disability-Adjusted Life-Years, infant mortality, life expectancy, and deaths arising from infectious and non-infectious disease) and environmental quality (habitat conversion, water and air quality, CO2 emissions, combined indices), using data from over 100 countries. Reduced environmental quality correlates positively with disease prevalence and death rates in humans (e.g. a 10% reduction in water quality is predicted to kill another 35.5 million infants/yr globally, and a 10% reduction in air quality will kill another 343,000 people/yr from cancer), after controlling for population growth and density, per capita wealth and expenditure in health services. Healthy natural ecosystems therefore probably buffer human populations from life-threatening disease and increase life expectancy.
Direct vs indirect competitive effects of exotic plants on locally-declining natives

Biological invasion effects often vary with spatial scale, but temporal changes in native-exotic diversity over a range of scales is rarely documented. Understanding the cause of localized native species declines would inform research and management, and is essential to predicting effects of invaders and successfully restoring natives. Long-term monitoring has shown declines in certain native annual forbs over the past 40 years at one California grasslands site, while abundance of certain exotic grasses has increased. These grasses may competitively exclude forbs via direct competition between seedlings or indirect competition through build-up of litter. We established a two-way factorial competition removal experiment to examine the effects of these two factors on the grassland community and six seeded forb species with documented declines. Herbicide application significantly reduced grass and increased forb abundance; litter removal did so to a lesser extent. Combining treatments did not produce a synergistic effect on either grass or forb abundance, however. Seeded species responses were highly idiosyncratic among species, treatments, and spatial location. High levels of spatial variation in community properties were observed overall, suggesting that the effects of such management actions will strongly vary. Thus, limited resources should either be focused on locations where they will have the greatest impact or, when this is unknown, spread over highly variable sites.

Metapopulation conservation in fragmented landscapes of Central Europe - the Natura 2000 protected area network and beyond

Confining biodiversity conservation to protected areas is inadequate in human-dominated landscapes. In recognition of this, the European protected area network Natura2000 promotes a system of functionally interacting sites, with the unique specification that interventions planned outside of a designated site, but representing a potential threat to the protection aim, also require impact assessment. This specification is crucial for preserving (meta-)populations of species with extensive area requirements, however its effective implementation is frequently hindered by a lack of knowledge about the supplementary areas required to ensure population dynamics and connectivity. The capercaillie (Tetrao urogallus) is severely affected by habitat loss and fragmentation in Central Europe. In the Black Forest (Southwestern Germany) its occurrence was one of the primary criteria for designating special protected areas (SPA, EU Birds’ directive) but these areas only cover permanently occupied habitats. We used species monitoring and population genetics in combination with spatial modelling of habitat and habitat connectivity to localize and prioritize all areas - inside and outside SPAs - relevant for long-term metapopulation conservation. The results provided the spatial framework for the regional Capercaillie Action Plan that includes measures of habitat improvement, tourism management and predator control and was developed in collaboration with all responsible stakeholder groups.

Recovery efforts for the endangered Basking Shark (Cetorhinus maximus) within Canadian Pacific Waters

The Basking Shark (Cetorhinus maximus) is the only extant species in the family Cetorhinidae. The Pacific population is estimated to have experienced a rate of decline exceeding 90% within
**SP1.9** Brook, RK*; McLachlan, SM; University of Saskatchewan, University of Manitoba; ryan.brook@usask.ca

**Re-Thinking the Culture of Corridors**

While the importance of landscape connectivity is well established in conservation biology, much less is known about the role of the motivations and behaviour of people living within habitat corridors. In this study we examine the combined influences of habitat and human attitudes and actions on wolf and ungulate (moose, elk, and white-tailed deer) use of corridors and the agriculture-dominated matrix and assess the relative contribution of these social and biological aspects. Farmer observations of wildlife and the associated attitudes and farm management practices were documented within the agriculture-dominated matrix around two large protected areas, Riding Mountain National Park and Duck Mountain Provincial Forest in southwestern Manitoba, Canada using 786 responses to a mail-back questionnaire and participatory mapping interviews with 107 farmers. Biological datasets from radio-collaring, aerial surveys, and wildlife mortalities were used separately and in comparison to the social datasets to evaluate biological and social variables predicting the occurrence and survival of each species outside of the protected areas. For elk, deer, moose, and wolves, 46% of all human-caused mortalities on farmland occurred within 2km of a protected area. The probability of occurrence of each species was directly influenced by a combination of habitat and farm management variables. Our results strongly support the need for an integrated approach to corridor establishment and management.

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**Tools and Collaborative Approaches to Bridge the Communication Gap between Scientists and Northern Communities about Caribou Heath and Conservation**

Barriers to communication among scientists and indigenous communities in northern Canada about caribou and reindeer (Rangifer tarandus) health and conservation include: language, world-view, motivations, and a lack of suitable communication tools to facilitate knowledge sharing. The need for improved communication and collaboration is particularly acute given recent dramatic caribou declines. Understanding changes to caribou requires a diverse set of knowledge, tools, and approaches. Despite a range of anatomical features that are unique to the species and active research on diverse aspects their biology, relatively little work has been done to describe the anatomy of the genus Rangifer. It is important to describe what is ‘normal’ structure and function so that we can begin to understand ‘abnormal’. The purpose of the Rangifer Anatomy Project (RAP) is to describe the anatomy of Rangifer from both scientific and traditional perspectives. Data on caribou anatomy have been obtained from lab-based scientific dissections of preserved reindeer and field-based dissections of caribou while participating on community caribou hunts. Interviews with hunters and elders have elicited information on traditional uses of caribou parts as food, medicine, clothing, and equipment. We anticipate that the process of this project and the final products that describe caribou anatomy from multiple perspectives will ultimately facilitate greater discussion about caribou health and conservation.

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**5.3** Brooks, JS*; Waylen, K.; Borgerhoff Mulder, M; University of Illinois, Urbana-Champaign, Macaulay Land Use Research Institute, University of California, Davis; jhb26kalamail.com

**The effect of national socio-political context on community-based conservation outcomes**

Since the 1980s, various forms of community-based conservation (CBC) have been promoted in developing countries. Understanding why CBC projects have had mixed outcomes is of importance to conservation efforts. Two previous quantitative comparative evaluations of CBC projects have, respectively, suggested that market integration, benefits provision, and community involvement are associated with successful projects and that projects should engage with local culture. However, these studies did not test for the influence of the broader sociopolitical context in which all projects are embedded. This is needed because a growing body of theory and anecdotal evidence suggest that factors ranging from national governance institutions, to levels of corruption, to general standards of living can influence project outcomes. We present the findings of a new systematic review, which uses a larger dataset than previous quantitative comparisons to associate four measures of project outcomes (attitudinal, behavioral, ecological, and economic) with aspects of national sociopolitical and economic context. Associations with well-implemented national policy, low levels of corruption, and high ranking on the Human Development Index, were detectable even though their influence might be expected to be complex and nuanced. We also tested variables including provision of social benefits, engagement with local institutions and culture, market integration, and resource access. Conservation planners should account for broader socio-political institutional context as well as understanding local biophysical systems and cultures. These findings highlight a challenge for conservation practice and policy.

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**SY45** Brooks, TM*; Baillie, JEM; Boitani, L; Cox, NA; Lacher, TE; Stattersfield, AJ; Vié, J.-C.; Stuart, SN; NatureServe, Zoological Society of London, University of Rome, Conservation International, Texas A&M University, BirdLife International, IUCN Species Program, IUCN Species Survival Commission; tbrooks@natureserve.org

**A fifth of vertebrate species face a high probability of extinction? Progress and directions for the IUCN Red List**

The IUCN Red List of Threatened Species provides the authoritative, comprehensive measure of extinction risk for the world's species. It is documented through the efforts of the ~8,000 specialists of the IUCN Species Survival Commission, managed by the IUCN Species Program, and supported by the Red List Partnership. The process of assessing extinction risk for the Red List involves: a) application of quantitative categories and criteria (to ensure transparency and repeatability); b) comprehensive assessment of all species in a given higher taxon (not just those considered likely to be threatened); and c) systematic compilation of supporting documentation on distribution, habitat, threats, and conservation actions (to maximize utility for conservation action). In total, 27,893 vertebrate species have now been assessed (45%), including all mammals, birds, and amphibians. Of non-Delicate species, 23% mammals, 12% birds, and 40% amphibians are threatened; sampled assessment yields equivalent proportions of 21% reptiles and 23% freshwater fishes. These data can inform conservation implementation, and track its progress over time for reporting and as a basis for adaptive management. They also provide the starting point for modeling predictions of the impacts on extinction risk of landuse trends (e.g., biofuels, REDD) and emerging threats (e.g., climate change, invasives).
Artificial Night Lighting Alters Growth and Development of Aquatic Snails and Frog Larvae.

The expanded global use of artificial night lighting increasingly exposes organisms to unnatural patterns of illumination within natural habitats. Growth and development of vertebrates and invertebrates is controlled in part by hormones that are produced in daily cycles associated with illumination-dependent shifts in the production of photoperiodic hormones like melatonin. We studied growth and development of snails (Physa acuta) and frog larvae (Xenopus laevis) exposed to different amounts of light at night in laboratory studies. All animals were exposed to diurnal illuminations of 100 lx and varying nocturnal illuminations of 0.0001 lx (starlight; dark control), 0.01 lx (moonlight), 1.0 lx (twilight), and 100 lx (dim room lighting). After 37 days of larval development, we photographed and measured frog larvae and established their developmental stage. Frog larvae grew the fastest when exposed to small to moderate amounts of artificial night lighting and their development was significantly delayed at these illuminations relative to dark controls. Snails monitored over 120 days responded similarly with peak growth occurring at low to moderate levels of illuminations. Our results suggest that even small amounts of light pollution commonly found in aquatic habitats can significantly alter growth and development of aquatic organisms.

Forest Carbon Markets and Conservation: The Human Dimension

For decades efforts have been made to find the magic bullet for the conservation of forest landscapes. In the tropics, various schemes have emerged - tropical forest action plans, debt for nature swaps, conservation concessions and the Global Environmental Facilities. In the temperate forest, of countries such as China and New Zealand, halting clearcut logging, logging bans, large scale afforestation/reforestation and industrial plantations have been promoted. In the boreal forest emulsion natural disturbances, increasing protected areas and stopping illegal logging are the emphasis. But have any of these schemes, initiatives, institutions and policies really worked? If not, what are policy makers suggesting to replace them? One suggested answer: Payments for ecosystem services in forest based carbon conservation projects. In all of the world’s forested regions the projects are still at project level or experimental stages as policy actors grapple with the logistics, incentives schemes, contract design and human welfare. This paper will illustrate our research findings on key dimension of human welfare: income, subsistence, social capital, trust, and corruption from countries such as China and Mozambique.
P2.200 BURGESS-HERBERT, SARAH*; Euling, SY; Mortensen, H; AAAS Science & Technology Policy Fellow, U.S. Environmental Protection Agency; s.burgessherbert@gmail.com
Using Genomics to Reduce Uncertainty in Environmental Risk Assessments
A critical challenge for environmental risk assessment is in reducing the uncertainty introduced by the extrapolation of inferences across differing levels of biological organization, across species, and across variation within species. Our goal here is to critically evaluate the ways in which genomics data and associated computational biology approaches can address these latter two factors by reducing uncertainty in extrapolation across and within species. We evaluate cross-species methods for comparing genes and proteins important in the perturbation of biological pathways leading to toxicity-induced diseases; and, we evaluate methods for comparing the pathways themselves. We ask how genetic, protein, and pathway information can be interrogated from an evolutionary biology perspective to effectively characterize variations in biological processes among organisms. And, finally, we examine the use of genetic polymorphisms, transcriptomics, and proteomics in investigating the variation within species that leads to differences among life-stages, males and females, and among individuals with differing nutrition status, and existing health conditions. We conclude that, while improved bioinformatics methods and resources are needed, genomics approaches show promise for reducing uncertainty both within and across species. Disclaimer: The views expressed are those of the authors and do not necessarily reflect the views or policies of the US Environmental Protection Agency.

SP11.4 Burton, AC*; Balangtaa, C; Sam, MK; Brashares, JS; University of California, Berkeley, Wildlife Division of the Forestry Commission of Ghana; cole@berkeley.edu
Evaluating Carnivore Persistence and its Predictors in an Impacted West African Protected Area.
Despite their great ecological and cultural significance, many carnivores are increasingly threatened and inadequately studied. Effective conservation requires better knowledge of carnivore status and the factors underlying their vulnerability. This is particularly true in West Africa, where populations are poorly known and facing heavy impacts. We conducted the first assessment of carnivores in Ghana’s Mole National Park, a regionally important savanna reserve, using 253 remote camera stations deployed for 5,469 camera-trap days between October 2006 and January 2009. Only 9 of 16 historically occurring carnivores were detected, with spotted hyena (Crocuta crocuta) and leopard (Panthera pardus) among the most abundant. A hierarchical multi-species occupancy model estimated low detection probabilities across species but only limited support for the presence of undetected species. Additional data sources, including village interviews and anti-poaching patrols, indicated the park’s top predator, lion (Panthera leo), may still persist, but confirmed that it and other undetected species are likely at least functionally extirpated from the ecosystem. Contrary to expectations, variation in carnivore persistence was not explained by ecological or life-history traits such as body size, home range size or fecundity. Our results imply an urgent need for new conservation initiatives to protect and restore these regionally important carnivore populations.

SP4.10 Burton, PJ*; Rose, NA; Canadian Forest Service, University of Northern British Columbia; pburton@nrcan.gc.ca
Projecting Patterns of Climate Refugia for Conservation Planning in Central British Columbia
The prioritization of conservation targets that can persist under a changing climate has recently emerged as an important challenge for planners. We devised bioclimatic envelopes for some rare plant species and ecosystem types using the 5th to 95th percentiles of four interpolated climate attributes describing the range currently occupied by those conservation targets. Current and future climate attributes for existing rare plant populations and a 1-km grid of the study area were interpolated using ClimateBC and projected based on the A2 scenario and the 3rd generation of the Canadian general circulation model, CGCM3-A2. Locations where suitable climate is projected to persist through current and future conditions can be expected to provide habitat continuity over time, and should receive higher priority for protection than other locations. Rare species typically do not fully occupy the climatically suitable habitat open to them, yet only 7 of the 73 plant species evaluated are projected to experience climatic conditions suitable for persistence in our study area. Only 6 of the 30 terrestrial ecosystem units evaluated are projected to persist, over just 2561 km2 or 1% of the study area. When combined with other conservation criteria, areas projected to be climate refugia become clear priorities for protection. These results illustrate the magnitude of ecological change that can be expected, and the utility of available spatial modelling tools to set conservation priorities.

18.7 Burgman, M.; University of Melbourne
How to obtain better expert judgments
Expert judgments are pervasive in conservation biology, from listing decisions to estimating model parameters. Yet there are no comprehensive guidelines in conservation biology that describe how best to obtain them. Evidence from cognitive psychology and management science suggests that structured methods for expert elicitation will substantially improve the accuracy and calibration of expert opinion about facts. This presentation outlines the steps in acquiring and combining judgments from experts about facts that provides better-calibrated and more accurate estimates than na”ve elicitation. It uses a 4-step elicitation procedure, embedded within a modified Delphi-technique, and relying of frequency formats for questions. It can be used in small local groups or large groups linked by phone and the web. It is designed to provide for eliciting judgments about a “best” estimates and their uncertainty, partitioning lack of knowledge and natural variation. Perhaps most importantly, it generates group estimates that outperform the best-performing individual expert.
Predicting the Effect of Climate Change on Habitat Available for Waterbird Species in European Mediterranean Wetlands

It is expected that climate change will have a profound effect in Mediterranean wetlands. The increase in temperature and reduction in rainfall predicted in Southwestern Europe will affect seasonal wetlands reducing their extent, duration of flooding and depth, and increasing salinity. From February 2008 to February 2009 we carried a total of 1718 waterbird point-counts at 80 localities in Southwestern Spain. Covering a whole range of types from tidal to freshwater and from permanent to seasonal. We fitted statistical models (GAM & BRT) to presence-absence data of 69 species of birds using as predictors environmental variables measured on site at the time of the count and wetland characteristics measured on a GIS. We generated several climate-change scenarios for our localities assuming changes in extent, hydroperiod, depth and salinity, and predicted new probabilities of presence for each species. Comparing the mean probability of presence in each climate-change scenario with current probabilities we predict which species will be more affected by habitat reduction in Southwestern Europe.

Conservation by coincidence: Woodland caribou, surrogacy and biodiversity in the boreal forest of Canada

Woodland caribou is an at-risk species often portrayed as emblematic of functional boreal wilderness, partly because its principal threats include habitat loss and increased predation facilitated by extensive industrial activity. Since large protected areas are frequently proposed to maintain its persistence, caribou's emblematic status may have functional value for conservation of other species. We estimate the surrogacy value of the boreal population of woodland caribou by (i) evaluating co-occurrence of native taxa with caribou distribution for mammals (n=101), birds (n=338), at-risk mammals (n=7) and at-risk birds (n=28); and (ii) conducting systematic conservation planning to identify representative reserve networks, comprised of planning units deemed large enough (10,000 km2) to enable persistence, both at the extent of woodland caribou range and the entire boreal forest. Our analyses indicate strong anisotropy in the surrogacy of woodland caribou for overall mammal and bird diversity partly due to the pronounced latitudinal gradient in richness. Surrogacy values for at-risk species did not follow expected latitudinal patterns, suggesting priority areas for biodiversity conservation need to carefully consider a range of patterns, and not overall richness gradients. This information can help prioritize caribou management and planning in areas of high surrogacy for other taxa of conservation importance.
Governance Factors in the Identification of Global Conservation Priorities for Mammals

Global conservation priorities have often been identified based on combinations of species richness and threat (e.g., Biodiversity hotspots). With the development of the field of systematic conservation planning more attention has been given to conservation costs. This leads to prioritizing developing countries, where costs are generally low and biological diversity is high. But many of these countries have poor governance, which compromises conservation success. Poor governance has negative effects on conservation outcomes, either by resulting in ineffective conservation or by resulting in larger costs than initially expected.

Mammals are a group especially susceptible to threats that are linked to illegal actions, such as poaching. We explore how the consideration of governance indicators affects global conservation priorities for the world’s mammals in a complementarity-based conservation planning approach. We use data on Control of Corruption (Worldwide Governance Indicators project) as the main indicator of good governance, and GDP per capita as an indicator of cost differences between nations. We show that, while there is some variation in the countries of choice, poor governance seems to have little influence on which countries are main conservation priorities. Only when poor governance results in much higher management costs, conservation budgets are more effectively allocated to countries with better governance. Overall, the analysis supports the concentration of conservation efforts in most of the generally considered priority nations, but highlights the loss of conservation benefits through poor governance.

Biological traits of boreal bryophytes reveal the species most susceptible to habitat change after partial forest harvest

Mosses and liverworts (bryophytes) contribute to the plant diversity and function of boreal forests but are susceptible to changes in habitat conditions after forest harvesting. We examined how different levels of partial harvesting affected the persistence of species with differing traits. Bryophytes were intensively sampled in 24 forest stands (each 10 ha) five to six years after application of 10, 50, and 75% dispersed green-tree retention harvesting (unharvested stands as controls), in forests with contrasting abundances of broadleaf and coniferous canopy trees. Both retention level and forest type affected the composition and diversity of bryophytes, with the strongest predictor of bryophyte response being forest moisture. Liverworts and bryophyte species that preferentially colonize decayed wood and tree bark were more negatively affected than mosses and species with other habitat preferences. Species with infrequent sporophyte production, larger spores, dioicous sexuality, and which require greater moisture and shade were less abundant in the lower retention treatments and may also have more limited capacities to reestablish after harvesting. Assessment of bryophyte traits provides novel insight into the species most susceptible to changes in habitat conditions after partial harvesting, and helps to identify species that require careful consideration of alternative management practices for their conservation.

Status of the Western Interior Basin

The Western Interior Basin of southcentral British Columbia represents the northernmost extension of the arid sage-steppe and grassland ecosystems of western North America. Numerous microclimates related to the rolling topography and deep valleys support a high proportion of the listed Species at Risk in Canada as well as BC-listed species, despite the tiny size of this ecozone within Canada. Habitats in this ecozone are threatened by rapid growth of the human population, a century of fire suppression that has turned park-like woodlands into dense forests, current severe mountain pine beetle outbreaks in upland forests, and conversion of grasslands to vineyards, orchards, and urban zones. Rivers and lakes are affected by channelization, dams, and water withdrawal for agricultural and other human uses. Likely future threats include the over-all lack of protected areas within the region, predicted large effects of climate change, and continued human population growth.

Amplifiers on the Commons: The Role of a Sense of Self-in-Place and Community-Based Sustainability Initiatives to Promote Conservation Biology

As with other regional and local planning regimes, such as adaptive management plans, community-based sustainability initiatives (CBSIs) are required to deal with complex and intertwining systems of social and ecological organization. In an effort to conserve threatened biological resources, successful efforts to foster CBSIs must take into account the ways in which citizen’s individual and community-based beliefs regarding who they are in relation to where they live or their sense of self-in-place-influence the role community dialogue plays in amplifying the risks and opportunities attending species protection. This paper reviews various ways in which a sense of self in place can be applied in the context of landscape-scale planning to conserve biological resources and promote sustainability in general. Analysis at spatial and temporal scales of community engagement in the development of CBSIs is then summarized in a suite of principles for incorporating the sense of self-in-place into opportunities occasioned by the sustainability imperative as it relates to conservation biology.
A future for Fender's: restoring habitat for the endangered prairie butterfly, Icaricia icarioides fenderi

Development, agriculture, and invasive species have claimed over 99.5% of the Willamette Valley's prairie landscape. One alarming consequence is the decline of the endangered Fender's blue butterfly (Icaricia icarioides fenderi) and its threatened host plant, Kincaid's lupine (Lupinus sulphureus kincaidii). This study evaluates the effectiveness of three restoration projects, initiated adjacent to existing habitat in 2001, 2005, and 2007, in assisting the recovery of a Fender's blue population in Eugene, OR. In 2009, I assessed vegetation, butterfly, and egg distribution in native and restored habitat. The oldest restoration area (2001) provided less native nectar (22.6 mg/m2) than the more recent restoration areas (37.6 for 2005 and as much as 317.2 for 2007). However, it was visited by more butterflies: 0.018 individuals/m2 compared to 0.003 (2005) and 0.001 (2007). Comparable trends were seen for a variety of indices, including lupine density, egg density, and butterfly fecundity, such that older restorations had greater habitat value for Fender's blue. As restoration areas mature, they will play a key role in Fender's blue recovery. Results suggest that habitat quality improves with restoration age and that assessing a restoration's impact requires long-term monitoring, at least 6-10 years. Given the rate of decline of Fender's blue, assisting the recovery of a Fender's blue population in Eugene, OR. In 2009, I assessed vegetation, butterfly, and egg distribution in native and restored habitat. The oldest restoration area (2001) provided less native nectar (22.6 mg/m2) than the more recent restoration areas (37.6 for 2005 and as much as 317.2 for 2007). However, it was visited by more butterflies: 0.018 individuals/m2 compared to 0.003 (2005) and 0.001 (2007). Comparable trends were seen for a variety of indices, including lupine density, egg density, and butterfly fecundity, such that older restorations had greater habitat value for Fender's blue. As restoration areas mature, they will play a key role in Fender's blue recovery. Results suggest that habitat quality improves with restoration age and that assessing a restoration's impact requires long-term monitoring, at least 6-10 years. Given the rate of decline of Lepidopteran species, there is an urgent need to pursue restoration strategies that directly impact resource availability and in turn butterfly fecundity.

Primate density in fragments of gallery forest at Colombian Llanos

Habitat fragmentation is one of the main threats for primates in neotropical countries. Forest areas are highly reduced by colonization fronts due to an expansion of palm oil crops in some areas as Colombian Llanos. A six-year study of primate density monitoring was made in four gallery forest fragments of different sizes in San Martín–n area (Colombian Llanos). Direct counts and group recognition of five species of primates present at these fragments were made: Alouatta seniculus, Cebus apella, Callithrix ornatus, Saimiri sciureus albigena and Aotus brumbacki. Average densities found for Alouatta seniculus range 81.90 - 23.37 ind/ km2; Cebus apella range 53.33 - 26.92 ind/ km2; Callithrix ornatus range 57.94 - 7.61 ind/ km2; Saimiri sciureus albigena range 167.62 - 7.69 ind/ km2; Aotus brumbacki range 15.24 - 4.35 ind/ km2. Densities reported here are higher than that reported in other studies of C. apella, C. ornatus, A. brumbacki and S.s.albigena; except for A. seniculus which is between normal ranges of densities reported. Variations in densities between fragments are due to difference in primate community composition, vegetation and fragment size. All primates species present at this area used fence rows to cross between fragments. Connection between fragments and an education program are necessary at this area in order to improve sustainability of this primate community.

Genetic markers are useful for determining how sea turtles rookeries are related; this information is especially relevant when management concerns include anthropogenic mortality of feeding and nesting aggregations. Considering the lacking of information for the Colombian Caribbean we performed a preliminary phylogeographic analysis including some of the rookeries of loggerhead turtles worldwide reported in GenBank, and new information of individuals surveyed in two nesting beaches of Colombia. Eight blood samples from cervical sinuses were extracted and amplified for PCR and directly sequenced in order to perform an editing, alignment and phylogenetic analysis using Maximum Parsimony and Maximum-Likelihood. Two existing haplotypes were identified in this assessment: CCA1 and CCA2 reported for major nesting aggregations of South Florida (E.U.), also a new haplotype was recognize showing 7 deletions (SNP) named as CCH1SM. Three main clusters for populations of C. caretta worldwide were hypothesize as clades A, B and C, grouping rookeries and feeding populations from the Caribbean (Florida-U.S, Mexico, Brazil, Colombia) and Mediterranean. Clade C grouping the 4 major rookeries in the Pacific (Australia and Japan), showing an evident separation of the linages due to oceanographic and geographic barriers. An effort should be made to get samples from smaller, unsurveyed beaches, particularly in Colombia, in order to detect rare haplotypes.

SCB's evaluation of the federal delisting of the gray wolf in the U.S. Rockies: Can controversy advance dialogue among scientists and policymakers?

SCB's North America Section submitted comments critiquing aspects of delisting proposals for the US Northern Rocky Mountains gray wolf. These statements subsequently received support and criticism from prominent scientists both within and outside SCB. Similar controversy occurred in response to policy positions on this issue by the American Society of Mammalogists. Scientific societies face several challenges in their efforts to bring science to bear in policy debates concerning endangered species management. They must work to develop strategic partnerships with agencies yet maintain the ability to offer independent critiques of problematic policies. They must meet rapid comment deadlines yet encourage input from a broad spectrum of their membership. They must maintain rigorous peer review of policy positions by relevant species experts yet maintain consistent criteria across taxa. Permanent committees such as the new SCB policy task forces may help increase the inclusiveness and rigor of policy statements while maintaining SCB's ability for rapid response to emerging issues, and help SCB balance its collaborative and critical roles in order to fulfill an unique niche in advancing science-based conservation policies.
Designing landscape networks to enhance species persistence in dynamic systems

Early conservation planning addressed biodiversity pattern while implicitly ignoring landscape dynamics. This assumption becomes more untenable as anthropogenic climate change alters ecosystems. However, land designations such as reserves, when designed with an awareness of landscape dynamics, can retain an important role in conserving species. Several methods for “climate-change” aware landscape design have been recently developed. Ecoregional plans in British Columbia and eastern North America have prioritized areas based on patterns of heterogeneity in topography, soils, and climate, in order to maximize retention of variability in habitat types despite changing climate. Alternative methods, which have been applied to conservation of Proteaceae in the Cape Province of South Africa and old-growth-associated taxa in the US Pacific Northwest, involve development of species-specific climatic niche models in order to identify refugia and “climate corridors”, where habitat for each species will be persistent or contiguous across time. New tools that use circuit theory to map linkage habitat for wide-ranging species may also enhance prospects for these species to persist as their range shifts. The effects of climate change emphasize the need for “thinking big” to ensure persistence of not only charismatic area-dependent focal species such as large carnivores, but also narrowly-distributed endemics whose persistence may depend on protection of refugia and climate corridors.

Continuous Fields of Vegetation Characteristics for Species Distribution Modeling: An Alternative to Predictors Based on Landcover Categories

Most species distribution models include one or more predictor variables related to vegetation. Those predictors are customarily extracted from landcover maps derived from remote sensing, and thus are based on categories (e.g., proportion of pixels belonging to the class ‘forest’ within a circle of diameter x centered at the count station). In this talk we present some pitfalls to using this kind of predictors, and introduce an alternative approach based on continuous fields of vegetation characteristics, wherein a series of key vegetation variables are mapped as scalar fields that vary continuously across space and through time. For example, instead of using arbitrary thresholds in tree cover to separate ‘forest’ from ‘non forest’ and ‘deciduous forest’ from ‘evergreen forest’, two continuous fields could be employed: ‘tree cover fraction’ and ‘evergreen to deciduous ratio’. This approach yields a more proximal and parsimonious set of predictors (the conventional approach requires a separate variable for each landcover type); preserves more of the fine-grained information contained in the input data (i.e., satellite images) that otherwise is lost amidst discrete patches of homogeneous cover; and is more versatile (the same predictors can be used for very different response variables, thus facilitating the simultaneous analysis of multiple species). We illustrate the new approach with a grizzly bear habitat mapping project in Alberta.

New notes on the biology of the Mottled-face Tamarin in the Colombian Amazon

Saguinus inustus (Schwartz, 1951) is a poorly studied Neotropical primate which is known for its adaptability to slightly disturbed habitats. This species is frequently found in areas of secondary forest around indigenous settlements and consequently is commonly used as a pet. Due to the increasing human population and the expansion of areas for swidden agriculture within its distribution range, there is a need to understand how these habitat changes are affecting the mottled-faced tamarin populations. To contribute to the knowledge of the biology and population status of this species, behavioral observations of a group of S. inustus and censuses by the line transect method were carried out to estimate the density of S. inustus around two native settlements located in the Colombian Amazon. Results showed that this species used differently proportions of primary and secondary forests suggesting that this use depends on habitat preferences and resource offer patterns. This is the first density estimation of the mottled-face tamarin and with the new observations presented here this is a starting point for the understanding of the ecology of the species in order to formulate appropriate conservation strategies in areas with high levels of habitat transformation.

Determining the Effectiveness of Conservation Measures: A Case Study with Lesser Kestrels (Falco naumanni)

Lack of nest-sites was identified as one of the main causes of population decline in Portugal. Consequently, a large conservation programme providing different types of artificial nest-sites was implemented alongside a monitoring scheme to evaluate their effectiveness and cost-benefit. In 10 years, the lesser kestrel population increased from 155-158 to 527-552 pairs, 50% currently breeding in artificial nests. Provisioning of artificial nests increased colony size, reduced predation rate and interspecific competition, resulting in overall increased breeding success and population size. However, in 2008, unusual high temperatures registered during the chick rearing period caused high chick mortality and severe weight loss in broods from wooden nest boxes. Other types of artificial nests provided (e.g. cavities in walls or clay pot nests) performed better. These high temperature mortality events stressed the importance of monitoring conservation interventions. The future of lesser kestrels is highly dependent on artificial nests, so these should be cost-effective and designed to account for potential high temperature events during the breeding season.
Patterns and processes underlying global distribution of endangered mammal species and populations

Research on population and species extinctions shows an accelerating decay of contemporary biodiversity. This pressing environmental problem is likely to become even worse in coming decades. While impacts of human activities are global in scope, they are not uniformly distributed. The biota of certain countries and regions can be identified as being most at risk, having both exceptionally high richness and endemism, and exceptionally rapid rates of anthropogenic change. Here I evaluate the global distribution patterns of mammal population and species losses, and analyse possible causal processes underlying those patterns. I specifically describe and contrast global patterns of distributions at different taxonomic levels; evaluate the variation in overall species richness explained by higher-taxa patterns. I specifically describe and contrast global patterns of distributions at different taxonomic levels; evaluate the variation in overall species richness explained by higher-taxa patterns; and explain the implications of the results for conservation.

Men And Herpetofauna: Fear, Misperceptions And Persecution

The way that human beings perceives the biodiversity has important implications for conservation efforts. Reptiles and amphibians are some of the more negatively valued animals by people due to misperceptions, aesthetic arguments and the presence of myths and superstitions. Our research demonstrates how a negative perception of specific taxa can lead to persecution and little support for the conservation of these animals. Data from a questionnaire administered to 314 people in the district of Évora, Portugal, supported the hypothesis that the existence of misperceptions and negativistic values contributed to the phenomena of human persecution on these animals. In general, reptiles were more persecuted than amphibians, mainly due to fear and misperceptions. A pilot environmental education program held during the investigation indicated that a structured and widely applied program of environmental education can improve understanding and the human relationships with these animals.

Effects of different tropical forest restoration strategies on litterfall dynamics in southern Costa Rica

Restoration strategies to facilitate tropical forest recovery may accelerate the reestablishment of nutrient cycling. We evaluated litterfall dynamics under four treatments: plantation (entire area planted), islands (planting in six patches of three sizes), control (natural regeneration), and young secondary forest (7 to 9 yrs). Treatments (plots of 50 × 50 m) were established in June 2004 at six replicate sites in Costa Rica. Planted species included two hardwoods (Terminalia amazonia and Vochysia guatemalensis) intercropped with two nitrogen-fixing (Inga edulis and Erythrina poepiggiana). Litter production recovered quickly under the two tropical restorations strategies studied as compared to areas under natural regeneration with same age. Litter production in the plantation plots was similar to young secondary forest. However, litter quality (measured by nutrient concentration and C to nutrient ratios) is greater in natural systems due to higher plant diversity, and it can influence forest restoration in the future. The dominance of litter from few species is not desirable for restoration practice once it determines nutrient availability and can negatively affect successional pathways. Accordingly, restoration strategies with more heterogeneous planting design as the islands may promote a faster increase in plant diversity and litter quality, and then accelerate the reestablishment of nutrient cycling.
Emerging patterns in the placement of protected areas (PAs) towards higher elevations and steeper slopes have been recognized, along with the increasing isolation of PAs due to deforestation outside PAs. There is however an elevation bias inside PAs which has been ignored as a wide scale pattern evident across the tropics, where the accessible lowland portions of PAs have higher deforestation rates than the largely inaccessible high elevation zones. Due to the geometry of mountains, most montane PAs have a significant portion of lowland forest, which has greater species diversity and more threatened species than high altitude forest. We compared the extent of forested and fragmented areas between lowland (1000 m asl) of the Blue and John Crow Mountains National Park in Jamaica, and found that in 2008, inside the montane zone, only 4% of forest was cleared with minimal fragmentation. In contrast, in the lowlands, 28% of forest was cleared and the density of fragments was eleven fold higher. These findings reflect an important pattern in tropical forest PAs on mountains worldwide, and we identify a 'PA hotspot zone' which lies between the PA boundary and the core high altitude zone, and which should be instituted in IUCN categories I and II PAs. The measurement of PA effectiveness within this hotspot zone will allow legal protection to be truly assessed, preventing PAs from gaining credibility due to large inaccessible high altitude areas.

### Marine planning for ecosystem services and cultural values: a proposed framework

Marine spatial planning (MSP) has the potential to balance and promote synergies between ecological, social and economic objectives. This requires incorporating ecological understanding in planning contexts, which are often virtual minefields of contesting interests, values and knowledge types (i.e., scientific, traditional, and local). Using case studies, we evaluate the extent to which MSP tools and decision making processes are ecosystem-based, integrated, place-based, adaptive, strategic (focused on long-term goals) and participatory. We found that tools and frameworks are increasingly incorporating ecosystem-service understanding, but stakeholder engagement, consultation and deliberation are often lacking a systematic method to facilitate the expression of a wider range of non-monetary values. No existing tool or analytical product acts as an adequate substitute for stakeholder engagement, and no tool or process without deliberation can account for all significant values in environmental decision contexts; accordingly, none can satisfactorily resolve value judgments and tradeoffs. We make recommendations for the design and employment of decision processes alongside tools and frameworks to integrate science and citizenship to help safeguard and rebuild ecosystems and livelihoods.

### Whole genome amplification and high-throughput sequencing enable large-scale studies using limited DNAs: an example in gibbons

DNA sequence data are powerful tools for understanding taxonomy, phylogeny and population history of endangered taxa. Because it may be difficult to obtain DNA-containing materials from wild individuals, the DNA samples preserved in institutes and zoos are very valuable, but even these samples are finite resources. We conducted a study of gibbon phylogenetics that exemplifies how to minimize the usage of original DNA samples and meanwhile generate large amounts of sequence data by combining whole genome amplification (WGA) and high-throughput sequencing. For each sample we used 10 ng of genomic DNA, which is approximately the DNA amount contained in 15 kb of sequence from the mitochondrial genome for each individual. This large dataset provided greater resolution than previous studies of short mtDNA segments (e.g., control region or cytochrome b) and showed with strong support values the basal position of genus Nomascus in gibbon phylogeny and the phylogenetic relationships of Hylobates species. Our study highlights that large amounts of DNA are not needed for the generation of large amounts of sequence data and suggests the routine use of WGAs on limited DNA materials from endangered animals. WGA products will be beneficial for DNA sample management and exchange among researchers.
Conservation of Endemic Fish Species: An Agro-environmental Innovation for Restoration of East Kolkata Wetlands

Studies on sustainable development paradigm in East Kolkata Wetlands (EKW) by spreading fiscal risk with alternative economic opportunity and agro-environmental innovations are discussed in this paper. The conservation effort includes developing germplasm bank for endemic fishes of EKW and establishing a seed production unit for them. It conjures poverty alleviation with environmental conservation of EKW, threatened by habitat loss, urban encroachment and waste escalation. Objective to conserve the unique fish biodiversity of EKW comprising 52 endemic species of fishes of which nearly 23% are reportedly vanishing fast, was achieved in 18 months. It is based on a community-ecosystem approach of participation and partnership for betterment of livelihood and ecological conservation for rural development. The project show commercial cultivation and germplasm conservation of few indigenous fishes of East Kolkata wetlands that are in the verge of getting ecologically threatened. Initially few self recruiting species were tried out like Puntius sophore, Cirrhinus multimaculatus, Labeo bata, Mystus gulio, Colisa fasciatus, Odontomblyopus rubicundus, and Labeo calbasu that survived the transmigration to waste waters. The native fishes were collected in oxygen packing from rural Bengal and stocked in harvested rainwater and further naturally acclimatized them in sewerage fed wetlands so as to develop the germplasm bank.

The importance of mixed canopies for understory diversity conservation

The southern portions of the boreal forest region across Eurasia and Canada are dominated by mixedwood forests including a mixture of canopy patch types dominated by varying mixtures of coniferous and broadleaf trees. Understory communities hold most of the boreal vegetation diversity in these forests making their assessment important for the conservation of boreal plant diversity. We assessed the composition patterns and the hierarchical organization of understory diversity in mature boreal mixedwood forests of western Canada in relation to canopy patch types (conifer, broadleaf, mixed, gaps). Understory diversity (richness & Shannon’ H’) was additively partitioned in relation to the four canopy patches across a hierarchy of four scales; 1-individual patch + 2-within canopy patch type + 3-among canopy patch type + 4-landscape. Understory composition patterns among patch types resembled a microcosm of the boreal mixedwood landscape as these mirrored patterns observed at the landscape scale among forest stands of differing canopy dominance. Our results suggest that the high understory diversity found in mixedwood stands is partly explained by fine scale variation among the four canopy patch types. Management practices that focus on maintaining an intermix of small patches of varying canopy composition will help to retain the natural hierarchies of vegetation patches. This, in turn, will help to conserve the natural patterns of vegetation composition and diversity of boreal mixedwood forests.

The Conformity of Wildlife Refuge of Kiamaki In Iran With IUCN Categorization System

Iran is a country with an extensive territory of rare and diverse nature. The Environmental Conservation Organization of Iran has managed to control and safeguard the diversity of its own ecosystems as well as the heredity of its botanical and animal resources by protecting samples of the richest natural regions in a system comprised of national parks, natural monuments, wildlife refuges and protected areas. The categories of Iranian national park and natural monument conform to categories II and III of the IUCN international categorization system respectively and Iranian protected areas conform to IUCN categories IV and VI. Indeed, the true status of the wildlife refuge in Iran may conform to IUCN category VI (Natural monument) rather than category IV when compared with the IUCN category system. We selected the wildlife refuge of Kiamaki as a case study. As soon as the ecological and socio-economic resources which led to the provision of the resources base map (scale: 1:50000) were identified the mapping and zoning processes founded on an analytical system resulted in the understanding of the environmental unit. At the final stage, the zoning model was ascertained. Accordingly, the wildlife refuge of Kiamaki matches the IUCN category IV very well because it contains the protected zone, recovery zone, buffer zone, extensive use zone, special utility and the zone of the other uses. For better management of this region, we suggest managing Kiamaki within the guidelines of the IUCN category IV. Key words: Protected Areas, Zoning, wildlife refuge of Kiamaki, IUCN and Systematic Analysis.
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Applying Integrative Problem Solving to Critical Habitat Policy

Integrative problem solving (policy sciences) is a proven method to advance the goals of conservation science, policy, and law through identifying key insights across different substantive disciplines. Policy Sciences has a long running track-record of successfully improving conservation policies in a wide range of conservation biology case studies, ranging from endangered species recovery in the Canada and the United States to national park management in developing countries. The methodology focuses on improving decision making through securing a process where empirical knowledge is integrated with disparate human values in pursuit of common interests. The author analyzes the Critical Habitat Symposium’s case material using the policy sciences to identify broad policy lessons for improving the implementation of future critical habitat policy in Canada and the United States. Key insights include developing more contextual problem definitions, meaningful arenas for stakeholder involvement, and clarifying stronger signals of authority and control.

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Conservation corridors for carnivores: integrating pattern and process in the Canadian Rocky Mountains

Corridor designs are typically based on patterns of structural connectedness, neglecting processes of resource selection and movement. We examined three questions fundamental to corridor planning for large carnivores in Canmore and Crowsnest using GPS data from grizzly bears and cougars: (1) where are large carnivores more likely to occur?; (2) what landscape features promote their movements?; and, (3) how do large carnivores move on the landscape? Resource selection functions (RSF) suggested grizzly bears were more likely to occur in areas with high greenness values, a variable associated with bear forage. Cougars were more likely to occur in areas with low road density in Canmore during non-winter and in rugged terrain in Crowsnest throughout the year. Step selection function (SSF) models suggested cougars selected habitat closer to paved roads and forest cover for movement and avoided crossing paved roads during non-winter season. Grizzly bears selected habitats closer to paved roads and shrubs when moving during berry season. Finally, grizzly bears and cougars moved faster near paved roads during the berry and winter seasons, respectively. Conversely, cougars in Canmore and grizzly bears in both landscapes moved slower near forest and shrubs during the winter and berry seasons, respectively. Taken together, our results show how diverse, empirically-based modelling approaches can support corridor identification and design.

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Climate change and adaptive landscape conservation in the Yellowstone to Yukon region

In the 1990s, a group of conservationists and conservation biologists identified the Yellowstone to Yukon (Y2Y) region as one of the North American continent’s best opportunities to conserve large predators and to maintain natural processes at an ecoregional scale. A key argument for working at the scale of Y2Y was the need for genetic connectivity, and consequently the conceptual and practical locus of conservation action was targeted on direct threats to connectivity—most importantly habitat loss and fragmentation, but also hunting of endangered species and invasive species. Although climate change was also an acknowledged threat, it was largely perceived as looming on the horizon. Yet in the course of little more than a decade, a number of indicators have brought climate change to the fore, including increasing average temperatures, declining snow packs, the receding of mountain glaciers, earlier spring thaws, and decreased stream flows. Climate change has in turn brought renewed emphasis on connectivity—but now with a focus on species’ capacity to respond to changing environmental conditions by moving across latitudinal, altitudinal, and other gradients. On the assumption that climate change will bring landscape change in an unpredictable manner, conservationists working under the Y2Y ecoregion are promoting adaptive conservation strategies, while at the same time reinvigorating efforts to protect lands of high connectivity value through traditional conservation approaches.

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Global Habitat Suitability Models for Mammal Conservation

Despite mammals being one of the best studied taxa, detailed information on their distributions has often been lacking, thereby hindering efforts for their conservation. We used the information from the 2009 IUCN Red List of Threatened Species, collected through a network of thousands of specialists belonging to more than 30 Specialist Groups, as a baseline for developing habitat suitability models for 5415 out of 5488 known mammal species, based on their habitat relationships. We focused on the following environmental variables: land cover, human impact, elevation, and hydrological features. Models were developed at 300 m resolution and limited to within species’ known geographic ranges, to avoid predicting species presence beyond their distribution limits. The models were validated comparing the average suitability score in areas of known occurrence of the species with the average score of sets of random points within the species geographic range. This authoritative, updated and fine-resolution data set can provide a substantial support for the development of mammal conservation strategies.

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Climate change and adaptive landscape conservation in the Yellowstone to Yukon region

In the 1990s, a group of conservationists and conservation biologists identified the Yellowstone to Yukon (Y2Y) region as one of the North American continent’s best opportunities to conserve large predators and to maintain natural processes at an ecoregional scale. A key argument for working at the scale of Y2Y was the need for genetic connectivity, and consequently the conceptual and practical locus of conservation action was targeted on direct threats to connectivity—most importantly habitat loss and fragmentation, but also hunting of endangered species and invasive species. Although climate change was also an acknowledged threat, it was largely perceived as looming on the horizon. Yet in the course of little more than a decade, a number of indicators have brought climate change to the fore, including increasing average temperatures, declining snow packs, the receding of mountain glaciers, earlier spring thaws, and decreased stream flows. Climate change has in turn brought renewed emphasis on connectivity—but now with a focus on species’ capacity to respond to changing environmental conditions by moving across latitudinal, altitudinal, and other gradients. On the assumption that climate change will bring landscape change in an unpredictable manner, conservationists working under the Y2Y ecoregion are promoting adaptive conservation strategies, while at the same time reinvigorating efforts to protect lands of high connectivity value through traditional conservation approaches.
Carbon sequestration by afforestation can help mitigate global climate change but may have adverse environmental impacts in some regions. For example, economic incentives for carbon sequestration may encourage the expansion of Pinus radiata timber plantations in the Fynbos biome of South Africa, with negative consequences for water supply and biodiversity. I built a dynamic ecological-economic model to investigate whether afforestation of a Fynbos catchment with Pinus radiata is economically viable when the potential benefits of carbon sequestration and timber production are balanced against the potential losses to water supply and tourism. I found that afforestation of the study catchment is currently economically unviable from the perspective of society. However, afforestation appears attractive to the forestry industry because the industry does not pay the true cost of water used by plantations. I also considered various plausible future scenarios and found that, under different scenarios, afforestation can be associated with either large future economic gains or losses. These results motivate two recommendations. Firstly, streamflow reduction fees currently levied on the South African forestry industry could be raised to improve. Should be based on the precautionary principle: afforestation for carbon sequestration should not occur where there is a reasonable chance that it will lead to serious, irreversible environmental damage.

Coastal vibrosis has increased significantly as noted in the recent epidemics affecting crustaceans along the Pacific Northwest and humans, as cholera, along the South American coast. Initial investigations suggest Vibrio bacteria increased due to rising water temperatures and decreasing salinity, conditions associated with a changing coastal climate. However, Vibrio bacteria have no known reservoir to explain the effects of these environmental conditions-a major gap in our understanding of how this pathogenic family shapes our coasts. Reservoir hypotheses for Vibrio center on chitinous crustaceans as virulence genes encode chitin attachment proteins. To elucidate this Vibrio-chitin connection, we examined the physiological correlation between Artemia salina, a common crustacean found along coasts, and Vibrio specifically investigating the growth of Artemia and Vibrio populations in the water column. We found there was a significant positive correlation between growth in Artemia, as measured by hatching efficiency of Artemia cysts and survival efficiency of newly-hatched nauplii, and Vibrio concentrations in the water column, under conditions mimicking the rising water temperatures associated with the South American cholera outbreaks. These results suggest warmer water temperatures may increase the chitinous crustacean and Vibrio populations, potentiating vibrosis outbreaks along our coasts and complicating conservation efforts to restore marine ecosystems.
Conservation regimes affect forest structure in the Białowieża Primeval Forest, Poland in the 19th-20th centuries

The Białowieża Primeval Forest (BPF) (Poland) is one of the few remnants of pristine European temperate lowland forests, with over a 500-year long conservation history. Historical evidence indicates shifts in the protection regimes which may have caused changes in disturbance, potentially shaping the forest structure. We address the question: How did species composition and size structure of tree populations change in the BPF in relation to shifting conservation regimes? Tree diameters in size classes were collected from forest inventories between years 1889 and 2002 covering the BPF area. Using size distributions we analyzed demographic patterns of 10 dominant tree species (pine, spruce, hornbeam, linden, maple, black alder, poplar, elm, oak, birch) in the main forest types. The changes occurred throughout the area irrespective of forest type. At present, pine and spruce have been restricted to one forest type, whereas hornbeam has expanded in all forest types. The observed changes in tree species composition coincided with shifts in conservation regimes. Despite the indirect role humans played during the last 200 years in shaping the BPF structure, the tree species richness has been constant during the study period suggesting that diverse systems are more resilient and may adapt to changes in the environment.

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Towards an ecosystem-based wetland compensation policy for Alberta

The premise of compensatory off-set wetland policies is that habitat loss can be mitigated through the creation, restoration, or protection of habitat that is equivalent to that which was lost. Many jurisdictions in North America use compensatory off-set policies as a means for managing wetland losses; however, the primary challenge of successfully implementing these policies is the selection of appropriate compensation sites. Despite a no net loss policy paradigm and a general consensus that replacement of wetland value and function should guide compensation policies, there is limited understanding of how to identify, combine, compare, value, and aggregate the ecological, social, and economic values and functions of wetlands across different spatial and temporal scales. Using data from a series of semi-structured interviews and written surveys with key policy actors in the United States and Canada, the implementation of wetland off-set programs in various jurisdictions is compared to identify which wetland characteristics and/or values are most commonly used by regulators to select compensation sites. Further, the practical and administrative challenges of achieving wetland site equivalency are identified. Preliminary results indicate that the majority of jurisdictions use wetland area and/or wetland type as the primary criteria for evaluating site equivalency, and that land availability is a primary driver in the selection of compensation sites. These results suggest that wetland compensation is currently being considered in very narrow terms, which may result in significant loss of wetland values and functions at various scales, despite existing policy efforts to mitigate these losses.

3-7 July 2010, Edmonton, Alberta 42
Many migratory bird species are in serious decline. Understanding how birds assess and use increasingly large, brightly lit, and noisy cities as they travel through urban landscapes and encounter tall buildings, towers, and aircraft is essential to their conservation. However, little is known about how birds evaluate obstacles presented by cities during migration, which generally occurs at night and is confounded by ubiquitous light pollution. We test a novel approach to tracking birds migrating through an urban-rural corridor and quantifying the effects of light and noise pollution on such migration. We recorded nocturnal flight calls at multiple sites along an urban-rural corridor from New York City north and simultaneously collected data on measures of light and noise. Some studies suggest birds are drawn to brightly lit areas and that bird density is artificially increased in cities. Consistent with these studies, we documented more nocturnal flight calls in brighter, noisier locations than in nearby darker, quieter green spaces. These higher calling rates may also reflect increased confusion of birds in noisy urban environments.

Ecosystem change under cumulative stress and disturbance: Vulnerability of whitebark pine ecosystems in NW British Columbia

The response of forest communities to multiple disturbances may indicate the resilience of a system to change. Whitebark pine (Pinus albicaulis) is currently listed as a threatened species due to its exposure to ongoing stresses and disturbances. We examined P. albicaulis ecosystems at the northern edge of its range in the Coastal mountains of British Columbia, Canada. Study sites surveyed in the 1970/80's were re-visited in 2007/09 to quantify changes in overstory and understory vegetation over this time period. Trends in two P. albicaulis ecosystem types (à Moderately dry/poor' and à Dry/poor') were compared to a reference (à Fresh/medium') non-whitebark pine ecosystem. Results indicate a shift in the overstory of à Dry/poor' whitebark pine ecosystems towards a composition more similar to à Fresh/medium' ecosystems over time, while the understory did not change. The overstory in à Moderately dry/poor' ecosystems had not changed significantly, but understory composition became more variable over time. P. albicaulis continues to regenerate in both whitebark pine ecosystems, however it constitutes a significantly higher proportion of regeneration in à Dry/poor' ecosystems. The persistence of disturbance agents and stressors targeting P. albicaulis will further decrease its' abundance in the future and continue to threaten these rare ecosystems. Our conclusions indicate that restoration efforts for P. albicaulis in this study area should be focused in à Dry/poor' ecosystems.
Postfire salvage logging, saproxylic beetles and soil nutrient dynamics in boreal mixedwood forests

In North America, pressure to recoup economic costs of wildfire by salvaging burned timber is increasing, despite insufficient understanding of the ecological consequences of this practice. We examined saproxylic beetle assemblages in recently burned, logged and salvaged boreal mixedwood sites in north-central Alberta, Canada. Species richness was lowest in salvage logged sites and species composition was altered more by salvaging than by either wildfire or harvesting alone. Wood-boring beetles, like the white-spotted sawyer (Cerambycidae: Monochamus scutellatus), were among those species most heavily impacted by salvaging suggesting that this group might be of greatest conservation concern. In addition, results from both field and laboratory experiments indicated a strong link between the white-spotted sawyer and soil nutrient dynamics in burned sites. Taken together, these findings indicate that the combined effects of wildfire and harvesting on the same sites may be synergistic for saproxylic beetles and that these effects may have serious ecological consequences in forests recovering from wildfire.

When is an invasive not an invasive? Macrofossil evidence of doubtful native plants species in the Galápagos Islands

The Galápagos Islands are globally renowned for their ecological value and as a world symbol of scientific discovery; however this unique region currently has numerous ecological threats towards its native species. One of the threats is the detrimental impact of approximate 550 non-native plants introduced over that last 500 years of human presence in the archipelago. In addition to these species with known arrival method, there are 62 vascular plants that have been classified as ‘doubtful natives’, where native status remains unclear. To help address the questions of origins regarding these doubtful-natives and their impact on highland ecosystems over the past 500-1000 years, we analyzed plant macrofossils in sedimentary records. Appropriate species’ classification (native or introduced) was determined using baseline data of species presence on the islands. We determined six plants (Ageratum conyzoides, Solanum americanum, Rambunculus flagelliformis, Brickellia diffusa, Galium canescens, Anthephora hermaphrodita) once considered doubtful-natives or introduced are actually native to the Galápagos flora. The use of long-term historical baseline data can be directly applied to conserving and restoring the native biodiversity in Galápagos.

Natural history data for species distribution modelling: regional effects of georeferencing error on model success

Natural history data can be an important data source for species distribution modelling (SDM). However, with older records, this data often lacks precise location information. With the extensive number of natural history records available for the flora of Switzerland, it is essential to determine their value for SDM. If a certain level of error in a biogeographical region can be identified as having insignificant effects on model performance, then the appropriate records can be included. To investigate their effects on model success, four levels of error (50m, 100m, 200m, 500m) were artificially added to existing, precisely located, systematic presence-absence data in Switzerland’s Alps and Plateau regions. Species group (bryophyte; lichen; fungi; herb; woody) and modelling technique (boosted regression tree; generalized linear model; maximum entropy) were included as additional factors. All levels of error had negative impacts on model success in both regions, however overall success was higher in the Alps. Among the additional factors, models of woody species and models generated with boosted regression trees were most successful. Our results show that imprecise natural history records may be included into species distribution models with minimal negative effects on performance. We also show that biogeographical regions should be taken into account when modelling over diverse landscapes. Future SDM endeavors should carefully consider these factors for more effective models.

The rapid decline of a previously common native pollinator in North America

Pollinator declines have recently become a significant conservation issue globally. The potential cascading effects of these declines in agriculture and native ecosystem sustainability has brought much attention from the public, policy makers and the media. However, in North America our baseline data on native pollinator populations has thus far been lacking. Here, I will summarize what is known on the decline of Bombus affinis (The rusty-patched bumble bee) using museum records, recent surveys and GIS analyses. This species was previously one of the most common bees throughout eastern North America and is currently up for listing by COSEWIC due to a dramatic decline over the past 20 years. The decline of this species is likely due to multiple stressors including pathogen spillover, habitat loss and climate change. In particular, this species may be more vulnerable to threats compared to other bees because of its narrow climatic niche. Recommendations for the conservation of this and other native bee species based on these findings will be discussed.
Assessing the Impact of Fire Frequency, Severity and Topography on Hollow Occurrence in Trees and Coarse Woody Debris

Urbanisation has drastically altered the ecology of temperate eucalypt forests of eastern Australia. Anthropogenic pressures stemming from urban areas have resulted in an increase in sources of planned and unplanned fire, leading to increased fire occurrence. Frequent fire has the potential to alter biotic and abiotic components of ecosystems, although impacts may vary spatially due to underlying topographic influence on fire severity. This study examined the effect that fire frequency, severity and topography have on the presence and abundance of hollows in fallen coarse woody debris (CWD) and standing trees, an important resource for many species of fauna. A total of 684 logs and 585 trees were randomly selected across 30 sites, stratified by fire frequency and topographic position (gully, ridge). Fire frequency was categorised as ≤2 (low) or ≥4 (high) fires over a 26 year period. Generalised linear mixed models were used to analyse data. Results indicate that hollow occurrence in CWD was greater in the low fire frequency treatment. Fire frequency had no effect on hollow occurrence in trees, while increasing fire severity had a negative effect. The impact of fire frequency did not vary with topographic position. Models indicate that size and condition of CWD and trees were more influential drivers of hollow occurrence than fire. Expected changes to fire regimes may lead to a decline in hollow availability, potentially having adverse effects on biodiversity.

Assessing Private Landowner and Land Manager Knowledge of and Attitudes Toward Invasive Species in Adirondack Forests

Due to the high number of non-native invasive species in New York State, the Adirondack Park faces new challenges to managing forestland for biodiversity. Although much attention has been given to the management of non-native invasive species on public lands across the U.S., little recognition has been given to the importance of incorporating private landowners in management schemes. To be successful, regional invasive species management plans must incorporate the values of all stakeholders, particularly in mixed public-private areas such as the Adirondack Park. Since little is known about the attitudes of landowners and land managers towards non-native species, a survey was developed and implemented to assess knowledge of and attitudes towards invasive species of both private landowners and land managers in the Adirondack Park. The results of this study will enhance regional invasive species management plans by reflecting the views and values of stakeholders and will provide a survey template that can be applied to other mixed-ownership forested regions.

Payments for Ecosystem Services in Central Africa: Experience from a watershed in Gabon

The concept of payments for ecosystem services (PES) is still very novel in Central Africa and there are very few examples of operational schemes across Africa. In Gabon, WCS is working with Government partners on a new PES initiative aiming to establish a sustainable financing mechanism to ensure long-term protection of the high conservation value and economically important Mbâô watershed. The purpose of this presentation is to document different steps taken in designing a PES project for the Mbâô watershed that will remunerate the upstream land managers for maintaining their land-use practices, thus securing the continued provision of a year round supply of high quality water to the downstream users. Some of the early challenges that have been faced are the lack of technical capacity for PES in Gabon, the lack of existing data available and the institutional complexity. We employed a stakeholder-driven participatory process to design a project that aims at removing some of these barriers and challenges. Key focus areas of the project include: working to strengthen the enabling environment and capacity building.

Conservation Outcomes: A Social Analysis of Landowner Participation in the Adirondack Park

To address the global decline of biodiversity, public land conservation reserves must be supplemented with conservation measures that target private land. A primary mechanism for conserving biodiversity on private land is the use of designated programs to facilitate the protection and enhancement of habitat by private landholders. Many different programs exist, utilising a spectrum of legally binding, non-binding and market-based policy instruments. In the design and implementation of private land conservation programs, the role of conservation agencies as policy-makers, and landholders as program adopters, is clearly delineated. This disconnect can lead to inaccurate assumptions about the social context into which conservation programs are delivered, producing policy which is not cognisant of the influences on landholder decision-making for program adoption. This review will demonstrate that the motivations of landholders for positive conservation practices can be influenced by factors like; perceived legitimacy of policy interventions and policy development processes, intrinsic conservation motives, trust in prominent local identities and government agencies, and the perceived equity of public good conservation works on private land. Private land conservation occurs in an unavoidably social context, recognising the potential influence of this context on decision-making and conservation outcomes can be critical for successful policy design.
Is structural retention in aggregated harvests an effective long-term, regional strategy for conserving old boreal forest cavity users?

In landscapes managed for forestry in the boreal plains, targets for old forest conservation are achieved through protected areas, reductions in harvest volume and extended rotation periods. Structural retention is an important strategy for conserving old forest species within harvested landscapes in the short term however it may also contribute to a regional conservation strategy. Cavity-using vertebrates associated with old upland forest are conserved in large (>1000 ha), spatially-aggregated harvests when 20% of the mature and old forest is retained in patches. However, the value of this strategy over the long-term and at a regional scale is unknown. For a 278,000-ha landscape in northeast Alberta, we simulated 150 years of forest succession and harvest for four aggregated harvest scenarios that varied in retention level (0-20%). The greatest area of old forest was conserved in the 20% retention scenario however significant amounts of old forest were lost in all scenarios. As well, greater conservation of old forest was associated with increased harvest of mature stands and greater fragmentation of old forest patches. No retention strategy consistently conserved more habitat for Yellow-bellied Sapsuckers, Black-capped Chickadees or Northern Flying Squirrels compared with aggregated alone. More Pileated Woodpecker habitat was lost from the 20% scenario because suitable forest patches were too small to accommodate their home range. For all focal species, losses of habitat in all scenarios ranged between 30 and 90%. While structural retention is critical for retaining old forest species in regenerating stands in the short term, additional long-term strategies are needed for conserving old forest species regionally.

Effects of Hunting on Cougar Population Demography

Many wildlife species are managed based on the compensatory mortality hypothesis, which predicts that harvest mortality (especially adult male mortality) will trigger density-dependent responses in reproduction, survival, and population growth caused via reduced competition for resources. We tested the compensatory mortality hypothesis on two cougar (Puma concolor) populations in Washington, USA (one heavily hunted and one lightly hunted). We estimated population growth, density, survival, and reproduction to determine the effects of hunting on cougar population demography based on data collected from 2002 to 2007. We found no differences in rates of maternity or natural mortality between study areas, and kitten survival was lower in the heavily hunted population. We rejected the compensatory mortality hypothesis because vital rates did not compensate for hunting mortality. Heavy harvest corresponded with increased immigration, reduced kitten survival, reduced female population growth, and a younger overall age structure. Light harvest corresponded with increased emigration, higher kitten survival, increased female population growth, and an older overall age structure. Managers should not assume the existence of compensatory mortality when developing harvest prescriptions for cougars.

Forest Conflicts’ Influence on Local People’s Livelihoods: A Case of Conflicts between Timber Companies and Farmers in the Mankranso District of Ghana.

Off-reserves in Ghana provide an important source of timber resources for the wood industries and also livelihood support to forest fringe communities. However, over the past decades, there is overwhelming evidence of a decline in the maximum utilisation of forest off-reserves due to several factors. The management of off-reserves is faced with contested roles of the formal and informal institutions, both claiming access to timber and non-timber forest products (NTFPs), land and benefit-sharing rights. The institutional changes in the off-reserve areas have contributed to forest livelihood conflicts with nagging effects and deforestation through chainsaw operations and farmers’ willingness to destroy trees in the off-reserve communities. This thesis describes both the formal and informal institutions in the context of the study area and how they impact forest conflicts dealing with crop-damage compensation, access rights, benefit-sharing and land tenure disputes. The Sustainable Livelihood Framework by DFID in 1999 is used to measure the influence of forest conflicts between timber companies and farmers and the impact of these conflicts on the livelihoods of the farmers in the off-reserve area of the Mankranso District. The findings from the research show that forest conflicts have impact on social capital, natural capital and financial capital of the farmers and is concluded with a policy reform recommendation to secure farmers’ access, tenure and benefit rights for a sustainable collaborative forestry management for the off-reserve areas of Ghana.
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The Recovery of Forest Floor Invertebrate Communities and Ecological Processes Following Livestock Exclusion from Rural New Zealand Forest Fragments.

In New Zealand much of the remaining native forest exists as small, privately-owned fragments embedded in agricultural landscapes. In many regions, such as the central Waikato where

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Does Protection Increase the Resilience of Marine Habitats to Climate Change? Insights for Canadian MPAs

Resilience - the capacity of an ecosystem to absorb disturbance without shifting to an alternative state and losing function and services - has become a central concept in the management of natural ecosystems. Many current management actions aim to alleviate local stressors in an effort to increase ecosystem resilience to global climate change. Such a management philosophy is premised on the belief that eliminating local drivers of ecological change will increase the ability of an ecosystem to resist future climate disturbances, its ability to recover from such disturbances, or both. Marine reserves or no-take areas, the most popular form of spatial management for marine habitats, are widely thought to have the potential to increase marine ecosystem resilience, but do they really? In this talk, I review briefly the potential impacts of climate change on various marine habitats. I then summarise evidence for the idea that local protection can alleviate the impact of climate change on marine ecosystems. Because the majority of the evidence stems from studies of tropical habitats - coral reefs in particular - I discuss the relevance of the findings for more northern latitudes.

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Optimizing Bird Conservation and Function on Sustainable Farms Using a Yardstick of Temperature Response Across Trophic Levels

A major global issue is producing food and fiber for growing human needs while conserving ecosystem components including birds and other species that contribute important ecosystem services such as pest suppression, pollination, and value to bird watching. Decision tools are needed to facilitate mutual benefits between farming and birds, especially during critical life cycle stages. ‘Growing degree-days (GDD)’ is a concept familiar to farmers and based on the principle that accumulated heat units can more accurately predict the onset of insect and plant development stages, independent of calendar date. Given the importance of insects and plants as food sources for birds, we correlated historical GDD data to historical arrival and nesting dates of birds in selected areas across the United States. Preliminary results indicate that GDD can be used to track climate change over time and predict annual events in some birds. Given climate change projections, an uncoupling between birds and their food resources (insects to feed young) may be occurring that could hinder important pest suppression functions of birds in agroecosystems. As such, GDD may serve as a yardstick to assess responses to temperature change across predator-prey (biological control) food webs.

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Protected area performance for African mammals is primarily related to defensibility from humans therefore bigger is not always better

Protected areas are the cornerstone of global conservation efforts and yet their performance in maintaining populations of their key species remains poorly understood. We address this gap using a new database of 595 population time series for 74 species of large mammals in 82 protected areas. The direction and gradient of population change was calculated for each population time series. Then these gradients were modelled using linear mixed effect models. The explanatory variables for the modelling included information on the protected areas, the species life history traits, the human populations around the park and the country. The results of the modelling show that the protected areas that best maintained their mammal populations were the smallest ones with the least humans locally, and that the largest species has the most positive population gradients. These findings contradict conventional wisdom on protected area performance but can be explained. When human hunting is the chief threat present the larger protected areas are disadvantaged by being harder to patrol and defend from poachers. Likewise, it is easier for hunters to target smaller bodied species where the chance of detection of poaching events by the authorities is lower. These results imply that protected area size needs to match the resources available for protection when the threat is human hunting, bigger is not always better.
P2.5 Crawford, L.; Desjardins, S; Keyghobadi, N*; University of Western Ontario; kcransfo6@uwo.ca
Genetic structure analysis of an endangered population of the Mormon metalmark butterfly (Apodemia mormo) using amplified fragment length polymorphisms (AFLPs)
The British Columbian (BC) population of the Mormon metalmark butterfly, Apodemia mormo (Felder, 1859) is considered at-risk, yet its protection to date has been hindered by a general lack of knowledge surrounding the butterfly's basic habitat requirements, dispersal capabilities and population structure. In this study we investigated the genetic structure and diversity of the BC population of the Mormon metalmark using amplified fragment length polymorphisms (AFLPs) generated from non-destructive samples of butterfly wing tissue. We found that the majority of the total genetic variance was partitioned within sub-populations, however sites which were geographically isolated (>4km from their nearest neighbour) demonstrated significant genetic differentiation. These results suggest that distances greater than four kilometres are beyond the dispersal capabilities of this species. Overall, the population demonstrated a significant pattern of isolation-by-distance, indicating that dispersal occurs primarily between nearest-neighbouring sub-populations. This information will contribute to efforts to predict future population trends and develop a recovery strategy for this species. As well, the successful development of AFLPs from wing tissue and the use of the technique to assess genetic structure in an endangered butterfly population have validated the method as a valuable tool for conservation research.

SP5.9 Cristescu, Bogdan*; Boyce, Mark S.; University of Alberta; cristescu@ualberta.ca
Five Focal Topics In 21st-Century Ecology And Their Relevance To Conservation Science
Conservation challenges faced by the world are unprecedented, complex and multifaceted. The array of challenges makes it daunting to prioritize key issues to be addressed in ecology and conservation research. Building on a literature review on recent advancements in ecology and conservation, as well as on one hundred recently published questions of importance to biodiversity conservation, we propose 5 topics for 21st century ecology that have major conservation implications. The topics address ecological concepts and processes from individual to ecosystem level that dictate global patterns of species distribution and abundance. Movement of organisms is a key topic because movement integrates ecological processes across landscapes and scales. Individual variation is another priority topic, reinforced by recent evidence on animal personality, with particular application in the conservation of rare species. From an ecosystem perspective, two topics with profound conservation implications relate to understanding trophic dynamics, and invasiveness as an ecological attribute. In today's changing climate, better information on ecosystem carbon dynamics is central to developing strategies to create links between carbon sequestration and conservation. To address these issues will require cross-disciplinary ecological research under the overarching guidance of conservation ecology.

SY13 Crooks, KR*; Theobald, DM; Rondinini, C; Boitani, L; Colorado State University, Sapienza Universit of Roma , Sapienza Universit of Roma ; kcrooks@cnr.colostate.edu
Global mammal connectivity: opportunities and threats
According to the 2009 IUCN Red List of Threatened Species, 25% of the world's mammals are threatened with extinction, and habitat loss and degradation are the primary threats globally. As habitat is lost, the remaining patches often become progressively smaller and more isolated through the process of habitat fragmentation, further threatening mammal populations. We used existing high-resolution distribution and habitat suitability models of the world's mammals to explore the connectivity of natural habitat for a select set of focal species. We applied a novel multi-scale, integrated landscape metric to measure the pattern of natural areas - or conversely degree of human modification - within species ranges. The natural landscapes metric provides a relatively simple, robust measure of land cover modification associated with human activities. We then measured the connectivity of the remaining suitable habitat for each of the selected species. Our approach can help inform how landscape context affects the degree to which configuration of habitat and declining connectivity threatens the world's mammals, and helps to identify opportunities to mitigate such threats.

P2.71 Crooks, KR*; Bevins, SN; Tracey, JA; VandeWoude, S; Colorado State University; kcrooks@cnr.colostate.edu
The effects of urban fragmentation and landscape connectivity on disease prevalence and transmission in North American felids
The objective of this collaborative study is to investigate the effects of urbanization and landscape connectivity on disease dynamics in North American felids, including bobcats, puma, and domestic cats in California, Colorado, and Florida. Bobcats and pumas are sympatric in these regions, which are susceptible to many of the same diseases, and at risk of infection with domestic cat pathogens. To date, we have collected samples from over 1000 wild and domestic felids, and have identified variation in seroprevalence that maps to region and species. We have recorded unexpectedly high levels of exposure to plague in pumas and bobcats, particularly in plague-endemic regions in Colorado, suggesting that serosurveys of wild felids could be early indicators of regional plague activity. We have also developed an agent-based computer simulation model, motivated by bobcats in southern California, which suggests that movement behavior is a major factor in the spread of disease and the effects of movement can be counter-intuitive. Ongoing studies include using Feline Immunodeficiency Virus (FIV) as a genetic marker for detecting genetic structure in urban landscapes, and GPS telemetry and remote camera surveys of felids to assess the impacts of urbanization on movement patterns and contact rates. These efforts will allow us to gain a better understanding of how urban fragmentation and landscape connectivity impact disease transmission in felids.
The influence of a “keystone” species over an ecosystem may be modulated by human effect of human disturbance on sable antelope densities modulated by the avoidance of responded negatively to increasing human disturbance. This result suggested an indirect disturbance did not directly influence sable antelope densities, but elephant densities with surface-water availability, but declined with increasing elephant densities. Human water-surface availability and vegetation. Sable antelope densities were positively correlated in sub-Saharan Africa, especially around protected areas. In the last two decades, elephant (Loxodonta africana) densities concomitantly with environmental covariables such as surface-water availability and vegetation. Sable antelope densities were positively correlated with increasing human disturbance. This result suggested an indirect effect of human disturbance on sable antelope densities modulated by the avoidance of human-disturbed areas by elephants. Our study provides an example on how the strong influence of a “keystone” species over an ecosystem may be modulated by human disturbance.

### Integrated priority areas for fuel treatments in the western United States

A century of fire suppression has resulted in build-ups of dense vegetation (i.e., fuel) on millions of acres of forestland in the western United States. Many of these forests may benefit from fuel reduction treatments such as mechanical thinning or prescribed fire. Possible benefits of fuel reduction treatments include improving forest health and resiliency, restoring certain types of wildlife habitat, and reducing the risk of uncharacteristically intense wildfire. Fuel reduction treatments, however, are often undertaken with a piecemeal approach that fails to consider other forestland management objectives over broader landscape and temporal scales. Our objective is to compare different forestland management approaches and evaluate how each might influence future fuel conditions, key wildlife habitats, natural disturbance regimes, and economic potentials of forests and woodlands in Arizona, New Mexico, Oregon, and Washington. Our analysis builds on VDDT (the Vegetation Dynamics Development Tool), a modeling approach currently used in the study area. Results will be summarized to watersheds (5th code hydrologic units), ownership classes, land allocations, and biophysical environments. Results from regional studies using this methodology in northeast Oregon provide direction for changes in forestland management practices that may restore forest characteristics to those found under natural disturbance regimes.

### Modeling Nationwide Patterns of Avian Biodiversity: The Influence of Habitat Structure

Avian biodiversity is under great threat, primarily from human influences. With limited resources for habitat conservation, the accurate identification of high-value bird habitat is crucial. Existing biodiversity maps either cover small extents or employ coarse resolution. Our goal was to model nationwide patterns of avian biodiversity with high spatial resolution. One major factor known to influence avian biodiversity is habitat structure. We evaluated the performance of the 2001 National Land Cover Database and the National Biomass and Carbon Dataset 2000 as measures of habitat structure for the prediction of avian diversity. We calculated the proportion of different land cover classes and mean and standard deviation of estimated vegetation height for ~2,000 Breeding Bird Survey routes across the US. Both NLCD and NBCC were effective in explaining the variation in avian species richness. For forest birds and grassland birds, the mean of estimated canopy height alone yielded $R^2$ values of 0.31 and 0.34 respectively. Multivariate models of forest and grassland bird richness yielded $R^2$ values of 0.45 and 0.45 respectively. Measures derived from land cover classification and canopy height estimates are a useful method for characterizing habitat structure. Our models thus facilitate efficient fine-resolution mapping of avian diversity and the identification of biodiversity hotspots at scales that are relevant for land management.
A forest is not an elephant: Towards a holistic understanding of forests from multiple disciplines

What is gained and what is left out by using methods from different disciplinary traditions to characterize forests? Like the proverbial blind men describing the elephant, single-discipline approaches to understanding complex systems like forests can describe only a part of the whole. By using diverse methods, conservation practitioners and researchers hope to be able to get a more holistic understanding of forests. Unfortunately, the forest as seen through the lens of one discipline may be difficult to reconcile with that of another, causing confusion and conflict rather than a single, more powerful understanding. Global implementation of policies to reduce greenhouse gas emissions from deforestation and forest degradation (REDD) presents an opportunity to develop a multidisciplinary framework capable of embracing multiple perspectives. A reductionist understanding of forests solely as carbon storage and capture systems could be one consequence of REDD implementation. In order to meet international commitments to the protection of indigenous and local land rights and to biodiversity conservation, however, REDD implementation must draw upon diverse understandings of forests. This review considers which combinations of methods to characterize forests may be more or less effective for REDD project implementation and management.

Use of population viability analysis to set interim population and habitat recovery targets for data-poor species at risk

Delays in critical habitat designation jeopardize recovery and underscore the need for setting interim population and habitat recovery targets. Our goal was to identify rules of thumb on the amount and spatial configuration of habitat recommended for recovery of data-poor species. We summarize results from 45 models of spatially structured populations from species that vary taxonomically and in life history. We used Bayesian methods to estimate and characterize the uncertainty in the minimum number of populations, initial population size, and habitat carrying capacity required to achieve a range of recovery goals. We also estimated the optimal distance among habitat patches. Advice to managers would vary according to recovery goal, desired probability of success, and population trend (stable or declining). For example, the median amount of habitat predicted to maintain persistence probabilities of 0.9 over 100 years (IUCN Vulnerable listing threshold) would support ~8200 adults in 35 subpopulations exhibiting stable or positive growth, but ~29,000 adults for declining species. A more precautionary threshold of 0.95 over 100 years would support recommendations to protect sufficient habitat for at least 9600 adults. We found no correlation between habitat needs and 8 life history variables, but optimal habitat configuration was related to dispersal distance. For data-poor species, interim targets for habitat protection should enhance species’ recovery and reduce management uncertainty.

Political Developments Toward a Steady State Economy

As with many movements toward policy reform, the movement toward a steady state economy has an academic origin and phase. For the past several decades, the steady state economy has been hatched to the wagon of ecological economics, which at most universities must be pulled through a landscape of neoclassical economics and business schools. Some wagons have sunk in the mud, but more are getting to higher ground. Also, in recent years the steady state economy has been finding an academic “home away from home” in numerous natural resources departments and schools where the steady state economy is readily identified as a requirement for resource conservation and ecological integrity. Concurrently with these developments in academia, there have been nascent political efforts toward a steady state economy and even economic degrowth. As is common with new, complex challenges for public policy, steady-state politics are yet in the position-taking or coalition-building phase, which precedes electoral politics and policy reform. Such efforts have included the formal adoption of positions and resolutions on economic growth by professional societies and other organizations, formal support for such positions by prominent individuals, and formal endorsement of positions by non-governmental organizations and even some business firms. The resulting, loose-knit coalition has helped to empower a small number of political parties and candidates to develop steady-state political planks, and to defuse the fallacious “win-win” growth-conservation rhetoric of other politicians. On all fronts, the movement toward a steady state economy is growing and intensifying in the context of climate change, supply shocks, and financial crises.

Functional diversity of continental carnivore guilds: implications for conservation and management of our remaining large predators

The link between species richness and ecosystem function has emerged as a key question for conservation biology, and recent work highlights that the structure of species assemblages may be as important as their species richness. Large carnivores may be important ecosystem components but are extinction prone due to small populations, slow growth rates and large area requirements. Consequently, many assemblages of large carnivores have been depleted, and many populations have been reduced to population sizes too small for them to form functional units. We evaluated depletions in continental carnivore guilds since the late Pleistocene, and use these results in combination with a functional analysis of contemporary carnivore guilds to synthesize recommendations for carnivore conservation and restoration. Recent extinctions have lead to both taxonomic and functional depletions in North America, South America, and Australia. In Eurasia, the assemblage is fragmented and not locally intact. It is only in Africa that we find relatively intact assemblages of sympatric carnivores. We argue that global priority must be given to restore sympatric assemblages of Eurasian carnivores and to retain the sympatic but depleted assemblages in North and South America. We emphasize the need to evaluate the ecological effects of carnivore reintroductions and conservation programs, and that local efforts must prioritize species with little functional overlap with locally present species.
Many animal populations migrate to compensate for seasonal fluctuations in their resources. Two important questions related to migration are (1) how migration patterns emerge from small-scale movement decisions made in response to local environmental conditions and (2) how stable migration patterns and, by extension, migratory populations, are to increases in environmental variability due to climate change. We modeled the movements of migratory caribou (Rangifer tarandus) using basic consumer-resource equations which assumed that caribou moved toward nearby resources but had no knowledge of the landscape as a whole. Resource regrowth rates were linked with temperature, fluctuating seasonally and according to latitude. Without large-scale knowledge of the landscape the model still predicted cohesive migration patterns. However these patterns destabilized as environmental variability increased. In order to test these predictions in the field, we used the model to predict the isotope ratios for H and O in caribou hair as a function of their movement path. Comparing the isotopic signatures of historical hair samples with the predictions of migration models may allow us to learn about the long-term response and viability of migratory populations to climate change.

SY68 Darveau, M.; Ducks Unlimited Canada & Laval U.; m_darveau@ducks.ca
Quebec boreal case study: science, conservation and policy achievements
The boreal ecosystem of eastern North America is often considered a low priority for waterfowl conservation at a continental scale because of presumed rarity of wetlands, waterfowl, and threats to them. In 2003, Ducks Unlimited initiated a boreal conservation program in Quebec, where forested landscapes, taiga and tundra total 1 million km². Initial science efforts were devoted to wetland mapping, waterfowl-habitat studies and development of predictive models of waterfowl occupancy. Concurrently, we adapted existing conservation planning approaches to riparian areas (dual planning with terrestrial and aquatic components). Key results include: a quantification that wetland and deepwater habitats on average cover 25% of forested landscapes; evidence that streams and ponds are primary habitats for waterfowl in these landscapes; evidence that human settling is detrimental to some boreal species and beneficial to the invasive mallard; and indications that riparian management should be hydrosystem-based. These findings have influenced current regulations and policies in Quebec’s forests and have given us a foundation with which to engage in broader conservation planning efforts within the Quebec government initiated “Plan Nord”, which offers an unprecedented opportunity for conservation and sustainable development to proceed in concert to conserve half of northern Quebec (50% of 1.2 million km²).

SY55 Darwall, WRT*; Holland, RA; Smith, KS; IUCN, International Union for Conservation of Nature; william.darwall@iucn.org
Africa’s Important Sites for Freshwater Biodiversity
The boreal ecosystem of eastern North America is often considered a low priority for waterfowl conservation at a continental scale because of presumed rarity of wetlands, waterfowl, and threats to them. In 2003, Ducks Unlimited initiated a boreal conservation program in Quebec, where forested landscapes, taiga and tundra total 1 million km². Initial science efforts were devoted to wetland mapping, waterfowl-habitat studies and development of predictive models of waterfowl occupancy. Concurrently, we adapted existing conservation planning approaches to riparian areas (dual planning with terrestrial and aquatic components). Key results include: a quantification that wetland and deepwater habitats on average cover 25% of forested landscapes; evidence that streams and ponds are primary habitats for waterfowl in these landscapes; evidence that human settling is detrimental to some boreal species and beneficial to the invasive mallard; and indications that riparian management should be hydrosystem-based. These findings have influenced current regulations and policies in Quebec’s forests and have given us a foundation with which to engage in broader conservation planning efforts within the Quebec government initiated “Plan Nord”, which offers an unprecedented opportunity for conservation and sustainable development to proceed in concert to conserve half of northern Quebec (50% of 1.2 million km²).

23.J Dalziel, BD*; Ellner,SP; Cornell University; ben.dalziel@gmail.com
Estimating the historical migration patterns of woodland caribou using movement models and stable isotope data
Many animal populations migrate to compensate for seasonal fluctuations in their resources. Two important questions related to migration are (1) how migration patterns emerge from small-scale movement decisions made in response to local environmental conditions and (2) how stable migration patterns and, by extension, migratory populations, are to increases in environmental variability due to climate change. We modeled the movements of migratory caribou (Rangifer tarandus) using basic consumer-resource equations which assumed that caribou moved toward nearby resources but had no knowledge of the landscape as a whole. Resource regrowth rates were linked with temperature, fluctuating seasonally and according to latitude. Without large-scale knowledge of the landscape the model still predicted cohesive migration patterns. However these patterns destabilized as environmental variability increased. In order to test these predictions in the field, we used the model to predict the isotope ratios for H and O in caribou hair as a function of their movement path. Comparing the isotopic signatures of historical hair samples with the predictions of migration models may allow us to learn about the long-term response and viability of migratory populations to climate change.

SA1 Darling, Emily*; McClanahan, Tim; Cote, Isabelle; Simon Fraser University, Wildlife Conservation Society; edarling@sfu.ca
All stressed out? Cumulative impacts of fishing and coral bleaching on Kenyan reefs are additive or antagonistic, not synergistic
A challenge for conservation science is predicting the impacts of co-occurring human activities on ecological systems and the goods and services they provide. Multiple anthropogenic stressors impact ecosystems globally and are expected to jeopardize their ecological functions and the success of conservation and management initiatives. The possibility that two or more stressors interact synergistically is of particular concern, but such non-additive effects remain largely unidentified in nature. A long-term dataset of hard coral cover from Kenyan reefs was used to examine the independent and interactive effects of two stressors: fishing and a temperature anomaly in 1998 that caused mass coral bleaching and mortality. While both stressors decreased coral cover, fishing by 51% and bleaching by 74%, they did not interact synergistically. Instead, their combined effect was antagonistic or weakly additive. The observed non-synergistic response may be caused by the presence of one dominant stressor, bleaching, and co-tolerance of coral taxa to both bleaching and fishing stressors. The finding that the impacts of fishing and bleaching are not synergistic is hopeful news given future predictions for coral reefs. However, our results also suggest that marine reserves may not provide corals with a refuge from climate change.
SY31 Dau, Jim; Alaska Department of Fish and Game; jim.dau@alaska.gov  
Status and management of caribou in Alaska

About 28 barren-ground caribou (Rangifer tarandus granti) herds, ranging from several hundred to almost 500,000 animals, are currently recognized in Alaska. Of 9 large herds, 6 have declined since 1985, 1 intensively managed herd has been stable and 2 are increasing. Historically, most Alaskan herds have only received basic population monitoring which limits our understanding of proximate and ultimate causes of changes in abundance. Where conducted, studies have shown that range condition, predation and human harvests affect caribou numbers, and disease appears to impact environmentally stressed herds. Recently, warm summers and winter icing events may have negatively impacted some herds. Alaska is a patchwork of land ownership resulting in varied policies, management objectives and regulations related to resource use. This hinders implementation of consistent, comprehensive caribou management and resource development strategies at the scale of individual herds, and statewide. For hunters and associated businesses, it creates confusing caribou harvest regulations. State and federal agencies manage wildlife for multiple individual herds, and statewide. For hunters and associated businesses, it creates confusing caribou harvest regulations. State and federal agencies manage wildlife for multiple individual herds, and statewide. For hunters and associated businesses, it creates confusing caribou harvest regulations. State and federal agencies manage wildlife for multiple sustained uses; however, each regulatory system identifies subsistence as the priority use of caribou. Cooperative management groups comprised of diverse stakeholders are attempting to bridge administrative boundaries and facilitate management of some Alaskan caribou herds and associated ecosystems.

SY45 Davidson, Ana*; Hamilton, Marcus; Boyer, Alison; Brown, James; Ceballos, Gerardo; Universidad Nacional Autónoma de México, University of New Mexico, Yale; davidson@unam.edu  
Multiple Ecological Pathways to Extinction in Terrestrial and Marine Mammals

As human population and resource demands continue to grow, biodiversity conservation has never been more critical. About one-quarter of all mammals are in danger of extinction, and As human population and resource demands continue to grow, biodiversity conservation has never been more critical. About one-quarter of all mammals are in danger of extinction, and over half of all mammal populations are in decline. A major priority for conservation science is to understand the ecological traits that predict extinction risk, and the interactions among those predictors that make certain species more vulnerable than others. Using a new database of about 4,600 mammal species, we use decision tree models to quantify the multiple interacting factors associated with extinction risk. We show that the correlates of extinction risk vary widely across mammals, both terrestrial and marine, and that there are unique pathways to extinction for species with different lifestyles and combinations of traits. We find that risk is relative, and that all kinds of mammals, across all body sizes, can be at risk depending on their specific ecologies. Our finding that many small species are also at high risk is consistent with the growing recognition that risk in the current extinction crisis does not scale simply with body size. Our results increase understanding of extinction processes, generate simple rules of thumb that identify species at greatest risk, and highlight the potential of decision tree analyses to inform conservation efforts.

SP9.4 Davis PZR; Parent MS*; Bakary G; Anasse F; Poonian CNS; Community Centred Conservation (C3), C3 Madagascar and Indian Ocean Islands Programme, Centre National des Recherches Oceanographiques, Madagascar, INRAPE, Comoros; maryse@ic-3.org.uk  
Novel, Low-Cost Research Methods for Effective Dugong Conservation in Developing Countries

The dugong (Dugong dugon) is a wide-ranging species that can migrate over distances exceeding 600km. To date, costly methods such as aerial surveys or the use of tracking devices have been used to assess the status and distribution of dugong populations over large spatial scales. However, some of the world’s most endangered dugong populations are located in developing countries that often lack the technical and financial capacity to conduct such studies. We have field-tested and refined novel low-cost methods to rapidly assess the status and distribution of dugongs in northern Madagascar and the Comoros where focused research and effective management are urgently required to halt the rapid decline of the species. Our work consisted of three components: 1) questionnaire surveys with fishers and in-depth interviews with key informants, such as professional dugong hunters; 2) dugong habitat mapping, using remote sensing techniques and local knowledge to identify key seagrass areas for in-depth surveys 3) examination of historical records and anecdotal accounts dating as far back as the 16th century to assess the historical decline of the species and the changes in habitat availability over time. Results from the combined methods revealed past and present dugong hotspots and feeding areas to prioritize conservation efforts in key areas. Historical records corroborate and validate information gathered from surveys and highlight the importance of the shifting baselines concept in assessing populations of endangered marine species. This work has been supported by the Conservation Leadership Programme, Convention on Migratory Species, Rufford Small Grants Foundation, PADI Foundation, Sea World Busch Gardens Conservation Fund and Mohamed bin Zayed Species Conservation Fund

24.6 Davis, RA*; Scott, R; Stojanovic, D; Barrett, G; Stock, W; Finn, H; Burbidge, A; Valentine, L; School of Natural Sciences, Edith Cowan University, Birds Australia and School of Natural Sciences, Edith Cowan University, Birds Australia and Australian National University, Department of Environment and Conservation, Western Australia, Biology and Environmental Science, Murdoch University; robert.davis@ecu.edu.au  
A slow fade to extinction: recovering Carnaby’s Cockatoo - a generalist species subject to multiple threats.

Carnaby’s Cockatoo (Calyptrorhynchus latirostris) is a large, gregarious, generalist parrot endemic to Western Australia where it is threatened by habitat loss and fragmentation throughout its range. It is a migratory species utilizing breeding and non-breeding habitats hundreds of kilometres apart. The ability of managers to respond to threats is hampered by lack of knowledge of the species’ movements and habitat preferences. Breeding sites in agricultural regions are being lost due to hollow competition and non-breeding habitat for this species encompasses the heavily urbanized capital city of Perth and its hinterland. Here rapid and ongoing loss of vegetation for housing has caused significant loss of feeding and roosting habitats. Carnaby’s Cockatoo has adapted to preferentially feed on non-native plantation pine which is energetically more favourable and where it also roosts. However, research indicates major future impacts since plantation pines are scheduled for progressive removal. Current legislative frameworks deal poorly with these threats primarily because federal conservation legislation fails to address cumulative impacts or identify critical habitat. There is also ongoing state-federal conflict regarding impact assessment policy and procedures. We believe that Carnaby’s Cockatoo provides a powerful model for investigating the conservation challenges of widespread, generalist species that are slowly fading out due to multiple threats.
The Prairie Ecosystem of Canada represents the northernmost extent of the Great Plains of North America. The ecosystem is comprised of mixed-grass prairie in the western portion of the country and tallgrass prairie to the east. Approximately 30% of the mixed-grass prairie and tallgrass prairie of Canada occurs in Alberta.

White-tailed deer have expanded their range into northern boreal habitats, which are atypical for this species, and are already having negative effects on the novel communities. Northern ungulates rely on stored body fat to survive winter, a period of net energy loss due to deep snow, cold temperatures, and limited forage intake. Warmer, shorter winters with less snow may increase northern deer survival by decreasing energy loss; however, land use increases forage abundance, which may increase survival by improving fat stores. To differentiate land use from climate effects, it is necessary to show biologically relevant changes in climate patterns. We develop a method to calculate a well described winter severity index using snow water equivalent rather than snow depth data, to capitalize on available climate data sets with broad temporal and spatial coverage. We then apply this index to historical deer data from across Alberta. Results suggest increases in white-tailed deer as winter severity decreases; however they are conditioned on spatial and temporal scale, as proximate effects of land use are also evident.

Canaries in the coalmine: Birds as indicators and motivators for private landowner habitat management

While birds have achieved policy and research relevance as indicators of environmental change, limited research has explored the value of the "canaries in the coal mine" for lay audiences. Birds likely motivate and serve as indicators for private landowners undertaking habitat management practices on their land. We explored the role of birds, as compared to other wildlife or priorities, in encouraging private lands conservation in New York—specifically early successional habitat (ESH), which is considered to have low aesthetic and financial value. With changing land use practices and suppression of natural disturbance, ESH and related species are in decline in New York. Historically, ESH was prevalent in the state, but now, its quality and maintenance depends upon management. Given that 77% of New York's forest lands are privately owned, the existence of adequate ESH hinges on private landowners' activities. We conducted in-depth interviews with landowners who are managing for ESH to learn why they are undertaking such management, whether they are seeing expected results, and how they are measuring success. We also considered the types of birds, if any, that motivated landowners and kept them engaged. We found that landowners were undertaking this management largely for wildlife benefits (birds as well as mammals), differed in wildlife species goals depending on their recreational activities, and noted changes in wildlife populations without structured monitoring.

Necessity for Tri-national Action for Bird Conservation: Protecting the Migration Spectacle and Unique Role of the Boreal Avian Nursery

Canada, Mexico, and the continental United States share 882 native landbird species. The great abundance and variety of our bird life provides immeasurable ecosystem services and serves as an indicator of changes to our environments. Facing unprecedented loss of bird populations and the imminent threat of extinction for many species, Partners in Flight Science Committee undertook a vulnerability assessment for the landbirds that regularly breed in the three countries. The assessment highlights the loss of bird diversity and habitats of greatest concern, the loss of a shared spectacle as common birds continue to decline, and the need for trans-boundary action. More than 200 species, and 80% of individual landbirds, rely on habitats in all three countries. Birds shared among all three countries are particularly well-represented in boreal forests during the breeding season and in Mexican forests in winter. These same forests provide year-round habitats for 70% of continental-concern species. The linkages among birds and habitats compel us to work internationally, to reinforce partnerships, and to develop new mechanisms for conserving both migrants and residents. We can achieve our goals to protect, restore and enhance populations and habitats of our birds, but the window is rapidly closing. Conserving our shared birds will require a continental, and ultimately hemispheric, perspective and a commitment to international cooperation.
Forest fragmentation is considered to be a main cause of the worldwide and Canadian decline in biological diversity. The existing threat of fragmentation to flora biodiversity in Quebec, Canada, is exacerbated by climatic changes that shift suitable environments northward, away from species' current ranges. It is critical to evaluate the potential of plant species, exceptionally those restricted to forest environments, to migrate northward as an adaptive range shift to climate change. This research examines the temporal patterns of dispersal of forest herb species through corridors within agro-ecological landscapes of southern Quebec, Canada. We hypothesize that: 1) similarity in species composition between mature forests and corridors will increase with time, suggesting dispersal and recolonization and; 2) traits of forest herb species such as dispersal mode, flowering phenology, seed mass, etc. are related to species temporal patterns of dispersal through corridors. Data was subjected to Linear Regression and Redundancy analysis, to examine variance in species composition between forests and corridors over time. To explore associations among species traits and the environmental conditions of sites, Fourth-corner analysis was utilized. Our results provide insights on species that may be threatened by fragmentation and climate induced range shifts within agro-ecological landscapes. This study contributes to a larger research consortium whose purpose is to evaluate the state of biodiversity in Quebec in the context of a changing climate, and inform adaptation and mitigation strategies for biodiversity conservation.
Breeding Areas Versus Temporary Settlement Areas: A Lesson For Conservation Biology

The dispersal behaviors and patterns of floaters are crucial elements in conservation biology. For species needing recovery plans, an accurate knowledge of dispersal behavior can be a key factor of conservation success. Because the areas where dispersers settle are unknown or difficult to detect, fewer efforts are typically devoted to the conservation of these sites compared to breeding territories; however, this can decrease the effectiveness of conservation plans and action. Population studies, analyses of population viability and extinction risk assessments that ignore the dynamics of dispersers within settlement areas may fail to understand how and why animal populations decrease, and may support inappropriate or ineffective conservation action. Dispersers may frequently use areas in which high levels of anthropogenic disturbance result in high mortality rates; moreover, settlement areas can look very different from breeding areas. Thus, while apparently low-value areas are not typically considered in conservation plans, they may be inhabited by the majority of floaters waiting for breeding opportunities. As a result, human and economic efforts are wasted in locations other than those in which conservation measures are really necessary. In fact, declines in breeding population size could divert attention from critical problems in the floater pool. By integrating information from both theoretical simulations and empirical studies on birds of prey and owls, we show the crucial link between the floating and breeding fractions of animal populations, as well as the importance of disperser's settlement areas for population dynamics, stability and persistence.

Adapting western USA landscapes to climate change: the climate commons

Increasing land-use pressures combined with climate-change stressors present unprecedented challenges to land managers in the Western USA. Climate change strategies on federal lands, for instance, have focused largely on adaptive management approaches while those on nonfederal lands have been largely stakeholder driven and locally based. Here, we present some general principles for managers to respond to the challenges of climate change based on fundamentals of conservation biology, adaptive management, and stakeholder involvement. On federal lands, this includes protecting roadless areas as climate refugia and carbon stores in old forests as climate change mitigation, reducing stressors from multiple land-uses, and maintaining properties that allow change species, and, in aggregate, ecosystems to resist and rebound from disturbance. On nonfederal lands, we present case studies from several basins in Oregon and California designed to develop broadly supported strategies for climate change at the local level. We argue that land management must shift from the "tragedy of the commons approach" of the 20th century to a "climate commons" whereby land managers and local communities use best science to prepare natural and human systems for climate change. Investing now in climate change planning will reduce substantial economic and ecological costs later from run-away climate change.

Upholding scientific integrity in the case of the threatened northern spotted owl (Strix occidentalis caurina)

the northern spotted owl is the symbol of old forests in the Pacific Northwest, USA. The owl was listed as threatened in 1990 due to destruction of its old forest habitat and a lack of sufficient regulations. For over a decade, the Northwest Forest Plan (NWFP), a global model in landscape conservation, served as a de facto recovery plan. Lawsuits by the timber industry in 2001 prompted proposals by the Bush administration to weaken protections under the NWFP; additional lawsuits by conservation groups in 2003 triggered development of an owl recovery plan but the plan proposed additional reductions in habitat protections. Testimony by scientists during Congressional hearings in 2006-2008 and a report by the investigative branch of the federal government in 2008 documented political interference in the owl recovery plan and dozens of endangered species decisions by the Bush administration. Legal challenges and scientific scrutiny of these proposals eventually led to their withdrawal by the Obama administration. This talk focuses on the role played by scientists, peer review, and conservation groups in uncovering political interference in the recovery of a threatened species. Throughout this process, peer review was pivotal in demonstrating the importance of best science in endangered species decisions.

We need better ways to deliver the science we do have, develop the science we don’t have, and get science to affect real outcomes on the ground. The amount of new science on fire, fuel management, and forest restoration is overwhelming for managers to deal with effectively. Information is often conflicting, fragmented, not site-specific, or difficult to interpret. Time is scarce. Scientists tend to focus narrowly on ecological questions, are often poor in delivering timely and pertinent results, and often have few incentives to apply science in site-specific settings. Federal, state, university, and private partners, researchers and managers, are developing the Pacific Northwest Consortium for Fire Science Delivery as a neutral broker to tackle those issues and facilitate effective science-based management of the fire-prone forest and rangeland ecosystems of Oregon and Washington. A community of practice will create a "virtual learning community" to foster the delivery and sharing of knowledge via interactive web networking and training programs. An adaptive management process is being developed to select and implement projects that use current science and test alternatives, ensuring that we learn better from management and that differing scientific or societal views are accommodated. We plan to fully begin work in Spring 2010.
SY15 Dempsey, Jessica; University of British Columbia; jdempsey@interchange.ubc.ca
Assessing the risks of ecosystem change for financiers and insurers: the future of conservation?
Risk is a dominant lens for corporate and financial decision-making. Several international initiatives - including the World Economic Forum, host of the annual infamous meeting in Davos, Switzerland - aim to constitute present and future biodiversity and ecosystem service change as material risks to the bottom line calculations of investors and insurers. Incorporating measures of biodiversity loss and ecosystem services into financial risk analysis is a new approach for conservation policy and practice, and is worthy of further consideration. Towards this, my paper explores the following questions: how are biodiversity and ecosystem services being brought into financial models and decision-making? And how are these approaches changing corporate, financial, and conservation practices? My research includes an analysis of the methodologies proposed to determine biodiversity and ecosystem service risk, and an assessment of the challenges faced in creating new objects of risk calculation. It also based on interviews with the proponents of such approaches from various sectors - finance, business, non-profits, and the United Nations. Bringing biodiversity and ecosystem services into risk analysis faces serious difficulties, particularly related to establishing quantification metrics that work with existing financial methodologies. Furthermore, it is unclear how this particular approach will mesh with the increasing focus on democratic and participatory conservation practice, as the types of spaces, species, and services prioritized under such a risk framework are those linked to protecting the material health and well-being of corporate and financial institution profit.

10.3 Denis, Jean-François*; Dr De Blois, Sylvie; McGill; jean-francois.denis@mail.mcgill.ca
Invasion dynamics of common reed in freshwater wetlands
North America is currently experiencing an increase in rates of invasion by exotic species. Common reed (Phragmites australis) is an introduced species damaging wetland habitats. Its tolerance to a wide range of environmental conditions allows it to invade disturbed areas and to create monotypic stands that affect ecosystem functions and local biodiversity. Furthermore, native haplotypes of the reed are now subject to competition pressure induced by this aggressive invader. Knowledge about reed dynamics in freshwater wetlands of North America is still fragmentary. Our objectives were 1) to assess the invasion dynamics of two reed haplotypes (M, F) at population level; 2) evaluate impact of invasive haplotype M on the other haplotype and 3) to quantify the effects of reed on plant communities. 18 permanent plots adjacent to reed populations and non-invaded at t0 (9 exotics, 9 natives, 3 habitats) were monitored for 3 years. 5 transects each containing 11 plots at zone of contact between the haplotypes were also monitored for 3-4 years. Results suggest that haplotype M spreads faster, especially in disturbed areas. Haplotype M competitive value seems higher than its native counterpart and is affecting floral community structure. Haplotype M will most likely lower local value of biodiversity.

P2.2 Dennenmoser, S*; Rogers, SM; Vamosi, SM; University of Calgary; sdenenmoser@ucalgary.ca
CRYPTIC GENETIC DIVERSITY IN FRESHWATER FISH UNDER CLIMATE CHANGE: NOT YET DISCOVERED, BUT ALREADY THREATENED?
The presence of unrecognized cryptic species may lead to an over-estimate of population size and genetic diversity and, subsequently, to an under-estimate of extinction risk in cases of habitat disturbance or rapid environmental change. We conducted a phylogeographic analysis using mitochondrial and nuclear DNA to explore demographic history, population genetic structure and the occurrence of putative cryptic species in a widely distributed northern temperate freshwater fish, the prickly sculpin (Cottus asper) in British Columbia and Alberta. Preliminary results indicate a complex pattern of at least four genetic lineages, with southern coastal and inland populations being highly divergent from each other. Furthermore, genetic diversity in the western Peace River region was significantly low and may reflect a bottleneck caused by habitat disturbance or a founder effect due to recent, post-glacial range expansion. These four lineages may be representative of genetically distinct groups that may have diverged in glacial refugia during the Illinoian and Wisconsinan Pleistocene glacial maxima. Overall, these results suggest that populations of C. asper represent a species complex and highlight the importance of disentangling historical from environmental effects on genetic diversity when undertaking conservations efforts aiming to preserve the genetic integrity of the evolutionary processes that generate biodiversity and allow adaptation to global change.

SP9.5 Develey, P.F.*; Luiz, E. R.; BirdLife/SAVE Brasil ; pdeveley@uol.com.br
Engaging Local People as a Strategy for Bird Conservation: Local Pride in Brazil’s Atlantic Forest
The participatory process to build conservation strategies is crucial to achieve concrete results, since local people are active players in managing the environment around them. Here we present the results of a five-year conservation program in the Boa Nova region, Northeast Brazil, with the purpose to raise awareness in the local community and to change the way it interacts with the natural environment. Despite the region’s biological importance (396 bird species, 14 globally threatened) Boa Nova is under the same intense pressure as most of the remnants throughout the Atlantic Forest region. Considering educational activities, we have promoted 125 talks for children, teenagers and adults from urban and rural areas with a total public of 3000 people. The main theme of all talks was the environment, the area’s unique biodiversity and the importance of best practices to preserve the local natural resources using the Slender Antbird as a flagship species. We have also established a group comprised of 28 landowners resulting in the private protection of 10 hectares of forests. Presently, the Slender Antbird has been adopted as a symbol of Boa Nova and environmental protection is part of the culture of the city. One important lesson from this project was learning the importance of having a key person inserted in the local community, experiencing the local reality and deeply understanding the environmental, social and cultural characteristics of the region.
The Mixed Wood Plains Ecozone - Status, Trends and Stressors

The Mixed Wood Plains of Ontario and Québec is Canada’s smallest and southernmost terrestrial ecozone. Despite its small size, the ecozone is home to 53% of Canada’s human population and the population is growing at a higher rate than in the rest of the country. Species diversity is high, and the region supports a large proportion of Canada’s Species at Risk. Most of the original natural cover has been lost and much of the remaining natural habitat is fragmented by agricultural and urban developments. Lakes and streams have also been affected by habitat degradation and fragmentation from multiple dams. Less than 2% of the ecozone is in protected areas, but there has been a recent trend towards the securement of private conservation lands and stewardship activities on private lands. In addition to habitat loss and fragmentation, the ecozone has been particularly affected by invasive alien species and pollution. Future threats include the cumulative effects of continued habitat loss and fragmentation associated with the ever expanding human population, the introduction and spread of invasive alien species, and the effects of climate change.

Impact of climatic change on tree phenology in the North American temperate forest

The available data on climate change over the past century indicating that the global temperature is increasing and it has a major impact on plant phenology as phonological events are strongly responsive to temperature. Scientist from the different discipline were observed changing of different phonological events such as timing of budburst, earlier spring flowering, earlier leaf unfolding, extended of average length of the growing season etc. Different experimental and modeling approaches have been developed to identify the mechanisms behind these changes and to make a precise projections concerning the consequences of climatic change. Here, we will discuss the recent progresses in the field of phonological research in responses to climatic changes in North America and draw a possible conclusion concerning the future tree phenology in the changing climatic condition.

Indigenous cultivation in salt infested farmlands as Successful Climate Adaptation Practices in Cyclone Hit deltaic Sunderbans of India

Indigenous rice varieties yielded better production at 3.7 milimhos EC in salt infested farmlands of deltaic Sunderbans compared to HYV that failed to grow in fields with EC above 1 milimhos after saline water intrusion in Cyclone Aaila. Agroenvironmental conservation through integrated climate adaptation, drainage management and soil engineering by developing 5% water body where watertable is high and water moved horizontally and forming corner wells and diagonal drains in secluded plots of 35'X 45' dimensions, where watertable is at 1 m and water moved vertically helped in reducing the top soil EC by 74%. Fertilizer management was integral in adaptation measures, wherein additions of rotten Azolla soup reduced salinity effects on crop. Application of Zn and sufficient N, P, K with organic N as topdressing at critical growth stages prevented salt stress. Basal N proved less efficient on saline and sodic soils where replacement of Na by Ca was mediated through the application of gypsum in reduced P availability in the soil. Germplasm conservation and seed banks have been established to restore indigenous rice varieties like Nonabokra, Getu, Taalmugra, Patnai, Folkosha etc. proved to be better climate adaptation strategy, which was initiated through community participation and partnership.

Germplasm management and its conservation implications in small white lady’s-slipper (Cypripedium candidum) orchid in Canada and its conservation planning

The small white lady’s-slipper (Cypripedium candidum) is an attractive endangered prone of extinction perennial orchid that inhabits in open areas of prairie and fen habitats. It occur relatively isolated populations at southern Ontario and eastern Manitoba in Canada and eastern and western parts of the U.S.A. Different studies it revealed that there are 8 populations in southern Ontario and 15 populations in southern Manitoba. Among them one population in Manitoba and one in Ontario contain three-quarters of all of Canada’s small white lady’s slippers whereas rest 13 populations have less than 100 individuals and some of these consist of only a few plants along roadside ditches. The overall most significant risk factors for the viability of the populations are industrial, urban and agricultural development activities, encroachment by invasive weeds and woody plants, hybridization with other lady’s-slipper species, inbreeding due to small isolated populations, and illegal orchid collection. For protection and conservation of small white lady’s-slipper in field level may require; maintain the currently protected sites, increase the public awareness, control the hybridization with other lady’s-slipper, a well defined habitat management strategies and a multi dimensional and institutional approach for implementation of conservation activities.

Effects of climate change on germination and growth of small white lady’s-slipper (Cypripedium candidum) in Canada

The available data on climate change over the past century indicating that the global temperature is increasing and it has a major impact on plant germination and growth as germination events are strongly responsive to temperature. Different experimental and modeling approaches have been developed to identify the mechanisms behind these changes and to make a precise projections concerning the consequences of climatic change. Here, we will discuss the recent progresses in the field of germination research in responses to climatic changes in North America and draw a possible conclusion concerning the future germination and growth in the changing climatic condition.
The mountain pine beetle (Dendroctonus ponderosae Hopkins) epidemic has altered lodgepole pine (Pinus contorta Dougl. Ex Loud. var. latifolia Engelm.) forests to an unprecedented extent in British Columbia. The current infestation of lodgepole pine by the MPB has been estimated at over 10.1 million hectares attacked and around 710 million m³ of mature pine killed to the end of 2007. After an MPB outbreak, advance regeneration typically forms a new canopy and stand; however, the time needed is unknown. Stands likely contribute to ecological processes and future timber supply. Assessment of regeneration and growth of residual trees in stands after MPB attack is critical for: forecasting long-term development of attacked stands; selecting stands for growth improving silvicultural treatments; and forecasting impacts to hydrology, habitat, and vegetation types. This work reviews and synthesizes relevant investigations about the regeneration and growth status of MPB attacked lodgepole pine stands in central BC describing species composition and abundance, spatial distribution and overall health. Different investigations revealed that more than 40% of stands dominated by pine have adequate advance regeneration after MPB attack. In most cases, the distribution of advance regeneration was clumped and species composition varied at stand and landscape levels. Most of the affected area will likely recover on its own and can provide midterm and long-term timber supply, as well as ecological services. However in some cases, effective management of advance regeneration is required following MPB attack to attain desired future stand level conditions and maintain ecological processes.
For years, economists and politicians have wrestled with the concept of rising Gross Domestic Product (GDP) as a measure of progress. Even the father of national income accounting, Nobel laureate Simon Kuznets, warned the U.S. Congress in 1934 that "The welfare of a nation can scarcely be inferred from a measurement of national income." In 1968 Robert F. Kennedy lamented, "Too much and for too long, we seem to have surrendered personal excellence and community value in the mere accumulation of material things." He went on to list a series of ills (e.g., air pollution and highway carnage) that are added to GDP. More recently, the Commission on the Measurement of Economic Performance and Social Progress has added a rigorous and critical analysis to the debate on GDP. GDP is a very useful indicator of the scale of the economy, but a poor indicator of societal well-being and progress. It has become clear that our economic accounts need an overhaul, especially to address declining stocks of natural capital, including ecosystem services and biodiversity. Many other indicators, such as the Genuine Progress Indicator, Ecological Footprint, and Happy Planet Index have been developed to distinguish between increasing economic scale and increasing economic well-being. Given the adage that "we manage what we measure," it is time to supplement GDP, so that we can manage the economy to meet people's needs without undermining the life-support systems of the planet.

Ten years of adaptive community-governed conservation: evaluating biodiversity protection and poverty alleviation in a West African hippopotamus reserve

Although community-based natural resource management has been accused of failing on social, economic, or ecological grounds, balanced assessments are rare. We therefore examine the first 10 years of Ghana's Wechiau Community Hippo Sanctuary using an evaluation framework that considers socioeconomic and ecological outcomes as well as resilience mechanisms. The initiative at Wechiau, which builds on traditional, local taboos against the killing of hippos, has attempted to conserve an imperilled large mammal, protect biodiversity and alleviate abject poverty amidst a bush meat crisis and complex ethnic diversity. We find that the Sanctuary has improved local livelihoods by spurring economic diversification and infrastructure development rates 2-8 times higher than in surrounding communities. Simultaneously, threats to biodiversity have subsided, hippopotamus numbers have remained stable and the Sanctuary's riparian habitats now harbour more bird species than comparable areas nearby. Improved social capital, true empowerment, an equitable distribution of benefits, ecological awareness among the next generation and support for the Sanctuary even amongst community members who were disadvantaged by its creation speak to good long-term prospects. Risks remain, some of which are beyond the community's control, but evidence of socio-ecological resilience provides hope for sustainability. Lessons learnt lead to recommendations for future community-based conservation initiatives.
Avoid maladaptive activities. Presented that show the range of shoreline sensitivity types and case-specific strategies to along the British Columbia coast we focus on the protected areas. Three case studies will be previously rated sensitivity of coastal and marine feature classes. We then modified the coastal sensitivity. We used an existing biogeographic land classification dataset, and rates marine and terrestrial segments then spatially combines the ratings to build a map of temperature patterns. Managers require knowledge of the relative sensitivity of shorelines to climate change and an appropriate set of adaptive responses. Our approach independently rates marine and terrestrial segments then spatially combines the ratings to build a map of coastal sensitivity. We used an existing biogeographic land classification dataset, and previously rated sensitivity of coastal and marine feature classes. We then modified the ratings based on slope, exposure and sediments. While the results are informative for any site along the British Columbia coast we focus on the protected areas. Three case studies will be presented that show the range of shoreline sensitivity types and case-specific strategies to avoid maladaptive activities.

P1.15 Doug Macaulay*; Jill Henry; John Hallet; Alberta Agriculture and rural Development, County of Grande Prairie, Alberta Conservation Association; doug.macaulay@gov.ab.ca Riparian Buffers for Habitat Enhancement of Beaverlodge Watershed - Alberta, Western Canada

Prior to European agricultural settlement of the Beaverlodge River watershed (Alberta, Canada) at the turn of the last century, the area contained extensive woodlands and wetlands. However, over the last hundred years, this area has experienced extensive deforestation, wetland drainage, and general habitat degradation. After the deforestation and wetland draining, increased agriculture (including cereal crops and cattle farms); and oil wells, has led to poor water quality, significant riverbank erosion, higher water temperatures and the loss of many native fish species such as the Arctic Grayling (Thymallus arcticus). This species is considered a sensitive species in the Alberta Sustainable Resource Development (2005) report. It is a cool water, sportfish that has significantly declined in the past fifty years. It is now only found in about 40% of its historical range as a result of overfishing, habitat fragmentation caused by activities such as improperly installed road culverts, increased water temperatures due to changes in the climate and detrimental land-use activities. The “Riparian Reforestation and Wildlife Habitat Enhancement” agroforestry project described in this chapter has built awareness of how habitat adjacent to the Beaverlodge River and its tributaries can be restored through tree and shrub plantings and fencing to improve riparian health and wildlife fish habitat. This three-year project was initiated in 2008 by the Agroforestry and Woodlot Extension Society (AWES) with support from the County of Grande Prairie and the West County Watershed Group, and funding from the Alberta Conservation Association's Grant Eligible Fund. The goal of this agroforestry project was to improve degraded woodlands bordering creeks and rivers in the Beaverlodge River watershed on private lands. The project attempted to show that agroforestry systems such as riparian buffers along with riparian protection can be used as a tool to help improve water quality and fish and wildlife habitat, and reduce the erosion of banks within the Beaverlodge River Watershed. The project worked with landowners in this watershed to replant degraded riparian buffer zones. Overgrazed pastures and cultivated farmland with no trees along these waterways were the primary focus of this work. Our methods included the formation of a planning team, a public awareness campaign to attract participants and educate them on riparian area values, hiring a tree planting contractor and a planting goal of 66,000 trees on 150 acres of private lands. So far, two years of funding were acquired, 13 private landowners have participated, and 44,000 trees have been planted.

P1.14 Draheim, Megan M.*; Rose, Naomi A.; Kruse, Christi A.; Parsons, E.C.M.; George Mason University, Department of Environmental Science and Policy, Humane Society International, George Mason University, Department of Biology; mdraheim@gmu.edu Looking a Gift Horse in the Mouth: Corporate Conservation Education Programs

As school budgets are cut, many teachers are searching for ways to augment their curriculum. Corporations are one source for free educational materials; however, these materials may be biased. We examined the free online materials that SeaWorld provides to educators. We used qualitative content analysis to break the materials into themes and compared SeaWorld's claims with the scientific literature in order to determine their value in a conservation education program. We found that the materials included factual inaccuracies. For example, Sea World generally characterizes the collapsed dorsal fins of male killer whales as “normal”; however, in most wild populations only 1%-5% of adult males have fully collapsed fins, while 100% of captive adult males do. SeaWorld also inaccurately portrays beluga whales’ life spans as being half of what the current scientific consensus is by using an analysis that is obsolete. By choosing not to acknowledge the best available scientific information, the quality of its educational content is put into doubt. While some of the content does have educational value, it is presented in such a way as to privilege SeaWorld’s corporate goals. Indeed, the material actively promotes its commercial activities. Free conservation educational materials can be an important asset to underfunded classrooms, but educators should be aware of corporate agendas and examine the materials from a critical perspective before incorporating them into their curricula.

P1.13 Dowsley, M*; Lemelin, H; Walmak,M; Franz Seibel; Fort Severn First Nation; Lakehead University , Lakehead University, KORI, KORI, Fort Severn First Nation; mdowsley@lakeheadu.ca Scenario planning to explore possible responses to the listing of polar bears as threatened in Ontario

Polar bears (Ursus maritimus), were listed as a threatened species in Ontario in 2009 as a precautionary measure based on the expectation that their sea ice habitat will decline. Both scientific information and traditional knowledge indicate the population is abundant and productive. The uncertainty of population status and appropriate government response can be dealt with effectively through scenario planning. As part of a larger collaborative project involving Cree communities of the Hudson Bay Lowlands, university researchers and the Keewaytinook Okimakanak (KORI) tribal council, we used scenario planning to structure discussions around possible futures for Cree-Polar Bear interactions. We will present information that led to three conclusions. 1. This tool is most effective when participants are familiar with the history and current information associated with the issue. 2. The scenarios were especially helpful in increasing the number of options to be considered and in generating discussions about all options, rather than allowing discussions to be sidetracked by the appeal of one or a few options. 3. Scenario planning allows participants to prepare rational and strategic decisions for all scenarios including those that are initially viewed to have a low probability of occurring. Scenario planning therefore provides a potentially valuable tool in examining resource use options.

P1.12 Doug Biffard*; Tony Stevens; Nolan Porther; Ministry of Environment, Vancouver Island University; doug.biffard@gov.bc.ca Shoreline Sensitivity and Climate Change Adaptation in the Coastal and Marine Protected Areas of British Columbia

Protected areas managers are facing the reality of climate change. The British Columbia protected area system includes approximately 10,000 km of marine shoreline with associated terrestrial and marine ecosystems. Traditional management approaches assume that many shoreline features are static and enduring. New information is needed to inform a new approach that recognizes the importance of adapting to rising sea level, increasing storm intensity and frequency, changing wind, rainfall, humidity, air temperature and water temperature patterns. Managers require knowledge of the relative sensitivity of shorelines to climate change and an appropriate set of adaptive responses. Our approach independently rates marine and terrestrial segments then spatially combines the ratings to build a map of coastal sensitivity. We used an existing biogeographic land classification dataset, and previously rated sensitivity of coastal and marine feature classes. We then modified the ratings based on slope, exposure and sediments. While the results are informative for any site along the British Columbia coast we focus on the protected areas. Three case studies will be presented that show the range of shoreline sensitivity types and case-specific strategies to avoid maladaptive activities.

21.3 Dowsley, M*; Lemelin, H; Walmak,M; Franz Seibel; Fort Severn First Nation; Lakehead University , Lakehead University, KORI, KORI, Fort Severn First Nation; mdowsley@lakeheadu.ca Scenario planning to explore possible responses to the listing of polar bears as threatened in Ontario

Polar bears (Ursus maritimus), were listed as a threatened species in Ontario in 2009 as a precautionary measure based on the expectation that their sea ice habitat will decline. Both scientific information and traditional knowledge indicate the population is abundant and productive. The uncertainty of population status and appropriate government response can be dealt with effectively through scenario planning. As part of a larger collaborative project involving Cree communities of the Hudson Bay Lowlands, university researchers and the Keewaytinook Okimakanak (KORI) tribal council, we used scenario planning to structure discussions around possible futures for Cree-Polar Bear interactions. We will present information that led to three conclusions. 1. This tool is most effective when participants are familiar with the history and current information associated with the issue. 2. The scenarios were especially helpful in increasing the number of options to be considered and in generating discussions about all options, rather than allowing discussions to be sidetracked by the appeal of one or a few options. 3. Scenario planning allows participants to prepare rational and strategic decisions for all scenarios including those that are initially viewed to have a low probability of occurring. Scenario planning therefore provides a potentially valuable tool in examining resource use options.
The logic of the market economy increasingly informs the design and outcomes of conservation in the developing world. This paper demonstrates that rather than replace coercive conservation, the current neoliberal turn rearticulates coercive goals by affecting farmer behavior in ways deemed consistent with forest conservation and market-oriented incentives. Case studies from Thailand and the Philippines show how and why the market-based mechanisms driving conservation become manifest in rural areas, pushing local livelihoods toward intensified commodity production. The conclusion asserts that market-based conservation governance may constrain as well as support farmer freedom to pursue particular livelihoods, resulting in contradictory outcomes for neoliberal conservation governance.

Wolf Research Possibilities in a Changing Boreal Forest

Consequences of climate change become more apparent, data on severity of impacts in Northern regions and communities is limited due to accessibility. The University College of the North, situated in the "heart of the boreal forest", is an ideal setting for conservation research opportunities. With expansion of their degree offerings, it is an opportune time to expand partnerships with community stakeholders and to identify research opportunities in those areas. Increased development in the Northern Manitoba region has opened access to these the Boreal Forest, Taiga, Tundra, Transitional, Freshwater and Marine biomes of which Thompson is the hub. Biomes in this region have had little research conducted with the exclusion of the Churchill region which is reachable from Thompson. Conservation and protection of these pristine northern areas will become an area of concern with escalation of development activities. Anecdotal information from Northern regional residents about the noticeable changes in the climate is the only data available at this moment. This data could be the first step for monitoring the changes, that is, it is difficult to state that the climate is changing without data for comparison. To stimulate research interests in this region, one top predator, the wolf, has been selected as anchor species for research. The wolf is a significant animal within many Aboriginal cultures and establishment of a "Wolf Centre of Excellence" has begun within UCN to promote innovative wolf research and provide support for researchers wanting to expand their scope to include these regions. UCN envisions itself as a facilitator and liaison available to researchers interested in conducting research with wolves and other species in the region.

Ethiopia has less than 2.7% of its land covered with forest though over 85% of the population relies on wood for construction, energy and other basic wood needs. In an attempt to protect the important forest reserves through minimalized human interventions, some forests were declared as protected forests. This paper tries to assess the moral challenges communities living around protected forests face and the possible mechanisms to mitigate or lessen the problem. The study bases on data collected using interviews, informal discussions, direct observation, and group discussions held with the society living near Menagesha Suba state forest. Due to strong reliance on forest products-even though the forests are protected-the society still utilizes them illegally. But members of the society revealed that such illegal usage has got serious moral impact on them. Some of the major moral challenges are theft, mistrust, transgression, illegality and lie. Though these moral issues are also unacceptable within the society, their problem surpasses these challenges - forcing them to continue the usage. It was also found out that the moral challenges result from four major types of decisions individuals make regarding usage of protected forests. Those are the no-alternative decision (usage due to lack of alternative forest products sources), the "luxury" decision (extracting wood to generate income for entertainment), the ignorance decision (usage due to lack of knowledge about its importance) and the revenge decision (usage because the state forest took their lands). In general, to minimize the moral challenges posed due to the new forest management scheme, it is important either to incorporate the people in to the project scope or help them to produce forest products by using tree-based agroforestry practices.
Forest - A Resource against Urban Poverty: Some Lessons from Central Ethiopia

Urban poverty-aggravated by rural-urban migration is a major problem in Ethiopia. Farmers with failed yields and poor lands, youngsters and women are fleeing to urban areas to find jobs. Through time they just remain in there by devising their own way of life. This paper tries to address how such poor people living in urban areas make-up their livelihood from forests close to their new homes. The paper is based on informal discussions, visits and direct observations with urban migrants living in a poor condition. Urban poor depend on forests for two major aims: for household consumption and for income generation. Household consumption includes fuelwood, construction wood and some medicinal parts of plants in the forest. Dependence on forests for income generation has many forms. Households earn income by collecting and selling fuelwood and eucalyptus leaves and twigs to urban consumers. Some are also engaged in illegal smuggling of timber and poles from the forests which are sold at sawmills in the towns. Moreover, many of the urban poor are engaged in brokering task of forest products which may benefit them up to 5% of the price of the forest products. In general, forests nearby urban areas are considerably helping the urban poor survive from day to day. Nevertheless, forests are under great pressure from various dimensions (e.g. overutilization, illegal exploitation, conversion to farmlands, conversion to resettlement areas especially near urban areas, etc.) which threatens the urban poor’s livelihood in the future. Thus, conserving forest resources is a mandatory activity in which urban administrations and communities and the rural farmers should be involved as forest depletion severely affects the whole community.

A camera-trapping approach for the study of the mountain tapir (Tapirus pinchaque) in the high-Andean ecosystems of the Purace National Park, Colombia.

The mountain Tapir (Tapirus pinchaque) is a large herbivore ungulate mammal inhabits the Northern Andes, including high-Andean ecosystems such as montane forest and paramo between 2000 - 4000 meters. This species is considered Endangered by the IUCN red list, being the habitat fragmentation a main threat throughout its original distribution. The larger populations are believed to be located in the Central Andean range of Colombia, distributed in some isolated protected areas. Also the hunting is reported how a critical threat for the species, owing to low density and intrinsic rate of natural increase in tapirs. Some studies reported a density between 0.17 - 0.25 ind/sq km and a home-range of 2.5 - 8.8 sq km through the use of radio-telemetry and GPS collars methods. The camera-trapping studies could be a prominent less expensive and invasive method for estimates some population parameters. Nevertheless, only one study with mountain tapir in Ucumari regional park - Colombia is reported using infrared monitors to survey the activity patterns of species. We initiate a camera-trapping approach for minimum abundance estimation of the mountain tapir on the Purace national park, for survey a site with tracks and visual records of the species. To date we found 1 individual on the area, visiting monthly the salt-lick and adjacent forest trails. We conclude that the camera-trapping is an efficient method for the area, how we expected to prove in the next months. At the same time we carry out a educational work in a settlement on the buffer-zone of the park, but we think that the stake-holders and administrator of the area could be the best fit population for replicate on time the human well-being knowledge beyond this study.

Landscape context may influence richness and abundance of prairie birds. Previous research has shown that local parameters have been better predictors than landscape parameters in explaining abundances of prairie birds. Yet many studies have been conducted at relatively small spatial extents on landscapes from 12 ha to 800 ha. We examined the spatial extent at which prairie birds respond most strongly to landscape factors. We sampled 20 landscapes in south-western Manitoba in 2008-2009 to determine species richness and abundance of obligate and facultative grassland birds. We evaluated bird responses to percent cover of grassland, forest, edge density and distance to the forest at seven spatial extents from 200 ha to 7200 ha. Obligate grassland birds responded at spatial extents of 1800 ha and higher, while facultative species responded at smaller extents of 450 ha. Abundance of obligate species decreased with edge density and distance to forest, while abundance of facultative species increased near woodland habitats. Our study emphasizes the importance of spatial extents greater than 800 ha and perhaps exceeding 7200 ha for some species. Previous studies that found local factors as better predictors may have evaluated landscape parameters at incorrect spatial extents. An incorrect selection of spatial extents may lead to misinterpretation of broad-scale processes, which can have undesired consequences for designing management strategies for species conservation.
The pace and scale of development is contributing to growing impacts and increasing cumulative environmental impacts and set acceptable environmental thresholds and limits on development on air, land, wildlife, water and climate and examine how a failure to manage oil sands development in Canada, provide an overview of environmental impacts of oil sands impacts on wildlife and ecosystems. This presentation will describe the current approach to oil sands development in Canada, provide an overview of environmental impacts of oil sands development on air, land, wildlife, water and climate and examine how a failure to manage cumulative environmental impacts and set acceptable environmental thresholds and limits on the pace and scale of development is contributing to growing impacts and increasing attention from around the world.

**Death by a Thousand Cuts? - an introduction to oil sands development in Alberta, Canada**

- Simmons, D.; The Pembina Institute; simond@pembina.org

Oil sands deposits underlay 140,000km² of Alberta, Canada - an area the size of Florida and by volume represent the world’s second largest recoverable oil deposit. Oil sands production of tar-like bitumen already exceeds 1.3 million barrels per day and is projected to increase significantly as new projects are developed. Oil sands development takes two forms: where oil sands are close enough to the surface it is strip-mined, where the deposit is deeper in situ techniques are used to extract the bitumen, most commonly involving injecting steam underground. Already, over 80,000 km² of lands have been leased for oil sands development - a process that includes no environmental assessment. Both processes have significant impacts on wildlife and ecosystems. This presentation will describe the current approach to oil sands development in Canada, provide an overview of environmental impacts of oil sands development on air, land, wildlife, water and climate and examine how a failure to manage cumulative environmental impacts and set acceptable environmental thresholds and limits on the pace and scale of development is contributing to growing impacts and increasing attention from around the world.

**Enhancing the role of local communities in managing coastal zones is an increasing commitment by governments in East Asia, including Japan. The Sato-umi Initiative is a traditional Japanese practice characterized by the harmonious interaction of local communities and coastal environment while preserving the traditional/local knowledge practiced by these communities. This paper discusses sato-umi conservation effort which regarded as a management option to reverse destruction of coastal habitats and support biodiversity conservation in Noto Peninsula. This study considered people’s perceptions relating to sato-umi such as dependence on coastal resources, resources’ condition, threats and support for the conservation and management of the bay. The Noto experience has shown that participatory approach working with stakeholders is effective in addressing coastal issues at the local level. Attention should focus on the need to link local concerns, needs and actions to the national and international level activities to conserve and manage the coastal and marine ecosystems. Results recognize that co-management, community-based approaches and traditional knowledge can be appropriate in dealing with coastal management. Finally, lessons from the initiative may provide a conservation model that Japan can share throughout the world. Some aspects relating to sustainable management processes may be suitable and relevant under certain scenarios.**

**Defining intrapopulation variation in the foraging behaviour of Arctic grizzly bears**

- Edwards, Mark; Derchner, Andrew; Hobson, Keith; Branigan, Marsha; Nagy, John; Royal Alberta Museum, University of Alberta, Environment Canada, Government of Northwest Territories; Mark.Edwards@gov.ab.ca

Frequently, broad dietary categories are ascribed to populations, which can mask intrapopulation variation and as a result we may fail to meet the needs of certain segments within the population. To examine intrapopulation diet variation, we used stable isotope analysis (δ13C, δ15N) on hair and claw from 52 grizzlies (2003-06) from Arctic Canada. We examined within-population differences in foraging and the relationship between trophic position (i.e., δ15N) and range use. Values of δ15N in hair and claw (2.0‰ - 11.0‰) suggested a wide niche width. Cluster analysis identified 3 foraging groups ranging from near-complete herbivory to near-complete carnivory. Although we found no linear relationship between home range size and trophic position when data was pooled or when grouped by foraging behaviour, movement was positively correlated to trophic position. To determine the proportional contribution of seven prey sources within each foraging group we used multi-source dual-isotope mixing models. The mean bear dietary endpoint across all grouped by foraging behaviour, movement was positively correlated to trophic position. To determine the proportional contribution of seven prey sources within each foraging group we used multi-source dual-isotope mixing models. The mean bear dietary endpoint across all grouped by foraging behaviour, movement was positively correlated to trophic position. To determine the proportional contribution of seven prey sources within each foraging group we used multi-source dual-isotope mixing models. The mean bear dietary endpoint across all grouped by foraging behaviour, movement was positively correlated to trophic position.
SY24 Eisenbeis, G*; Eick, K; Non-SBC member; geisenbe@uni-mainz.de
Attraction of nocturnal insects to street lights with special regard to LEDs
Artificial lighting is a key factor for nocturnal insects, which are attracted in huge numbers to many sorts of light sources. Millions of lights illuminate urban areas and extend deeply into the open landscape, especially along roads. In the summer of 2008 the City of Düsseldorf initiated a study to evaluate the insect flight activity to street lights. We compared modern lamp types such as metal halide and LEDs to older lamp types, e.g. high pressure mercury lamps, high pressure sodium lamps and fluorescent lamps. From June 24 to September 2, we used 20 traps to catch insects flying around the street lamps in a suburban area of Düsseldorf. Traps were exposed in a daily pattern. We analyzed 964 nightly samples containing 33,896 insects belonging to 13 insect orders, of which 7 predominated while 6 were counted only in lower numbers. In comparing the flight activity we used the attraction to the high pressure mercury lamps as reference (=100%). On this basis we determined a sequence of attraction for all insect orders down to -80%. The 7 most common attraction to the high pressure mercury lamps as reference (=100%). On this basis we determined a sequence of attraction for all insect orders down to -80%. The 7 most common orders behaved very differently, e.g. the moths were attracted to minimum values in the range of -95%. Two orders were found to be attracted stronger than the reference. The most significant differences regarding the bulk of insects were between LEDs and all the other lamp types. They did not emit any UV and proved to be very insect friendly.

SY26 Eldridge, D.J.*; James, A.I.; Whitford, W.G.; University of NSW, Jornada Experimental Range; d.eldridge@unsw.edu.au
Ecosystem services outcomes from effective conservation: soil-foraging animals restore degraded rangelands
Animal reintroductions are increasingly popular in many ecosystems. Although their primary goal is to increase the size of dwindling populations, there is increasing recognition that reintroduced animals have the potential to contribute positively to the restoration of degraded ecosystems. Surface disturbances of soil-foraging animals intercept water, sediment, seed and litter, are areas of higher moisture and litter mass, and nutrient-rich hotspots of litter decomposition. We consider five propositions related to the effect of the pits of soil-foraging animals on ecosystems: 1) foraging pits provide the mechanism and focus for the concentration of critical resources in both space and time, 2) pits buffer resource pulses, allowing plants to withstand resource-poor pulse periods, 3) pits enhance biotic decomposition at the expense of abiotic breakdown, contributing positively to soil nutrient stores, 4) disturbance leads to the formation of soil biomantles, and 5) pits maintain a diversity of niches by creating patterns of enhanced moisture and nutrients within a relatively homogenous matrix. We consider these propositions by examining the effects of native animals on soil and ecological processes, with special reference to the semi-arid woodlands of eastern Australia and the desert grasslands of south-western United States.

PI.9 Elia PÁdez-Reyes*; Carolina Franco-Espinosa; Jorge DÁvila-Osorio ; Javier Hernández-Fernández; 1GENA TICA, BIOLOGÍA A MOLECULAR & BIOINFORMÁ TICA LABORATORIO DE BIOLOGÍA A MOLECULAR, CARRERA DE BIOLOGÍA A MARINA, FACULTAD DE CIENCIAS UNIVERSIDAD JORGE TADEO LOZANO Cra. 4 No 22-61, Bogotá, Colombia; javier.hernandez@udea.edu.co
RFLPs OF THE MITOCHONDRIAL GENE COI: A STRATEGY TO IDENTIFY SPECIMENS OF HAWKBILL TURTLES Eretmochelys imbricata (Cheloniidae/Testudines)
The hawksbill turtle Eretmochelys imbricata is subject to heavy exploitation of its carapace and plastron for making handicrafts. In recent years there have been listed as critically endangered species. Due to the above condition it makes relevant to identify at any level the entire life cycle of this turtle, in order to establish the current status of this population and provide information for its conservation. The COI gene works as a molecular label used to combat the illegal trafficking of specimens and their derivatives. We used 15 samples of peripheral blood of juveniles from the San Martin de Pajarrales Island (Colombian Caribbean) from which total DNA was extracted and the COI gene amplified by PCR using specific primers. The amplified fragment was cut with the enzymes HpaII and BfaI and produced a band pattern of 432, 318, 240 and 158 base pairs. This pattern was compared in silico bioinformatics analysis of this gene for closely related species like the green turtle (Chelonia mydas) and freshwater turtles. Different patterns were observed, concluding that COI gene is a molecular tag usable for the identification of this species studied.
Matrix models are the foundation of most population viability analyses. However, they are often based on relatively little data, and use of predictions from these models remains controversial. We, first, quantified how matrix models are used in conservation and management, across 355 published models for plant populations. Most uses do not involve quantitative predictions, which means these models could be useful even if they do not provide accurate forecasts. We also used long-term data to test the predictive accuracy of matrix models, making forecasts with 5-15 years of data, and comparing these to observed population fates, 5-10 years after the data used to parameterize models were collected. Overall, population growth rates from stochastic matrix models were statistically significant correlates of change in population size. However, population size fell out of 95% projection limits substantially more than 5% of the time, in spite of the fact that confidence limits were wide, often spanning orders of magnitude. We discuss the implications for application of matrix models to conservation and management.

Back to the Future: Testing the predictive power of demographic matrix models for plant populations

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**P2.187** Enrico Di Minin*, Peter S. Goodman; Rob Slotow; Robert J. Smith; Institute of Conservation and Ecology (DICE), University of Kent, Canterbury, UK; Biodiversity Research Division, Ezemvelo KwaZulu-Natal Wildlife, Cascades, RSA; Amarula Elephant Research Programme, School of Biological and Conservation Sciences, Westville Campus, University of KwaZulu-Natal, Durban; ed66@kent.ac.uk

**Planning the return of the big game to KwaZulu-Natal: integrating distribution and spatially explicit metapopulation models**

Species distribution modelling and spatially explicit metapopulation models are important techniques for generating data as inputs into conservation planning. Here we discuss the use of the Maximum Entropy (MaxEnt) modelling approach, in combination with the spatially explicit metapopulation program RAMAS GIS, to model the potential distribution and total carrying capacity of lion, leopard, cheetah, African wild dog, elephant and black rhino in KwaZulu-Natal. MaxEnt models were fitted using presence records derived from ongoing research and monitoring in the area, as well as ecoregographical variables thought to affect species distribution. The effect of spatially autocorrelated sampling was examined by applying a spatial filter to the presence-only data. Resulting distribution maps were included into RAMAS GIS to define a metapopulation structure using a habitat suitability threshold and foraging distance for each species. Total carrying capacity for each species was then calculated by dividing the spatial extent of each population by its population density estimate. Area under the curve values indicated the distribution models were 'highly accurate'. This process identified a different number of viable patches for each species, although the total area of suitable habitat and the median patch size was species dependent. Overall, results showed that KwaZulu-Natal contains important patches of unprotected habitat and that the current population size for each species is below total carrying capacity.

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**SP2.10** Erb, LP*; Ray, C; Guralnick, RP; University of Colorado at Boulder; liezl.peterson@colorado.edu

**Climate drivers of pika persistence in the Southern Rocky Mountains**

Alpine species are among those most threatened by climatic shifts due to their physiological and geographic constraints. The American pika (Ochotona princeps), an alpine mammal found in rocky habitats throughout much of western North America, has experienced recent population extirpations in the Great Basin of the United States. These trends have been linked to climatic drivers, and the species was recently considered for protection under the Endangered Species Act (ESA). The species was not listed under the ESA, in part because it remains unclear whether the patterns of climate-related loss observed within the Great Basin extend to other portions of the species’ range. Currently, we are investigating the distribution of the American pika and the climatic processes driving these patterns within the Southern Rocky Mountain region. Following a resurvey of 69 sites historically occupied by pikas, data indicate that few populations have been extirpated within this region over the past few decades. Despite relatively few extirpations, low annual precipitation is implicated as a limiting factor for pika persistence in the Southern Rockies. Extirpations occurred only at sites that were consistently dry over the last century. While there is no climate change signal in these results, these data provide valuable insight into the potential future effects of climate change on O. princeps throughout its range.

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**4.4** Erickson, M.E.*; Boyce, M.S.; Found, C.; University of Alberta, Alberta Sustainable Resource Development; m.erickson@ualberta.ca

**Western Grebe (Aechmophorus occidentalis) abundance relative to persistence in Alberta, Canada**

The Western Grebe (Aechmophorus occidentalis) is a Species of Special Concern in Alberta, Canada that has undergone a 37% decline in distribution and 76% decline in abundance on 43 lakes over the past 40 years. Using a known former distribution of grebes, we evaluated how environmental variables including emergent vegetation, human development, and prey availability affect Western Grebe abundance relative to persistence. The small-population paradigm states that small populations are less likely to persist. However, persistence and abundance were weakly correlated among Western Grebe populations, suggesting that persistence alone may not adequately reflect the extent of the species’ decline. Both abundance and persistence were positively associated with shoreline bulrush (Scirpus lacustris) and human development in a 500m buffer surrounding the lake, while inversely associated with surrounding forest cover. Bulrush is known to provide important habitat for nesting, but the relationship with recreational development puts grebes at risk for future disturbance and habitat loss—a primary threat to endangered birds. We recommend that shoreline vegetation remain intact to maximize grebe breeding success and recruitment, and human activity around colonies should be kept to a minimum to curb further Western Grebe decline.

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**SY15** Ervine, K; Trent University; kateervine@trentu.ca

**The Contradictions of Market-based Conservation and Development: Lessons from the Mexico-Mesoamerican Biological Corridor in Chiapas, Mexico**

This paper examines the implementation of the Global Environment Facility’s (GEF) Mexico-Mesoamerican Biological Corridor in the Lacandón Jungle of Chiapas, Mexico. As an Integrated Conservation and Development Project, the Corridor is rooted in what the author refers to as the GEF’s “Universal Blueprint,” a program of biodiversity’s marketization as simultaneous conservation and poverty reduction strategy. It is argued that the Blueprint, whose framework both assumes and demands clearly delineated private property rights as the vehicle for determining payments for the preservation of ecosystem services, denied the existence of Chiapas’ historic conflict over land, thereby adding a new layer to it. This paper warns that the increasing ubiquity of market-based conservation strategies such as the Corridor threaten to lead to, or exacerbate, conflicts over land and resources with the outcomes tending to favour more powerfully-situated local actors. In this, such projects, rather than solving poverty and inequality, may lead to new forms of marginalization.
Using ecosystem models for marine management
Sea otters are widely regarded as a keystone species, able to structure nearshore marine environments by releasing macro-algae from grazing pressure. This restructuring can shift an invertebrate-dominated nearshore system (urchin barrens) into a kelp-dominated system, which is assumed to support a greater biomass and diversity than the urchin barrens. The nearshore ecosystem on the west coast of Vancouver Island (WCVI) is experiencing these shifts because of the reintroduction of sea otters in the 70’s, affecting those who depend on the natural resources. To manage this ecosystem, an integrated understanding of the ecosystem dynamics (including human interactions) is required. To contribute to this, I am building an ecosystem model using Ecopath with Ecosim (EwE), a software widely used for aquatic ecosystems. The model represents key ecosystem dynamics such as the relationship between sea otters-urchins-kelp forests as well as the indirect benefits provided by kelp forest to the ecosystem. Finally, it integrates information about the whole ecosystem since the reintroduction of sea otters to represent current and predict potential impacts to human activities.

Structured decision making for aquatic ecosystem management
I used the structured-decision making (SDM) to support the on-going marine planning process under development by West Coast Aquatic (WCA) - a multiple stakeholder body charged with managing the aquatic ecosystems on the west coast of Vancouver Island (WCVI). Usually, when individuals face complex tasks or problems, they make decisions by instinct, often ignoring or misprocessing important information (McDaniels, Gregory et al. 1999; Keeney and Gregory 2005). In multiple stakeholders’ processes, where participants have conflicting objectives, the instinctive way to make decisions can lead to social conflicts, disagreement towards the alternatives or decisions advocated by strong personalities in the group (McDaniels, Gregory et al. 1999; Gregory, McDaniels et al. 2001). SDM is a systematic approach to making better decisions based on the values and objectives of different participants (Clemen and Reilly 2001). I followed this approach to identify and categorize objectives, separate fundamental from mean objectives, and find performance measures for those fundamental objectives. This process helped to identify the most fundamental objectives for WCA, to state them in a more measurable way and to find appropriate performance measures. This required the clear understanding of what matters to WCA. Consulting with stakeholders and reviewing other cases significantly strengthen this process.

Plantation clearcut size and the persistence of early successional wildlife populations
Plantation clearcuts represent an important habitat for many open-area wildlife species in landscapes dominated by industrial forests. However, due to the ephemeral nature of clearcuts, species using this type of environment face a “shifting mosaic” in which their ability to successfully relocate to another habitat patch may play a crucial role in the species’ persistence in the landscape. Although several studies have shown a positive effect of patch size on the persistence of prairie species, forest clearcutting represents a special case in which, on average, larger patches also tend to be more isolated from each other, likely creating a trade-off between area and isolation effects. We developed an individual-based spatially-explicit model to test the effect of clearcut size (a critical management variable in plantation forestry) on the persistence of an early successional wildlife species in a landscape dominated by forest plantations. We simulated a landscape covered with a plantation harvested regularly over a 25-year rotation and different versions of a wildlife population whose habitat was constituted only by 1-4 year old patches. We observed that when the species could perceive the attributes of the neighboring pixels persistence time was usually higher at intermediate clearcut sizes agreeing with our prediction. Our results also highlight the importance that basic assumption on movement patterns may have on conclusions drawn from mechanistic simulation models.

Relationship between Hunting Management and Bird Diversity in Small Game Estates in Central Spain
In Europe, hunting and its associated management has been performed for centuries and has had profound effects on our landscapes and on the biodiversity they hold. There are a number of studies addressing the effect of hunting management on the populations of game species. However, the relationship between hunting and non-target species has received much less attention. In this work, we investigated the relationship between hunting management and bird diversity in Central Spain. For this goal, raptors and steppe birds (the two bird groups of most conservation concern present in the area) were surveyed in 53 hunting management units (HMU) with different intensity of game management. Birds were counted from fixed points; an average of 61 fixed points was surveyed in each hunting management unit. On the other hand, the information concerning game management was gathered through interviews with game managers. Among other variables, three hunting regimes were considered: 1) social HMUs are typically managed non-intensively by local non-profit societies; 2) private HMUs are usually intensively managed by game managers with economic interests; 3) intensive HMUs are a special type of private HMU in which the management is almost exclusively based on the legal release of thousands of red-legged partridges (Alectoris rufa). Our results show that the type of hunting regime may affect some variables of biodiversity, such as the total number of steppe birds observed.
Population Dynamics of the Mountain Pine Beetle (Dendroctonus ponderosae; Coleoptera) in the Endangered Whitebark Pine (Pinus albicaulis) Ecosystem

Whitebark pine, an endangered component of western North America's sub-alpine forests is threatened by multiple factors. Over the past 100 years, whitebark pines have been devastated by an invasive fungal pathogen, white pine blister rust. Rising concerns that mountain pine beetle (MPB) outbreaks will further threaten the remaining rust resistant whitebark pines brings urgency to recovery plans for the species. Historically, climatic barriers have offered some protection to whitebark pines from MPB outbreaks; however, recent observations of increasing mortality caused by MPB suggest these barriers are retreating. Laboratory and field experiments were conducted to determine MPB life history parameters in whitebark pine as compared to the MPB's primary host lodgepole pine. The objectives of this study are to better understand the factors influencing the spread of MPB through whitebark pine containing stands. The results of these experiments suggest that different life history strategies of host species will affect the population dynamics of the MPB in whitebark pines and that previously identified climatic boundaries have now receded. We conclude that MPB poses a significant threat to the survival of whitebark pines and consequently, to other species depending upon it.

SY52 Evie Witten*; Steve MacLean; Laura Chartier; The Nature Conservancy; lchartier@tnc.org
Adaptation for Conservation Planning: Incorporating Climate Change Into Strategies and Actions

Changes we can already see are putting people, economies and nature at risk. The Nature Conservancy (TNC) is promoting and implementing comprehensive solutions to reduce emissions, minimize impacts and use the power of nature to keep the things we care about healthy and secure. As part of this effort, TNC has developed a framework for adapting Conservation Action Planning methods to incorporate climate change. A cornerstone of this process is developing "hypotheses of change," which hone in on the critical, specific climate-induced threats a project should address with adaptation strategies. Developing a "hypothesis of change" includes identifying key ecological attributes for a conservation target, identifying the specific climate factors that affect those attributes, estimating ranges of potential change, and estimating the likelihood of the estimated change to occur. In the Western Arctic, a region experiencing rapid and drastic climate change, this approach allowed for a scale-appropriate understanding of climate impacts. For example, a hypothesis for ice-dependent marine mammals highlighted the critical vulnerability of this target as well as the need to focus strategy development on direct habitat loss due to sea ice melt. Innovative strategies growing out of the "hypothesis" process, such as identifying and protecting climate refugia, and connectivity between those areas, will be especially important in the Arctic, where ecosystems are on the leading edge of climate change impacts. Other ways of adapting planning processes, such as understanding and incorporating human responses to climate change, are also part of TNC's guiding framework.

SY36 Ewers, R*; Coomes, D; Kapos, V; Laforetzsa, R; Wearn, O; Imperial College, London, UK, Dept of Plant Sciences, University of Cambridge, UNEP World Conservation Monitoring Centre, Department of Scienze delle Produzioni Vegetali, University of Bari; vul.kapos@unep-wcmc.org
Trends in ecosystem integrity: A new tool for assessing the biological impacts of forest fragmentation

Ecosystem fragmentation and its ecological effects are significant drivers of biodiversity loss, yet changes in fragmentation through time are poorly understood because we lack biologically meaningful indicators to quantify those changes. In order to translate complex spatial patterns of land-cover and land-use into indicators of ecological or ecological impacts, a new generation of landscape metrics is needed. We have developed a statistical method that (1) examines how spatial patterns of ecological communities vary in relation to a range of fragmentation measures at multiple spatial scales; (2) predicts community composition for every forest pixel on a land-cover map; and (3) summarises these maps to calculate a landscape-level estimate of community change, which we term â€” BioFragâ€”. We have applied and tested BioFrag on a range of taxa from study landscapes around the world and at multiple spatial and temporal scales. BioFrag advances methods that quantify the degree of habitat modification and fragmentation from spatial patterns of forest cover alone by calibrating them to reflect observed species responses to those spatial patterns. It represents a significant step towards developing a biologically relevant, landscape-scale index of habitat fragmentation that will ultimately help quantify progress towards globally agreed policy targets on biodiversity and habitat conservation.
SY67 Fabinyi, M.; James Cook University; michael.fabinyi@jcu.edu.au

Experiences with Tourism as an Alternative Coastal Livelihood: An Anthropological Analysis from the Philippines

In the Philippines and many other tropical developing countries, tourism is being enthusiastically promoted by governments and some analysts as a livelihood that is seen as more socially and environmentally sustainable than fishing. Based on long-term, ethnographic fieldwork with fishing communities in the Calamianes Islands of the Philippines, this paper analyses the experiences of local fishers with coastal tourism. The paper demonstrates that while tourism offers the potential for some fishers to adopt a successful alternative livelihood, this potential is strongly influenced by a range of local social factors. For many fishers, tourism has instead created significant problems, particularly with regard to the security of land tenure. The paper concludes that policymakers promoting coastal tourism as an alternative livelihood in the Philippines need to take account of the ways in which the outcomes of coastal tourism are shaped by broader issues of class, land tenure insecurity and governance patterns in Philippine society.

P1.12 Fanny M. Cornejo*, Fanny Fernandez; Departamento de Mastrozooologia, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru, Programa de Educación Ambiental, YUNKAWASI, Lima, Peru; fanny.19m@yahoo.com

An innovative environmental education program for primate conservation in Peru

As one of the most primate-rich countries in the world and with very few people aware of primates’ existence, Peru needed urgently an education program that involved local people and used primates’ charisma for achieving public awareness and a change toward natural resources. The “conservation education program for Peruvian Primates” started in January 2008, in the regions of Amazonas and San Martin, part of the Tropical Andes Hotspot and home of Peru’s endemic primate species -like the yellow tailed woolly monkey, one of the 25 most endangered primates of the world- and Lima, the capital and home of one third of Peru’s population. The program was implemented through workshops, where surveys, audiovisual materials and guide books were distributed to school children and teachers. A total of 8675 schoolchildren and 382 teachers from 30 schools in 25 towns have been involved in the program, being more than 70 % from rural areas surrounded by forests where monkeys occur. Two additional activities were organized to complement the program: a ‘regional drawing contest of Peruvian monkeys” (2008) and a “myths and legends of Peruvian monkeys writing contest” (2009). The products are a Calendar featuring the best drawings and a book with the best works, both distributed freely. The enthusiasm and insight raised but these activities made the program extremely successful, surveys about the importance of the forests have changed radically since the beginning of the program, achieving the first step of the program: knowing the nature is loving it.

P2.82 Farokhkish, Bahram; Gross, Jackson*; Cornachione, Matthew A.; Sheddin, Beth L.; Henry, Theodore B.; Shaw, Steven R.; USGS Northern Rocky Mountain Science Center, Montana State University (Graduate Student), Montana State University, Ph.D. RC UK Academic Fellow/ School of Biomedical and Biological Sciences, Assoc. Prof-PhD Electrical & Computer Engineering, Montana State University; bmbaagleeboy@yahoo.com

Effects of electricity on rainbow trout embryos: A study to determine the efficacy of electricity for the eradication of invasive salmonids

The use of electricity on aquatic species currently only targets free swimming individuals and is not inclusive of early life history stages such as embryos. This study evaluates the susceptibility of embryonic and larval stage rainbow trout to direct DC current between 2-20v/cm in varying conductive waters to determine lethality for eradication efforts. Embryos (n = 10 per exposure) were initially exposed to homogeneous electric fields for 5s with a water conductivity of 220μS/cm from 1 day post fertilization (DPF)/27 temperature units (TU) to 15DPF/405TU. Mortality was assessed 24h post exposure and the LV50 (Lethal Voltage) at 220μS/cm was determined for each TU. Embryos from six periods of development were then exposed to their respective LV50 voltages in varying conductive waters (20-600μS/cm). Susceptibility to direct DC voltages decreased with development. Susceptibility to a constant voltage increased with increasing conductivity and was consistent throughout early development (81TU - 292TU), but the effects of increased conductivity were not enhanced as mortality in eyed embryos after 364TU remained static with the LV50 . These data suggest that a combination of direct DC current and increased localized conductivity would be an effective means of eradicating invasive and nuisance salmonids prior to eyed embryonic stages.

SY22 Ferdana, Z*; Kelly, D; Bruce, C; Odell, J; Taylor, C; Stein, D; Smith, B; Bode, A; The Nature Conservancy, Minerals Management Service, NOAA Coastal Services Center; zferdana@tnc.org

Alternative Energy in the Marine Ecosystem: Building a Collaborative Coastal and Marine Spatial Planning Framework

The seas are no longer a wide-open frontier, and its spaces are broadly allocated and with extensive overlap by many management agencies. Coastal and marine spatial planning (CMSG) is a process to develop a blueprint for area-based management that accounts for multiple management objectives. Many agencies are pursuing CMSP to address the increasing human activities in the marine environment that are progressively more in conflict and thereby affecting the health of the ocean. Here we address two objectives, alternative energy production and biodiversity conservation, as a case study for CMSP in the U.S. Applications for wave and tidal energy projects have dramatically increased in recent years. The National Oceanic and Atmospheric Administration (NOAA), Mineral Management Service (MMS) along with other Federal partners have implemented the Multipurpose Marine Cadastre (MMC) tool as a marine information system in U.S. waters (http://www.csc.noaa.gov/mmc). The MMC contains marine cadastral information such as maritime boundaries and limits and marine managed areas as well as other regionally-specific data in support of planning, management, and conservation of marine spaces. Along with authoritative data sources, the MMC also seeks to incorporate data from trusted sources like The Nature Conservancy (TNC). The Federal government and TNC are collaborating to integrate regional marine habitat and biodiversity information into the MMC in recognition that trusted data sources alongside authoritative ones add significant value in pursuit of CMSG aims. Only by full representation of the marine environment, the ecosystems and the many human uses of them, can the goals of multiple management objectives be adequately considered.
**Customary Forest Tenure in Southern Madagascar: A Contribution to Conservation but Incompatible with Conservation Policy**

Madagascar is undergoing an expansion of its protected areas system, with new protected areas being established in areas of human habitation. Consequently many protected areas now have both customary and state tenure regimes in force, two systems often at odds. Data was collected in 3 protected areas (Irotaka, Ankodida & Anadabolava) using structured household forest use surveys, participatory land use mapping and a survey of expert stakeholders. It was found that the characteristics of contemporary land tenure and conservation policy restrict how customary tenure of forests can be integrated into new protected areas. Restricted consideration of customary tenure and forest based livelihoods presents a challenge to the success of new protected areas. Exceptions to this situation do exist however: sacred forests and species taboos are of importance both to Antandroy culture and biodiversity conservation, and both institutions are frequently part of new protected areas and conservation strategies. However, despite assertions by some scholars and practitioners, there is relatively limited opportunity to base broader conservation strategies on such institutions because sacred forests are limited in scale and species taboos are not enforceable across ethnic groups. Conservation policy should take broader account of Antandroy 'tradition' which also respects the human right to derive a livelihood from the land, be it through deforestation, selective logging, hunting or otherwise.

**Modeling Potential Broadscale Wildlife Dispersal Pathways Within Extant Connectivity in the Western United States**

Wild LifeLines® depict potential dispersal pathways in the US between the Mexican and Canadian borders that emphasize the least human modification and highest extant connectivity for wildlife. These pathways are the result of a novel modeling approach that is based on a Natural Landscapes Index built from layers of land cover types, distance to roads, traffic volume, and housing density, and that identifies the least fragmented connections between remaining natural areas. We present two iterations, one of a branching system of pathways representing flowpaths of highest permeability for wildlife transit between the US borders; the second illustrates flowpaths of highest permeability between Gap 1 and 2 protected areas. Wild LifeLines help identify cores and linkages within conservation planning boundaries that might secure landscape capacity for broad-scale wildlife movement within extant high-connectivity lands. Although LifeLines identify areas important for landscape permeability, the intent is not to prioritize selection of parcels or local scale linkages, but rather to identify the most efficient existing pathways allowing broad-scale, regional dispersal. Wild Lifelines is a powerful new expression of places and pathways that are important for connectivity preservation projects with the goals of mitigating habitat fragmentation, providing for the dispersal of wide-ranging species, and facilitating adaptation to climate change.

**Can Climate Change Swamp Salamander Demographic Rates to Reduce Population Viability?**

Population viability analysis is a frequently used approach to assist in planning for rare species conservation. Although there is increasing interest in understanding the impact of climate change on species, it is often difficult to quantify the mechanistic link between population vital rates and shifts in climate patterns. We conducted a population viability analysis to assess climate impacts for a rare amphibian, the tiger salamander (Ambystoma tigrinum). These salamanders breed in artificial wetlands where shifts in rainfall patterns could result in complete loss of larval cohorts if wetlands dry too quickly. We first analyzed a deterministic model of population growth to examine its relative importance to adult survivorship, fecundity, and juvenile recruitment. We then simulated population dynamics under three different hydrological regimes: historical wetland flooding patterns based on past climatic data, current wetland flooding patterns based on our observed data, and potential future flooding patterns based on projected climate data. Adult survivorship had four times the effect on population growth as fecundity and twice the effect on population growth as juvenile recruitment. However, simulation results indicate reduced juvenile survivorship from shifts in climate could result in reduced population viability even when adult survivorship remains high.

**Emergence of REDD as a conservation finance strategy: insights from national process and a pilot project in Madagascar**

Madagascar is well known as a global biodiversity conservation priority and this led to significant changes in forestry policy over the last two decades. Integrated Conservation and Development Projects (ICDP’s), Ecoregion Conservation, Community Forestry and Co-managed Protected Areas all became part of Madagascar’s conservation policies. Most recently REDD emerged as a dominant global conservation finance mechanism, and NGOs in Madagascar were quick to establish five pilot REDD projects across the island. Projects were financed by bilateral and multilateral donors, Conservation NGOs themselves and the Private Sector. This paper will present analysis of national policy processes around Payments for Ecosystem Services (PES) through REDD on the island and these national level insights on policy will be put into context by case study material from a WWF run REDD Pilot Project in the southern spiny forest. The characteristics of local forest peoples livelihoods, customary tenure arrangements, forest carbon estimates and an institutional analysis of the new forest management arrangements of the REDD pilot project will be presented. The paper concludes with analysis from both national process and the site specific case, considering what potential the project has to finance conservation and local development as well as what challenges face the REDD approach in Madagascar in terms of policy effectiveness to deal with local livelihoods and customary tenure.
5.2 Figel, Joe; University of Central Florida; jofigel@hotmail.com

A cross-site comparison of jaguar (Panthera onca) conservation in community protected areas in Oaxaca and non-protected forest in Nayarit, Mexico

Most jaguar (Panthera onca) studies in Mexico have been conducted in lowland biosphere reserves despite substantial jaguar populations occurring outside protected areas (PAs). This study investigated jaguar ecology in two landscapes of varying protection and habitat types. Both study areas - the Chinantla in Oaxaca and the San Blas Municipality in Nayarit - are priority sites for jaguar conservation. The Chinantla is a remote, montane region populated by Chinantec indigenous peoples in the Sierra Norte of Oaxaca where the four study communities have declared 205 km² of their land as community protected areas (CPAs). In Nayarit, significant jaguar populations occur in non-protected, coastal forests despite greater human disturbance and the absence of PAs. Data on jaguar presence, livestock depredation, and human hunting of prey were collected at both sites. Camera-traps registered two jaguars in a 144 km² study area after 1,164 trap nights (TN) in the Chinantla. In San Blas, three times as many jaguars (six) were identified after 1/3 of the survey effort (308 TN) in a study area half the size as in the Chinantla (less than 75 km²). This was the first study to systematically assess the status of the species in both CPAs and non-protected forest in Nayarit.

5.63 Findlay, C.S.; Doak, D.F.; Wolf, S.; Mooers, A.O.; University of Ottawa, University of Wyoming, Center for Biological Diversity, Simon Fraser University; amooers@sfasca.ca

Critical Habitat for imperiled species: some Canada-US comparisons

There is evidence that Critical habitat (CH) designation is correlated with improving viability of listed species in the USA, but such designation has been contentious and unevenly applied under both the ESA and SARA. For example, 88% of listed plants in Hawaii have CH designations, 27% in California do, while elsewhere in the USA, the range is 18% to 0%. Lawsuits regarding CH are not uncommon under the ESA. Recent legal decisions in Canada should help clarify policy on designating CH under SARA. Prior to these court decisions, of the 99 species with Recovery Strategies on March 19, 2009, only 19 species had CH at least partially identified, and of these, 17 had CH identified either entirely or partly within existing protected areas. Interestingly, only 10% of listed species had CH identified under the ESA by the year 2000. Under both SARA and ESA, delineation of CH makes particular places, individuals and governments specifically responsible for the welfare of an imperiled species, a daunting responsibility. We conclude with thoughts on how to solve this roadblock in order to hasten action on species protection.

7.6 Finkelstein, ME*; Doak, DF; Grantham, J; George, D; Smith, DR; University of California Santa Cruz, University of Wyoming, United States Fish and Wildlife Service, National Park Service; myra@ucsc.edu

Lead poisoning in the endangered California Condor (Gymnogyps californianus): Evaluating sources and effects of lead exposure in an avian scavenger

Endangered California Condors (Gymnogyps californianus) continue to be lead poisoned on a regular basis and lead is regarded a major factor limiting their recovery. Although lead ammunition is considered the primary source of lead poisoning to condors, direct evidence is limited. We used lead isotopic analysis of blood samples collected from pre-release (n = 17) and free-flying condors in California (n = 70) and a representative selection of lead-based ammunition (n = 71) to evaluate the likelihood that condors are exposed to a lead source consistent with that observed in lead ammunition. Using an isotopic mixing model, we found that ~90% of the condor blood samples had an isotopic composition that is explained by exposure to lead-based ammunition. To evaluate the sub-lethal health impacts of lead exposure in condors, we measured aminolevulinic acid dehydratase (ALAD) activity in condor blood samples (n = 60). We found a significant negative relationship between ALAD activity and blood lead concentration with a > 60% inhibition in birds with blood leads > 20 μg/dL. Out of 760 condor blood samples collected between 2004-2009, ~35% had blood lead ≥ 20 μg/dL, suggesting that a large percentage of free-flying condors are chronically exposed to lead levels well-known to produce morbidity. Our work demonstrates that ammunition is the principal source of lead poisoning to California condors and ~1/3 of free-flying condors are experiencing toxicological effects from lead.
Risk factors for an at-risk carnivore: Wolverine density and habitat selection on the edge of the Canadian Rockies.

Assessing the conservation status of rare and elusive species is difficult, as the probability of falsely detecting absences is high. However, rare species are often the ones most in need of status assessment for legal designation - a conservation catch-22. This is the case for Alberta wolves (Gulo gulo), which historically occupied most of the province but have declined in the last century. Wolves' population size and distribution in Alberta had never been studied. We sought to inform these estimates and identify natural and anthropogenic landscape features that affect wolves' distribution. We used camera trapping and noninvasive genetic tagging to survey wolf occurrence in a protected mountain forest landscape with extensive forest harvesting and energy development. Wolf density was markedly higher in the undeveloped landscape than the adjacent developed landscape. Wolves selected habitats with rugged topography and avoided high densities of linear features associated with energy development. In this major energy-producing province, our research impresses the need for wolves to be explicitly considered in landscape management plans. It also illustrates the need to sample and model the detectability and occurrence of rare and elusive species where landscape development outpaces ecological data collection.

Changes in land cover, structural connectivity, and occupancy of riparian birds in the Great Basin

Climate and land-use change affect ecological processes, dynamics of patches of land cover, and viability of faunal populations. Management treatments like riparian restoration and prescribed fire also may change the structural connectivity of species' habitats. We examined current and projected future avifaunal responses to natural and anthropogenic land-cover change in the central Great Basin of the western United States. We used multiple sources of free remote sensing data at 1-10 m resolution and field data to develop comprehensive maps of riparian land cover at 10 m resolution. This is the first robust, spatially extensive representation of the distribution and composition of riparian cover in the region. We applied the recently developed tool Zonation to optimize the quantity and connectivity of riparian habitat for multiple species of birds over time under different scenarios of environmental change. Selection of abiotic and biotic components of riparian habitat included in the models was based on empirical data on relationships among topography, vegetation, and occupancy of birds. Scenarios were spatially and temporally explicit, and were derived from existing knowledge and hypotheses about the response of plants, animals, and ecological processes to climate, land-use change, and potential management actions.

SY10 Fisher, J A; University of East Anglia, UK; janet.fisher@uea.ac.uk

No pay, no stay?: Exploring local systems of environmental value under a payments for ecosystem services model.

A thread running through the literature on PES has raised questions about how a conditional, cash reward for service provision interacts with the systems of environmental value held by local people involved in PES. There is the possibility that local people will start to value natural resources more highly, responding to the external value demonstrated by the incentive. However, there is also the potential for payment systems to crowd out locally rooted systems of environmental value. This has led to the concern that PES may foster a "no pay, no stay" culture, where the behaviour providing the service is solely dependent on receipt of payments, and will therefore cease if payments stop. Little work has considered these issues empirically in relation to PES. This paper presents findings from a case study in rural western Uganda where communities have been paid in exchange for carbon sequestration, in an area bordering a forest reserve. The paper investigates the importance of the monetary incentive in changing people's behaviour relating to trees in the landscape, and explores the systems of value which local people hold for natural resources. It draws upon evidence from qualitative interviews, ranking exercises and ethnographic methods. Findings show that the monetary incentive far outweighs other motivations for environmental stewardship, although some interesting differences arise in relation to different forest management regimes. The paper considers the implications of this for the sustainability of PES interventions. While this is particularly pertinent for afforestation schemes due to a common mismatch between payment timescales and contract length, the findings are of wider importance for developing PES and REDD programmes.

SY24 Fleishman, E*; Dickson, BG; Dobkin, DS; Leu, M; Thomson, J; University of California, Santa Barbara, Northern Arizona University, High Desert Ecological Research Institute, College of William and Mary, Monash University; fleishman@bren.ucsb.edu

Changes in land cover, structural connectivity, and occupancy of riparian birds in the Great Basin

Climate and land-use change affect ecological processes, dynamics of patches of land cover, and viability of faunal populations. Management treatments like riparian restoration and prescribed fire also may change the structural connectivity of species' habitats. We examined current and projected future avifaunal responses to natural and anthropogenic land-cover change in the central Great Basin of the western United States. We used multiple sources of free remote sensing data at 1-10 m resolution and field data to develop comprehensive maps of riparian land cover at 10 m resolution. This is the first robust, spatially extensive representation of the distribution and composition of riparian cover in the region. We applied the recently developed tool Zonation to optimize the quantity and connectivity of riparian habitat for multiple species of birds over time under different scenarios of environmental change. Selection of abiotic and biotic components of riparian habitat included in the models was based on empirical data on relationships among topography, vegetation, and occupancy of birds. Scenarios were spatially and temporally explicit, and were derived from existing knowledge and hypotheses about the response of plants, animals, and ecological processes to climate, land-use change, and potential management actions.

P1.45 Fleming, MA*; Roby, DD; Irons, DB; Bixler, KS; Ostrander, EA; Cook, JA; Biology Department and Museum of Southwestern Biology, University of New Mexico, Albuquerque, New Mexico 87131, Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, Oregon 97331, Migratory Bird Management, U. S. Fish and Wildlife Service, 1011 East Tudor Road Anchorage, Alaska 99503, National Human Genome Research Institute, National Institutes of Health, Bethesda, Maryland 20892; maflemm@myuw.net

Detecting admixture of fur farm mink in native populations in Prince William Sound, AK

Prince William Sound (PWS), Alaska supports native mink on its nearshore islands and mainland, but non-native mink were also introduced to small islands in the 1900s for fur farming. We used a multigene approach to determine whether mink on the Naked Island Archipelago (NIA) were native or introduced via fur farms. Using 309 bp of mtDNA control region (n=135) and 10 microsatellites (n=211), we analyzed samples from 7 PWS localities (including Montague I. where fur farm mink were introduced in 1951), 2 fur farm color phases, and 8-24 localities across North America. MtDNA distinguished mink from eastern and western North America; contemporary fur farm mink had ancestry from both regions. Fur farm ancestry on NIA is evident from the single "eastern" haplotype there (n=9) and nowhere else in the west except Montague I. (1 of 9) and Knight I. (3 of 7), 6 km from the NIA. In contrast, nuclear analyses supported fur farm ancestry for Montague I. (e.g., high allelic richness, 24% of alleles found nowhere else in PWS) but native ancestry for NIA mink (e.g., low allelic richness, 95% of alleles shared with Knight I.). Either there was once a fur farm on the NIA, or admixed mink colonized or were introduced from Knight I. (which had fur farms nearby). Knowledge of the phylogeographic history of mink in NA and PWS was critical to determining the origin of NIA mink, which have decimated seabird colonies there in the last decade.
Political ecologists have increasingly drawn attention to the potential of conventional biodiversity conservation strategies to exacerbate the very socioeconomic inequality that, these critiques argue, underlies much natural resource degradation. Responding in part to critiques such as these, most contemporary conservationists now incorporate poverty alleviation in their agendas. Yet while such efforts, in their increasing emphasis on neoliberal, market-based income generation initiatives, may acknowledge political ecologists' diagnoses of the causes of environmental degradation, the solutions these critics advocate-focused, in the Marxist tradition, on fundamental redistribution of resource access—are commonly ignored. From a Marxist perspective, however, capitalist strategies will likely exacerbate the very poverty they ostensibly redress—or at best, merely redistribute the field of gainers and losers. Thus, much contemporary conservation seems to present a paradox, validating its critics' identification of inequality as a driver of resource degradation yet overlooking these same critics' identification of capitalist markets as a driver of this inequality. The results is a situation whereby poverty appears to be explicitly acknowledged and addressed as a major impediment to global conservations efforts while in practice this poverty may be largely neglected. Hence, inequality may constitute something of a "public secret" in conservation discourse at present, its importance and origins simultaneously acknowledged and denied. I illustrate this analysis with an examination of contemporary conservation practice in Costa Rica’s controversial Osa Peninsula.

17.5 Foley, ML*; Krauss, SL; University of Western Australia, Botanic Garden and Parks Authority; michalie.foley@bgwa.wa.gov.au
Population Size Effects on Genetic Pattern and Process in Banksia ilicifolia: Consequences for Conservation and Ecological Restoration

With the increasing desire of the community to own new houses, Banksia woodlands within the biodiversity hotspot of Southwest Western Australia are increasingly in high demand for housing estate developments in both urban and regional areas. This pressure of increased human encroachment has reduced population size and increased isolation which can be associated with a suite of genetic problems including loss of genetically differentiated populations, increased inbreeding and loss of genetic variation due to genetic drift. This project focuses on exploring genetic structure and the underlying genetic processes in the tree Banksia ilicifolia, a species that is naturally disjunct in its distribution. This common, wide spread species will serve as a model for understanding gene flow processes in a fragmented landscape. This project is being achieved through the use of microsatellite markers and paternity analysis of large and small populations within the Perth metropolitan area. With this knowledge of pollen dispersal it can be seen whether barriers such as roads, houses and gardens act as barriers and corridors. It can also inform land managers and housing estate developers on how new developments should be designed to for the long term sustainability of both common and rare plant populations.

P2.144 Flockhart, DTT*; Martin, TG; Norris, DR; University of Guelph, CSIRO Sustainable Ecosystems; dflockha@uoguelph.ca
Optimizing Conservation Investment for Migratory Monarch Butterflies in Eastern North America

Conservation planning for migratory species should attempt to maximize population size and probability of persistence during all aspects of the annual cycle. Migratory monarch butterflies (Danaus plexippus) in eastern North America face threats from loss of breeding habitat, reduction of food resources on migration, and degradation of specialized winter habitat. We will use decision theory to address two questions. First, what is the optimal land conservation strategy to maximize population size of monarchs across the entire distribution? Guided by land cost and a population model we will use dynamic programming to optimize how resources should be allocated between breeding, migration, and wintering locations at a continental scale. Second, what set of actions will maximize monarch population persistence on the winter grounds when considering three conservation actions: combating illegal forestry, supporting reforestation programs, or enhancing habitat quality? We will solicit expert opinion to gauge the likelihood of success of each action and use stochastic dynamic programming to determine the optimal investment schedule and action sequence, based on financial cost and ecological benefit, for wintering monarchs. We will provide strategies to protect migratory monarch populations at a vulnerable stage of their life history and across political boundaries and offers a framework that could be used to manage any migratory species with a complex migration facing multiple threats.

P2.40 Foley, MM*; Halpern, BS; Micheli, F; Armsby, MH; Caldwell, MR; Crain, CM; Pruhler, E; Sivas, Deborah; Center for Ocean Solutions, National Center for Ecological Analysis and Synthesis, Hopkins Marine Station, Stanford University, University of California Santa Cruz; mmfoley@stanford.edu
Guiding ecological principles for marine spatial planning

The declining health of marine ecosystems around the world suggests that the current structure of sectoral governance is inadequate to successfully sustain human uses of the ocean and support healthy coastal and ocean ecosystems. One possible solution to this problem is ecosystem-based marine spatial planning (EB-MSP), which aims to maintain sustainable uses, healthy ecosystems, and the delivery of ecosystem services. In order to achieve these goals, EB-MSP must be based on ecological principles that articulate scientifically recognized attributes of healthy, functioning ecosystems that can be incorporated into a decision-making framework. We present recommendations based on a synthesis of previously suggested principles, along with recommendations generated by a group of twenty marine scientists with diverse backgrounds and perspectives on MSP. The four ecological principles - maintaining or restoring (1) native species diversity, (2) habitat diversity and heterogeneity, (3) key species, and (4) connectivity, and two additional guidelines, (1) context and (2) uncertainty - must be explicitly taken into account in the planning process. When applied in concert with social, economic, and governance principles, these ecological principles can inform the designation and siting of ocean uses and the management of activities in the ocean to maintain or restore healthy ecosystems, allow delivery of marine ecosystem services, and ensure resilient economic and social communities.
Sustainable Wildlife Use: Can Africa and Canada share some lessons?
What are the best ideas in sustainable wildlife use to emerge from Sub-saharan Africa and Canada in the last century and are any of these ideas transferable across the political, ecological, cultural, economic, and latitudinal distance between continents? What are the limits of subsistence harvesting rights in various African contexts? Can scientific knowledge interface with traditional wisdom and understanding?

P1.165 Forsström, Sofie; Jefferys, Josephine; Scott, Makrina; Tremblay, Candice*; Augustana Campus, University of Alberta; candice.tremblay@ualberta.ca
Inter-specific Differences in Habitat Selection and Human Tolerance of Iguanids in a Dry Forest Mosaic
Two rapid assessment surveys were conducted in 2007 and 2009 to determine habitat preferences and effects of trail-use intensity on escape behaviours of the green iguana (Iguana iguana) and black spiny-tailed iguana (Ctenosaura similis). Five habitats with varying levels of human presence were surveyed using transects in a small, dry-forest mosaic in Guanacaste, Costa Rica. Species distributions differed significantly among habitat types ($X^2=60.40, P<0.05$). Keywords: Nest, topographical features, Pleskes Ground Jay, active nest, old nest, site selection.

Foroughi Abari, M; Radnezhad, H*; Islamic Azad University khorasgan (Esfahan) Branch, Islamic Azad University Khorasgan (Esfahan) Branch; maryforo62@yahoo.com
Nest Site Selection by Pleskes Ground Jay (Podoces pleskei)
For many species of birds, habitat selection is of particular importance. However, as of yet no study has been made of the nestling habitats of Pleskes Ground Jay. Apart from the observations made by Zarundy (1911), Farnsworth (1992) and Hamedanian (1991), little is known of this bird’s habitat. The aim of this study is to identify such parameters as proportion of floral cover, density, frequency, bare ground, normal gravel, fine gravel and topographical features of the plots surrounding the active and inactive old nests and their comparison with random sites not selected for nests. Ghareh Tappeh, a protected site with an area of 50,000 hectares south of Yazd Province in the central Iranian plateau was explored in 2005 and 2006 following the Bird Protocol (Martin, T.E. and G.R. Geupel, 1993). Some 30 active nests (14 active nests in 2005, 16 active nests in 2006), 202 inactive nests (30 nests in 2005, 173 nests in 2006) were found and the above parameters were measured for a total 232 nests at random habitat spots. Floral cover, density, frequency, proportion of bare ground and the topographical features were measured at both nest sites and random non-nest sites, for both active and inactive nests during the interval of the first and second year by placing plots and then were compared using a t-test, whereupon no statistically significant difference was observed (p<0.05). Keywords: Nest, topographical features, Pleskes Ground Jay, active nest, old nest, site selection.

The Ecotourism Species Concept: The Manipulation of Taxonomy to Advance Conservation and Tourism Development
Taxonomy has a fundamental role to play in setting conservation priorities because population sizes and distributions of a given species are only accurate if the taxonomy is correct. Taxonomy, can, however, be misused to elevate particular taxa in order to increase conservation funding, or to act as a proxy for landscape conservation, which has become known, colloquially, as the ‘conservation species concept’. Extending these ideas, this paper reports a case study of penguin taxonomy, conservation and ecotourism on Banks Peninsula, Christchurch, New Zealand. It reveals how a phylogenetic study of the white-flippered penguin (Eudyptula albosignata) appears to have been influenced by a proposal to develop a ‘penguin parade’ in which penguin chicks are translocated to establish a new predator-proof fenced colony in a highly valued and contentious landscape that is more accessible to tourists. We argue that while ecotourism can support conservation initiatives, the use of taxonomic science, and a resultant ‘ecotourism species concept’, to pursue the development goals of ecotourism promoters has the potential to adversely affect the work of both taxonomists and nature conservationists.
Fishing a sinking boat: Tropical shrimp trawl fishers’ knowledge of and attitudes about their fishers

Tropical shrimp trawl fisheries are currently unsustainable, with similar sets of management measures used globally to address the direct and indirect costs of their practices. Yet little is known about shrimp fishers’ perceptions, despite the clear importance of human behaviour in determining the success of fisheries management. We present the results of interviews with industrial shrimp trawl fishers from the southern Gulf of California, Mexico. Fishers were asked to comment on problems facing the fishery, management options to address the issues, and the future of the fishery in general. The interviews also elicited new knowledge on effort and valuable components of bycatch, useful to the management process. Among the problems facing the Gulf’s fishery, fishers tended to identify those generated externally - fluctuations in shrimp populations, increases in fishing effort, decreases in shrimp prices and increasing overheads - and thus distance themselves from responsibility for management options. The successes of any mitigation measures for the fishery are likely to depend on proper enforcement and reliable governance, as our study indicates. Should strong enforcement be put in place, then trawl free areas seem to be the most pragmatic way to alleviate problems associated with the fishery; our effort data point to areas that might have greatest acceptance among fishers. In the long run, however, it may be economic extinction of the fishery that reduces pressure on the marine ecosystem.

Predicting and Mitigating Deer-Vehicle Collisions in an Urban Area

Collisions with deer and other large animals are increasing across North America, and the resulting rise in economic costs and risks to public safety have made mitigation measures a priority for both city and wildlife managers. In the metropolitan area of Edmonton, Alberta, approximately 100 deer-vehicle collisions occur each year, involving mostly white-tailed deer (Odocoileus virginianus). We used a database of collision locations held by City administration and used GIS to identify the characteristics of both collision sites and randomly-chosen sites with a similar spatial distribution. We then created landscape and roadside habitat models to describe and predict deer-vehicle collision locations and frequencies within the city of Edmonton, Alberta. These models suggested that modifying certain landscape and roadside habitat variables could be an effective way to reduce deer-vehicle collisions. We also tested the effectiveness of warning signage at mitigating deer-vehicle collisions. We provided standard-sized deer crossing signs at half of the sites identified to have high rates of collisions. The other half of these sites did not receive signs. After one year, those sites with signs exhibited significantly fewer collisions than non-signed sites did. We conclude that alerting drivers to high-collision locations can be effective at reducing deer-vehicle collisions.
24.5 Francis, Wendy L.; Yellowstone to Yukon Conservation Initiative; wendy@y2y.net
Climate Adaptation in Practice: the Yellowstone to Yukon Conservation Initiative
The impacts of climate change are predicted to be exacerbated by existing conservation challenges. The loss and fragmentation of habitat from transportation and utility infrastructure, human settlement, and resource exploration and development are already major contributors to the accelerating loss of global biodiversity. Fragmented landscapes will pose barriers to plant and animal communities attempting to shift their ranges in response to changing temperatures and precipitation patterns. One highly-recommended management response to both biodiversity loss and climate change impacts is to pursue conservation planning with the goal of implementing large-scale networks of interconnected protected areas. The Yellowstone to Yukon Conservation Initiative (Y2Y) has been implementing and facilitating such a large-scale conservation vision for over 17 years. Its programs have achieved numerous successes in increasing the number and size of core protected areas, securing linkages zones and addressing the impacts of major transportation corridors. The Y2Y initiative represents a globally-leading model of an appropriate response to impending climate-induced biogeographic changes.

P2.11 Fraser, Christopher*; Princz, Juliska; Scroggins, Rick; Environment Canada; christopher.fraser@ec.gc.ca
The Development of New Test Methods for the Assessment of Contamination in Canadian Boreal Forest Soils
Due to significant industrial and commercial development in boreal forest region, there is a recognised need for new standardized toxicity methods for the assessment of soil contamination from these industrial activities. Regulatory authorities have recognized that there is a critical need for new test methods that use plant and invertebrate species representative of the boreal and taiga eco-zones of Canada. Current soil biological methods published by Environment Canada use test species validated for soils of agronomic regions of Canada. Methods are under development which better reflect the unique characteristics of the boreal forest ecosystem (i.e., stratified nature of boreal forest soils, difference in chemical characteristics such as depressed pH, species of plants and soil invertebrates native to forest soils). The current research is focusing on boreal plant species (such as black spruce, golden rod and paper birch), and invertebrates (collembola and earthworms). This poster will focus on the research conducted on the boreal earthworm species Dendrodrillus rubidus and the collembolan species Protosoma minuta.

P1.49 Frazer, KK*; Russello, MA; University of British Columbia (Okanagan); kfraczer@interchange.ubc.ca
Outlier locus detection in kokanee salmon and their utility for informing fisheries management.
Landlocked kokanee salmon (Onchorhynchus nerka) have differentiated into two distinct reproductive ecotypes that occur sympatrically in many post-glacial lakes along Pacific coasts of North America, Russia and Japan. Stream-spawners' migrate up tributaries, build redds and choose mates. Shore-spawners' are a novel form that aggregate along the lake shore to spawn. We are examining genetic variation at expressed sequence tag (EST)-linked and putatively neutral microsatellite loci within and between sympatric kokanee ecotype pairs from several isolated lakes to investigate the following questions: (i) did shore-spawning behaviour evolve independently within multiple lakes or is it ancestral to a single source population, (ii) can loci putatively under selection consistently distinguish sympatric ecotype pairs found in internationally dispersed lakes, and (iii) to what geographical extent can this genetics-based approach improve the accuracy of kokanee stock assessments within lakes. Preliminary results demonstrate significant variation in EST-linked loci exhibiting signatures of a selective sweep (4 outliers) among lakes. Yet, outliers provided superior accuracy in individual assignment and mixed population analyses for Okanagan and Wood Lake kokanee relative to neutral loci. Accurate abundance estimates for these morphologically indistinguishable, but ecologically and evolutionarily unique ecotypes, will better inform fisheries management in lakes where kokanee are of conservation concern.
First evidence of fishing on reproductive aggregation of Ocyurus chrysurus in the Brazilian coast.

The yellowtail-snapper *Ocyurus chrysurus* is an important reef fishery resource, representing a source of food for coastal populations in tropical countries. The Abrolhos Bank, Eastern Brazil, encompasses the largest and richest coral reefs in South Atlantic Ocean. In this study, we report the first evidence of fishing on aggregations of this species in the Brazilian coast. For this, we sampled fish landings, inferred spawning seasons using GSI data and interviewed fishers from May 2005 to October 2007 in four municipalities in the Abrolhos Bank. Temporal variability in spawning activity was evaluated using the GSI. The CPUE data was inspected for peaks. A set of 1850 landings from hook-and-line fisheries was sampled. Peaks in CPUE are observed mainly during the Southern spring and summer. A total of 619 fish were collected and analyzed macroscopically. *O. chrysurus* showed two peaks of reproductive activity, a more intense one between September and October, and another between February and March. The fisher knowledge corroborated our findings: of the 22 skipper interviewed, 7 (32%) felt capable to respond about the spawning season of *O. chrysurus*, which coincided with the two season detected using the CPUE and GSI information. The peaks of CPUE during the spawning season are typical of fisheries upon aggregations of reef fishes. Research efforts are being made to identify the spawning grounds and restrictions of fishing effort and the creation of MPAs are suggested.
Effective conservation of lions in Africa

There is general concern about the status of the African lion with conflict with livestock pastoralists being symptomatic. This trend has triggered conservation action plans at national and regional levels, with some rather high expectations. For example, each state within the current range of the lion should try and conserve at least one representative lion population. These goals may need to be reviewed. The key may be to rather prioritise larger populations. Key issues within realistically viable populations need to be tackled with more urgency. One of these is the issue of disease, with at least two of the six key viable populations already infected with bovine tuberculosis. One of the other key issues is the effect of trophy hunting. Clearly the quotas being set for lion hunting in most areas are very high, and this has infected with bovine tuberculosis. One of the other key issues is the effect of trophy hunting. Clearly the quotas being set for lion hunting in most areas are very high, and this has multiple and largely unknown effects on population performance. Many small isolated lion populations will not be viable in the long term without substantial intervention. Conservationists need to think very rationally about their efforts to ensure the persistence of these populations, which paradoxically are those in which the largest financial resources are being spent. Thus the effective conservation of lions in Africa will depend on a re-prioritisation of scientific effort and financial resources.

A Science-Based Vision for the Recovery of Alberta’s Threatened Grizzly Bear Population

Alberta’s grizzly bear has been recognized as a threatened species requiring recovery efforts. Alberta’s Endangered Species Conservation Committee made this recommendation because of small population size (~800), increasing habitat fragmentation, life-history characteristics that make grizzlies sensitive to human-caused mortality, and limited immigration from other populations. The goal of the Alberta Grizzly Bear Recovery Plan (2008-2013) is to “restore, and ensure the long-term viability of, a self-sustaining grizzly bear population” across “current provincial distribution and occupancy levels.” According to the recovery plan, this encompassing approximately 228,000 km² of western Alberta. Unfortunately, the current recovery plan does not appear to provide adequate amounts of secure habitat to achieve the plan’s stated goal. Based on successful recovery efforts in the U.S., the minimum requirement is to manage approximately 68 per cent of the recovery area as secure habitat. The current recovery plan would likely support a population of approximately 1100 grizzly bears across a much smaller area than was defined in the recovery plan. How many grizzly bears could the recovery area support? Habitat characteristics suggest that with appropriate recovery efforts, more than 2000 grizzly bears could be supported.

The effect of landscape features on boreal woodland caribou (Rangifer tarandus caribou) movement is poorly known, yet such information is important for the management of this threatened ecotype. If there has been restricted movement over time, landscape features may be correlated with spatial genetic structure (SGS). Here, we adopt a novel approach to identify correlates of SGS by examining the fit of landscape models to genetic observations obtained by non-invasive sampling of caribou fecal pellets. We built landscape graphs representing different hypotheses of caribou landscape connectivity, and tested their fit to the spatial genetic data. Fit was assessed using partial Mantel tests with geographic distance as a covariate to control for isolation by distance. We found strong evidence of SGS. Models describing the spatial configurations of treed muskeg and mature black spruce patches had good fits to the SGS. Because caribou are highly mobile, it is unlikely that disconnected habitat alone is determining SGS in this 600,000 ha (approx.) study area. A high cost associated with linear features yielded a 10-fold improvement in our goodness of fit metric and the best fit model overall (Mantel r = 0.29; p < 0.001). This suggests that provincial highways may be acting as barriers. More generally, our work demonstrates how graph theory based models of landscape connectivity can be used to explore SGS.
Ecosystem-based management (EBM) strives to address the inadequacies of traditional single-sector natural resource management approaches by targeting the full suite of ecosystem services being produced in a naturally delineated place, assessing cumulative impacts of different human activities, evaluating tradeoffs between objectives, and engaging stakeholders throughout the management process. Published articulations of EBM contain a variety of distinguishing characteristics, many of which have yet to be fully operationalized among pioneering EBM sites. Disparities between EBM theory and practice have been attributed by some to insufficient translation of EBM principles between scholars and practitioners. To determine the extent to which poor translation is inhibiting EBM implementation, I investigated two EBM demonstration sites on the central California coast, USA: the Elkhorn Slough Tidal Wetland Project (ESTWP) and the San Luis Obispo Science and Ecosystem Alliance (SLOSEA). Twenty-six semi-structured interviews were conducted with practitioners at these sites: ten from the ESTWP and sixteen from the SLOSEA. Distinguishing characteristics mentioned by practitioners in their descriptions of EBM were compared to published descriptions. The results indicate coherence between published articulations of EBM and practitioners’ descriptions within and across sites. This led me to conclude insufficient translation of EBM concepts is not a problem at the ESTWP or SLOSEA. The interviews yielded indications of other EBM implementation challenges, which appear to be playing more significant roles in hindering progress of EBM at these sites.

**2.8 García-González, Claudia*; Garcia-Vazquez, Eva; University of Oviedo (Spain); claudiaggg@yahoo.es**

**Country road and city road. Human constructions as Amphibian shelters.**

In North Iberia (south Europe), eight Amphibian species have been found in troughs constructed for cattle watering in the Trubia valley. Seven of them were in juvenile development stages. Moderate management, presence of sediments in the bottom and abundant floating vegetation were identified as principal factors contributing to Amphibian species richness. However, changes in agriculture activities in the region consisting of decreasing husbandry and increasing tourism are leading to changes in trough use: from cattle watering to loss of function (abandon) or transformation into decorative elements. Most Amphibian species cannot develop in excessively cleaned troughs. As no other sites suitable for reproduction of aquatic amphibians were found in the valley studied, traditional troughs can be considered refuges. Management actions like moderate cleaning and protecting vegetation and bottom sediments are recommended. To compare urban with rural areas, we have sampled a very small urban pond and found abundant populations of two Anurans and one Urodele (Alytes obstetricans, Discoglossus galganoi and Triturus helveticus). The three species present in the pond exhibited high genetic diversity at mitochondrial DNA, comparable to that found for near rural areas with larger water points with Amphibians. Under the current situation of strong Amphibian decline, we suggest that urban ponds are subject of conservation measures.

**SP2.5 Garner, Jocelyn; Thompson Rivers University; jocegarner@gmail.com**

**Once a spadefoot always a spadefoot? Ecology of the Great Basin Spadefoot (Spea intermontana) in a ‘novel’ environment**

The Great Basin Spadefoot (Spea intermontana) ranges from Arizona to British Columbia in western North America, being typically associated with arid grasslands such as in BC’s southern interior. However, they also appear further north in BC, where only pockets of grassland dot a forested landscape and the climate is cooler and wetter. Other than data on their presence at certain breeding ponds in early spring, there is little information available on this population, and it is unknown how they utilize the atypical northern environment. Using telemetry, I am examining core terrestrial habitat and utilized habitat characteristics at two scales for these animals near their northern limit at 70 Mile House, BC, namely mesohabitat (forest vs grassland) and microhabitat (ground cover). In 2009, core terrestrial habitat ranged from 6.4 to 219.5 m from the pond edge (mean=72.1 m). All retreat sites were in open grassland, indicating forested or shrub habitat was not preferred. The strongest predictor for use at the micro-habitat level was bare ground, along with correlated decreases in ground cover (litter, shrubs). My preliminary study suggests that spadefoots at this location are, like conspecifics further south, still tied to open grassland, which is relatively scarce in the northern ecosystem.
P1.140 Garrard, Georgia*; Williams, Nicholas S. G.; Bekessy, Sarah A.; McCarthy, Michael A.; Wintle, Brendan A.; University of Melbourne, University of Melbourne, RMIT University; ggarrard@unimelb.edu.au

A general model of detectability and minimum survey effort for plants

Imperfect detectability is recognised as an issue in ecological surveys and, if unaccounted for, may have implications for the management of threatened and invasive species. A number of modelling methods now exist for estimating species’ detectability. These models provide valuable information about detection rates and required survey effort, but inference is restricted to the species for which they were developed. Here we present a multi-species model of detection time for plants in which detectability is modelled as a function of the characteristics of the species, and demonstrate the application of our model in a case study in native temperate grasslands in south-eastern Australia. Plant characteristics shown to influence detectability in this study include life-form, rarity, flower colour and size, phenology, uniqueness and origin. Because the model is based on species traits, detection rate estimates can be derived for species even if repeat surveys are not available for those species. Given that there are insufficient suitable data to estimate detection rates for most plant species, our model will be extremely useful for ecologists and conservation practitioners needing to determine minimum survey requirements for monitoring or impact assessment when species-specific detection data cannot be collected.

P1.132 Gärtner, Stefanie*; Reif, Albert; Nill, Michael; Prinz, Juliane; Essmann, Hans; Department of Renewable Resources, University of Alberta, Edmonton, Canada; Institute of Silviculture, Albert-Ludwigs University, Freiburg, Germany; Forest Research Institute of Baden-Württemberg, Freiburg, Germany; Institute for Forest and Environmental Policy, Albert-Ludwigs University, Freiburg, Germany; stefanie.gaertner@ales.ualberta.ca

Integrating local interests in land use planning for conservation in a changing environment: a case study from the Upper Rhine Valley in Southwest Germany.

Our objective was to show how a public participatory approach and a decision support system can be used to improve the efficiency and transparency of decision making in land-use planning. A decline in ground water levels due to the canalization of the Rhine River has changed what was formerly flood-plain vegetation to xerothermic vegetation. Although these xerothermic sites are receiving costly conservation measures to prevent valuable species and habitat loss the measures cannot prevent ongoing succession. We identified the land use objectives with five stakeholder groups. Their objectives were defined as desirable landscape conditions through the use of criteria and indicators. The present condition of the landscape and the landscape conditions desired by the stakeholders were evaluated. This process revealed several land use conflicts. Based on these evaluation results three compromise variants were designed as possible development directions for the area. The results were discussed with the landowners and a trial treatment was applied. Within this project we have developed a concept showing how the traditional cultural landscape in the former alluvial sites of the upper Rhine valley can be transformed by improving habitat qualities. This could become a model for restoration practices in the region.

P1.63 Gaul, K. *; Barai, S.; Centre for Development Research, University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria; Practical Solution Consultancy Nepal Pvt. Ltd., Kausaltar, Bhaktapur, Nepal; kalyan.gaul@boku.ac.at

Livelihood outcomes of commercializing non-timber forest products in Nepal’s community forest user groups

This paper compares a traditional and an enterprise oriented non-timber forest product (NTFP) marketing approach in two community forest user groups (CFUGs) of Dolakha district in Nepal. This is important, because forest policy documents of Nepal consider the commercialization of NTFPs in CFUGs as an effective poverty reduction strategy. What remains unclear, however, is the role that institutional arrangements play in both approaches in order to reduce poverty. The data were collected using various participatory rural appraisal methods such as household interviews and key informant interviews, formal and informal discussions with CFUG members. The study findings suggest the enterprise oriented arrangement ensures secure market access, which benefits poorer households in particular. In comparison, the traditional marketing approach tends to benefit better-off users. Moreover, the findings also suggest that users in both CFUGs spent most of their NTFP income on purchasing cereals. As poorer households under the enterprise oriented approach earn proportionally more than their traditional counterparts, they are in a better position to fulfill the household food requirements. Based on our findings we conclude that the enterprise oriented NTFP marketing has secured NTFP related benefits to poor users.

6.3 Gates, C. Cormack*; Suitor, Michael J.; Jones, Paul; Jakes, Andrew; Kunkel, Kyran; Bender, Darren; Grue, Mike; Sheriff; Faculty of Environmental Design, University of Calgary, Faculty of Environmental Design, University of Calgary, Alberta Conservation Association, World Wildlife Fund U.S.A., Dept. Geography, University of Calgary, Alberta Conservation Association, Tera Environmental Consulting; ccgates@nucleus.com

Conserving crucial habitats and connectivity for pronghorn in the Northern Mixed-grasslands of the Great Plains

Large mammal migration is an increasingly threatened element of biodiversity globally. For populations exhibiting partial migration, the loss of migrants can substantially decrease population resilience and abundance. Truncation of migration by anthropogenic features and landscape change are two leading threats to migratory populations. We demonstrate that pronghorn in the mixed-grasslands of Alberta, Saskatchewan and Montana exhibit two types of seasonal movements; long distance (LD) migration and much shorter movements where summer and winter ranges overlap or are in close proximity. Movements during migration periods differed between migrants and non-migrants. LD migrants moved 451 + 177 km (SE; maximum 831 km, a record for the species). LD migrants occupied larger winter home ranges than non-migrants. Pronghorn were more abundant where both types were represented in large areas of intact native prairie. The apparent loss of LD migration in a highly converted landscape (tilled) suggests LD migration is sensitive to landscape change. Areas were identified in migration pathways where development threatens to block migration. If managers wish to maintain resilient and abundant populations of pronghorn, it will be necessary to design land use plans that maintain the competence of landscapes to sustain LD migration, including seasonal habitat corridors, movement corridors, and key linkage zones.
Large Carnivores and Human Conflict
The ability to survive consistently all African predators on the ground at night, marks the beginning of human evolution 2.0-2.5 years ago, segregating ape from human. We alone among primates do not require trees. It freed us to evolve as carnivorous herbivores, changing from man the hunted to man the hunter. Our dispersal into Eurasia was predicated on dealing with new predators such as bears and wolves. Our North America colonization was delayed some 40,000 years till the collapse of the Pleistocene gigantic, food-stressed predators. Already in the Upper Paleolithic the species patterns in cave art indicate that wolves and hyenas were intensely disliked, much as is in modern times. There is a long history to human - wolf conflict. Where unarmed humans meet wolves, tragedies develop; were wolves meet well armed people co-existence is possible. This conflict deals with predation on humans, livestock and wildlife, and with the effects of parasites and diseases. Historically, Grimm’s fairytale of little Red Riding Hood was rooted in painful reality.
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Alberta Grizzly Bear Recovery Plan Implementation
The conservation of grizzly bears in Alberta continues to maintain a high public profile, and is often controversial. Improved population estimates have informed a recent species status reassessment. This presentation will outline recommended action items from the approved recovery plan, and steps taken to address them. The focus of conservation effort is generally to reduce human-caused bear mortality. A moratorium was placed on sport hunting in 2006. Public education efforts are in place, and are continually being expanded. Ongoing efforts are needed to deal with human-bear conflicts. The current major challenge is to reduce motorized access within important grizzly bear habitats. The Alberta government is committed to maintaining sustainable grizzly bear populations over the long term.

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Conservation Democracy: Ecology, Democratic Theory, And National Forest Management Under The Healthy Forest Initiative
National forest management in the United States has traditionally included public participation in agency decision-making. Under the Bush Administration's 2002 Healthy Forest Initiative, the rules governing citizen involvement were substantially modified. A consequence of this was that the US Forest Service was able to propose more commercial forestry in US National Forests with less public oversight and environmental review previously mandated by the National Environmental Policy Act. This combined with other rule changes allowing use in sensitive areas with "extraordinary circumstances" that were previously off-limits to commercial activity. This North Carolina case study explores the affects of the Healthy Forest Initiative on citizen participation and environmental management in the Pisgah, Nantahala, Croatan, and Uwharrie National Forests.

Diana Ghikas; Canadian Wildlife Service; Diana.Ghikas@ec.gc.ca

Linking Habitat Use to Vital Rates by Accounting for Extreme Behaviour
Using habitat in an extreme way may be risky or rewarding for an animal, yet rarely is this behaviour explicitly identified and considered when seeking insights about how an animal's habitat affects its survival or reproduction. I introduce an approach that: i) utilizes the lower and upper quartiles of habitat use by the population to characterize habitat features and identify extreme behaviour; and ii) measures habitat use by an individual relative to that of the population, HR. This approach is illustrated using data collected by Martin Jalkotzy and Ian Ross who studied a population of cougars (Puma concolor) during 1981-94. To predict the effects of habitat use on cougar survival and reproductive success, generalized-linear models were developed that included relative habitat use, HR, estimated by the population quartile approach (PQA), or, the average absolute habitat used, HA. Models involving these relative and absolute measures of habitat use were compared and the most parsimonious models selected. Methods and results will be presented. Â· Â· Models that considered extreme behaviour predicted survival and reproductive outcomes better than models that considered the average absolute habitat used, in all cases; Â· Â· The PQA of characterizing habitat provides lower and upper bounds which can be used as coarse guidelines for habitat conservation; and, Â· Â· Important insights about the effects of habitat on an animal's vital rates can be achieved by accounting for extreme behaviour.

Puma concolor (Cougar) Survival and Reproduction
The relative importance of intrinsic and extrinsic factors on fluctuations in the size of animal populations has been debated extensively in ecology. Variation in the vital rates of a hunted population of cougars was explained well by behaviour (i.e., habitat use) and seasonal weather. To examine how survival and female reproductive success varied with a cougar's identity and behaviour, cougar density, and seasonal weather, we analysed data from a population of cougars in SW Alberta studied by Jalkotzy and Ross during 1981-1994. Generalized-linear models were developed to identify different influences on cougar survival and reproductive outcomes. Survival during winter increased significantly if cougars frequented habitats >1.4 km(♀) or >2.2 km(♂) from a highway, between 1445-1678 m(♀) or 1513-1646 m(♂) elevation, and with 50% and >45% open-canopy cover) within 1 km2 of a cougar's location. Winter survival was higher during dry winters and following wet springs. Productive females frequented habitats with 49% open-canopy cover) within 1.0 km2 of a female's location. Litter sizes were large when mothers occupied mid-elevation habitats (summer: 1437-1745 m, winter: 1445-1678 m). Female-biased litters were reared when mothers experienced harsh conditions: cold snowy winters and springs; poor-quality habitat. Implications of habitat and climate on cougar survival and reproduction are discussed.
There is growing interest in the potential of payments for environmental services (PES) to encourage land managers to protect the environment. However questions remain about how PES agreements should be designed. A division exists in whether schemes structure payments by action or by results. Most biodiversity PES schemes pay by action: for example incentivizing land managers to carry out actions believed to increase biodiversity. Payment by results is a common incentive structure in the private sector (e.g. labourers doing piece work or no-win no-fee lawyers) but rarer in PES. Using a modelling approach we investigate the conditions under which each way of structuring payments may be more cost-effective in a biodiversity PES. We found that payment by results is favoured in degraded landscapes as it creates incentives for managers to use their local knowledge and to join the scheme only if they can increase biodiversity. Other factors, including the relative cost of monitoring results or actions, have a weaker effect. We illustrate these principles with examples (maintaining carnivores in herding areas, restoring farmland wading bird populations and protecting bushmeat species) and suggest that, despite not being suitable in all circumstances, payments by results deserves more attention from those designing biodiversity PES.

Should we pay for biodiversity conservation by action or results?

There is growing interest in the potential of payments for environmental services (PES) to encourage land managers to protect the environment. However questions remain about how PES agreements should be designed. A division exists in whether schemes structure payments by action or by results. Most biodiversity PES schemes pay by action: for example incentivizing land managers to carry out actions believed to increase biodiversity. Payment by results is a common incentive structure in the private sector (e.g. labourers doing piece work or no-win no-fee lawyers) but rarer in PES. Using a modelling approach we investigate the conditions under which each way of structuring payments may be more cost-effective in a biodiversity PES. We found that payment by results is favoured in degraded landscapes as it creates incentives for managers to use their local knowledge and to join the scheme only if they can increase biodiversity. Other factors, including the relative cost of monitoring results or actions, have a weaker effect. We illustrate these principles with examples (maintaining carnivores in herding areas, restoring farmland wading bird populations and protecting bushmeat species) and suggest that, despite not being suitable in all circumstances, payments by results deserves more attention from those designing biodiversity PES.

A Study of the ground squirrel's response to the Ashy Tit's alarm calls in a Namibian semi-arid ecosystem

The following is a proposal concerning my Master thesis within the programme "Biodiversity Management and Research", which is jointly been offered by the Humboldt-Universität zu Berlin and the University of Namibia. By taking a comprehensive ecological approach, I propose to examine the co-evolution of interspecific communication between the Cape ground squirrel (Xerus inaurus) and selected bird species. The study will take place between March and July 2010 on the farm "Brackwater" that is situated app. 15 km north of Namibia's capital Windhoek. I will use observational studies on the avian species richness, squirrel population characteristics and squirrel behaviour to gain a higher understanding of the function of this particular system. Furthermore, I will conduct playback experiments using seed trays and local bird call recordings to determine the timeliness, intensity and type of squirrel responses (responses to direct predatory calls and responses to warning calls from fellow prey species). Through this comprehensive study I aim to prove if the co-evolution of this eavesdropping behaviour which has already been proven in North America and Europe is conserved in the savannah ecosystem of Namibia.

Tracking Trends in Arctic Wildlife: The Arctic Species Trend Index

The Arctic Species Trend Index (ASTI) has been developed providing a circumpolar perspective on trends in the Arctic’s living resources. The ASTI illustrates overall vertebrate population trends by integrating data from across the Arctic over the last 34 years (1970 to 2004). It gives a composite measure of the overall trajectory of Arctic populations and can be disaggregated to investigate trends based on taxonomy, biome, region, etc. These analyses can help identify species groups and regions undergoing rapid change and improve predictive ability. 965 populations of 306 species (35% of all Arctic vertebrate species) were used to generate the ASTI. In contrast to the global Living Planet Index, whose overall decline is largely driven by tropical vertebrate population declines, arctic populations rose by an average 16%. This pattern is similar to the temperate LPI and consistent in both the North American and Eurasian Arctic. The increasing trend is thought to be partly driven by the recovery of some vertebrate populations (e.g. marine mammals) from historical overharvesting as well as from recent changes in environmental conditions both inside (e.g. Bering Sea Pollock) and outside of the Arctic (e.g. Lesser Snow Geese) resulting in dramatic population increases. This increasing trend, however, is not consistent across biomes, regions or groups of species. Despite the robust dataset expanded monitoring efforts are needed to fill critical gaps.
Coastal Resilience: Using marine spatial planning to support management decisions that address the needs of natural and human communities

Coastal Resilience (www.coastalresilience.org) is an ecosystem-based marine spatial planning framework and tool that discusses and illustrates biodiversity conservation and coastal hazards information in Suffolk County, New York, USA. Much of Suffolk County’s private property is only inches above sea level, placing millions of dollars in public and private funds at risk to rising sea levels and other coastal hazards. These impacts also threaten wetlands and other coastal ecosystems that provide habitat, natural buffers to storms, and other ecosystem services. Despite a growing awareness of global climate change, local decision makers still lack the tools to examine different management objectives as sea levels rise and coastal hazards increase. The Coastal Resilience project provides tools and information to better inform decision-making with a primary goal of identifying vulnerable levels rise and increased storm frequency and intensity. The Nature Conservancy, working with multiple partners such as the NASA Goddard Institute for Space Studies and NOAA’s Coastal Services Center, deliver this information via an internet mapping application to help local decision makers keep the environment and public safety in mind.

How long is perpetuity?
Understanding the time frame over which human actions are valid, or can be enforced or predicted, is critical to conservation planning, and to an understanding of the value and permanence of field-based observations and modeling. In both the social and natural sciences, the time frame over which actions are valid is often stated, or assumed, to be “in perpetuity.” In reality, perpetuity has a length that can be measured and or inferred and is almost always significantly less than what most of us would consider “forever.” This presentation explores how concepts of perpetuity translate into reality and what this means for our ability to plan and manage our conservation efforts, effectively, into the future. In this work I assess the time frame and accuracy over which different biological endeavors are measured (e.g. the predictive values of Population Viability Assessment; the length of long-term field studies of species, populations, or ecosystems; accuracy of various models projecting human population growth, deforestation etc. produced in the 1970’s and 1980’s, etc) and compare this to the time frame over which legal instruments and policy efforts related to conservation (easements, leaseholds, treaties, etc.) remain in force. My finding is that in both the biological and socio-legal realms, perpetuity last for 25-100 years, and rarely can be measured, or projected, beyond this.

Macroecology And Distribution Of Neotropical Rodents: Conservation Implications

We analysed the range of 791 species of Neotropical rodents in order to understand whether their distribution is affected by habitat quality and quantity on a continental scale. Distribution data (size of each species’ range, Km2) and relative quantity of each macrohabitat type (Km2) were obtained respectively from the Global Mammal Assessment data bank (IUCN Red List 2008), and the Global Land Cover 2000 (GLC 2000). Habitats were grouped according to 9 categories, ranging from Forest to Bare areas. Total range size varied significantly among families with members of the family Cuniculidae having larger ranges than any other families, followed by Myocastoridae, Caviidae, Dasyproctidae, and Erethizontidae. Mean range size did not differ significantly between endemic and non-endemic taxa. The range size of each species was significantly influenced by five habitat categories (shrubland, grassland, flooded, artificial, and cultivated). Cultivated habitat was important for three families, shrubland and flooded for two families, and grassland, artificial, and near water habitats for one family. Forest housed the great majority of the species of conservation concern; the other two habitats housing a considerable number of threatened species were grasslands and shrubland.

Intensive Rotational Targeted Grazing of Romney Sheep as a Control for the Spread of the Invasive Plant Mile-a-Minute (Persicaria perfoliata)

We investigated the effectiveness of an intensive rotational targeted grazing protocol for controlling the spread of the invasive plant Persicaria perfoliata. Three Romney ewes (Ovis aries) were deployed into a system of four experimental (exp) paddocks, each with an area of approximately 200 m2, at sites invaded by P. perfoliata in the Ward Pound Ridge Reservation (Cross River, Westchester County, NY). The ewes were moved from one paddock to the next at 2-3 d intervals. Four adjacent, ungrazed reference (ref) paddocks were also delineated. A suite of plant community attributes (cover classes, species richness and composition), as well attributes of individual P. perfoliata plants (stem density, inflorescence) were monitored in the exp and ref paddocks from June 24 to August 7, 2009. P. perfoliata cover in the exp paddocks was reduced, on average, by 18.69 + 14.6 percent relative to the ref paddocks and inflorescence was nearly eliminated in the exp paddocks. Recovery of native and naturalized species was also evident. While, prior to grazing, mean species richness in exp and ref paddocks were not different (t=0.56; p>0.05), differences (exp = 23.8+3.0; ref=16.8+3.3) were significant (t=3.03; p<0.05) following grazing.
I investigated the conservation awareness and opinions of whale watching tourists in Samana, Dominican Republic. I collected 485 questionnaires from January 26 to March 10, 2009. I examined the knowledge and opinions of tourists viewing humpback whales (Megaptera novaeangliae) regarding marine mammal conservation and education, threats to marine mammals and the potential impact of whale watching. Respondents represented 34 countries with participants primarily from the United States, France, Canada and Germany. 44% of respondents stated they had some amount of knowledge regarding conservation issues. The majority (82%) of respondents believed public education was "very important" or "important" and 48% had no opinion. To assess respondents' whale knowledge they answered a series of statements as true, false or unsure. General knowledge questions were answered correctly but accurate responses decreased with more detailed questions. In conclusion, more boat-based education programs by qualified individuals should be offered by whale watching companies to increase the awareness and knowledge of whale watching tourists.

**The conservation awareness and attitudes of whale watching tourists in Samana, Dominican Republic**

**Assessing the Vulnerability of Coastal Wetlands to Sea-level Rise: Implications for Adaptation**

An accelerating rate of sea-level rise due to climate change poses a significant threat to coastal wetlands and other habitats in the United States and around the world. A better understanding of the potential risks to habitats at a regional scale is necessary to enhance and support efforts to restore and protect the long-term ecological integrity of those habitats. The National Wildlife Federation (NWF) has conducted several studies across the U.S. to model the impacts of sea-level rise on coastal wetlands, including those in the Pacific Northwest, the Chesapeake Bay, Florida, and (currently) Louisiana, to help decision makers involved in developing climate change adaptation strategies assess the risks of sea-level rise and identify reasonable steps to manage those risks. Specifically, we applied the Sea Level Affecting Marshes Model (SLAMM), which was designed to simulate the dominant processes involved in wetland conversions and shoreline modifications among a multitude of different habitats under various scenarios of sea-level rise. The results of these studies can be used to inform a number of important decisions regarding coastal restoration and management to help fish, wildlife, and people cope with the expected changes to their habitats and communities and build in the flexibility to deal with unforeseen impacts.

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**Implications of a Changing Montane Landscape: Assessing Nutritional Carrying Capacity for Elk of the Red Deer River Valley**

The fescue grasslands of the Red Deer River valley have provided both seasonal and winter range for a large migratory elk (Cervus elaphus) herd since the 1950’s. Within the eastern slopes of the Rocky Mountains of Alberta, grasslands have experienced fire suppression, resulting in woody plant encroachment. I used field data on forage and browse biomass to estimate the change in nutritional carrying capacity of elk over this time period using a model developed by Hanley and Roger (1989) for deer. The loss of grassland extent in the Red Deer River between 1952 and 1992 was quantified using aerial photography. Model inputs included 4 different plant communities, quantity and quality of forages within these plant communities, and elk nutritional requirements. The model estimated nutritional carrying capacity as the number of elk days of use/ha under the assumption that winter is the limiting season. We quantified changes in major meadow complex levels between time periods and the net change in elk winter range. The implications of our results for future landscape management will be discussed.

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Birdwatchers are dependent on natural resources to conduct their recreational activity and as such, are proposed to demonstrate a level of awareness of and concern for those resources commensurate with level of involvement. Previous research on other nature-based recreationists has shown that individual meaning associated with an activity can serve to mediate this relationship (Bright and Porter 2001) but this has not been tested for birdwatchers. To test the relationship between involvement, meaning, and environmental concern, a mail-back survey was sent to 1256 American Birding Association members residing in several southern U.S. states that examined birdwatchers’ participation, motivations, and environmental-related behaviors and beliefs. We used structural equation modeling to conduct mediation analysis and included the following variables in our models: number of days spent birdwatching representing level of involvement (predictor), responses to the New Ecological Paradigm scale as a measure of environmental concern (criterion), and birdwatcher motivations representing individual meaning (mediator). Given that birdwatchers do not compose one homogeneous population (e.g., Cole and Scott 1999), we predict that individual meaning may mediate the relationship. An understanding of birdwatchers’ environmental views is necessary to develop effective education on issues pertaining to conservation of natural resources geared towards this population of recreationists.

SP9.1 Gobush, K.S.*; Baker, M.R.; Vynne, C.V.; Department of Biology, University of Washington, School of Aquatic and Fishery Sciences, University of Washington; mathematic@uw.edu
Systematic Review of Significance Patterns in Glucocorticoid Measures in Wildlife
An increasing need to understand how wildlife populations respond to disturbance and environmental change has resulted in a proliferation of research examining physiological indicators of stress response in wildlife. Among the most frequently measured physiological indicators of the vertebrate stress response are stress hormones: glucocorticoids (GCs), typically cortisol and corticosterone. To provide a comprehensive comparison of the factors, covariates, and interactions that influence GC measures across vertebrate species, we conducted a comprehensive review of the current state of research on stress physiology of wild or free-ranging animals and their conservation. This literature review examines more than 1000 articles from 1969 to 2007. We delineate the breadth of studies completed across vertebrate taxa, organized by class, order, species, and conservation status, and commercial value. Such an inventory is useful in highlighting the current focus of conservation physiology and identifying new areas relevant to this field. We also inventory the range of ecological and anthropomorphic factors, hypothesized to influence or correlate with variation in GC values. We analyze patterns of significance and the consistency of these patterns across studies. This review provides a quick, comprehensive, unbiased view of factors and covariates that influence GC measures and should be useful to prospective conservation physiologists in study design, analysis and interpretation.

SP1.75 Glowinski, Sheri L.*; Porter, Rob; Moore, Frank R.; The University of Southern Mississippi, Western Illinois University; sheri.glowinski@eagles.usm.edu
The Relationship Between Birdwatcher Involvement And Environmental Concern: Evaluating The Role Of Individual Meaning
Birdwatchers are dependent on natural resources to conduct their recreational activity and as such, are proposed to demonstrate a level of awareness of and concern for those resources commensurate with level of involvement. Previous research on other nature-based recreationists has shown that individual meaning associated with an activity can serve to mediate this relationship (Bright and Porter 2001) but this has not been tested for birdwatchers. To test the relationship between involvement, meaning, and environmental concern, a mail-back survey was sent to 1256 American Birding Association members residing in several southern U.S. states that examined birdwatchers’ participation, motivations, and environmental-related behaviors and beliefs. We used structural equation modeling to conduct mediation analysis and included the following variables in our models: number of days spent birdwatching representing level of involvement (predictor), responses to the New Ecological Paradigm scale as a measure of environmental concern (criterion), and birdwatcher motivations representing individual meaning (mediator). Given that birdwatchers do not compose one homogeneous population (e.g., Cole and Scott 1999), we predict that individual meaning may mediate the relationship. An understanding of birdwatchers’ environmental views is necessary to develop effective education on issues pertaining to conservation of natural resources geared towards this population of recreationists.

SP3.10 Gobush, KS*; Harting, B.; Littnan, C.L.; NOAA, NMFS, PIFSC; kathleen.gobush@noaa.gov
Detection and Deterrence of Shark Predation of Hawaiian Monk Seal Pups
Shark predation on critically endangered Hawaiian monk seal pups (Monachus schauinslandi) at French Frigate Shoals significantly contributes to the 75% decline of this important subpopulation. In 2001-2003, systematic observations conducted from a 12-foot tower resulted in over 3000 observation hours that confirmed Galapagos shark (Carcharhinus galapagensis) in pup predation. However, observing a shark attack was rare; thus we also developed conservative criteria to determine incidences of shark kills when data was limiting but pup disappearance confirmed. Additionally, shark-detection ability decreased as observation time proceeded though predation rates remained constant, suggesting sharks were wary of the presence of humans. In 2008, we conducted a pilot study to determine the feasibility and efficacy of a suite of devices to deter predation, including visual cues, and electromagnetic and auditory instruments. In 2009, device application was repeated in a systematic manner. The incidence of shark predation was compared across three experimental treatments that capitalized on the apparent wariness of sharks and included 24-hour human presence, visual and auditory devices mimicking human presence, and a control at two islets. Through direct observation and remote camera video recording, we made 15 shark sightings. A chi-square analysis revealed that a treatment effect was not significant and device deployment did not appear to influence the pattern of attacks across years. Although these new approaches provide additional insight, the detection and deterrence of shark predation continues to be a challenge to the recovery of this monk seal subpopulation.

SY43 Glowka, Lyle; Convention on Biological Diversity; lyle.glowka@cbd.int
The Convention on Biological Diversity: On the Road to 2010 and Beyond
The Convention on Biological Diversity (1992) is the only global forum focusing comprehensively on the conservation and sustainable use of biodiversity. Its membership includes all but two countries in the world. It sets the global agenda for biodiversity conservation and sustainable use, while providing a broad set of international commitments for action by Governments at national level. The presentation will explore the concept of biodiversity and its evolution into a cornerstone of sustainable development, particularly since the Millennium Ecosystem Assessment (2005) demonstrated that biodiversity underpins the ecosystem goods and services that support human well-being. It will explain the CBD’s basic framework for action and its global toolkit. Two key challenges will be encountered in the run-up to the tenth meeting of the CBD Conference of the Parties in 2010 during the International Year of Biodiversity: (1) Assessing progress towards achieving the 2010 Biodiversity Target and implementing the Convention and (2) updating the CBD Strategic Plan and setting a new post-2010 target. The role of science within and contributing to the forum will be explored. Opportunities for inputs by SCB and its members will be suggested.
Adaptation to Sea Level Rise in San Francisco Bay

The San Francisco Bay is the largest estuary on the west coast of the Americas. It has been extensively modified through urbanization, which has substantially decreased the Bay's wetland habitats. Global sea level rise driven by global warming threatens to inundate not only developed areas, but also much of the Bay's remaining wetlands and natural habitat. The San Francisco Bay Conservation and Development Commission has prepared a vulnerability assessment of the risk posed by sea level rise and the need for adaptation strategies that address both the natural and built environments.

Conserving Nature can Impact People but Impacts can and should be Compensated

Conservation approaches can impact people by limiting access to land such as through creating a protected area with limited use or through implementing conservation management practices diminishing land area available for crops and/or grazing. Nature provides essential livelihood services to people, like clean water and fertile soil, but this provision can be delayed or unequally distributed among people impacted by conservation. Thus, compensating for impacts to people is critical. The Nature Conservancy is leading the implementation of a series of payment for watershed service projects, water funds, which compensate people for the potential livelihood impacts of watershed conservation strategies. In water fund projects, water users voluntarily pay water suppliers (upstream watershed communities and natural ecosystems) to secure a clean regular supply of water. Watershed communities are relatively poor, small-scale agricultural producers. Water funds support implementation of conservation management practices, like fencing riparian areas or reforestation/re-vegetation of landscapes. Such practices help achieve water user goals, but they tend to diminish the land available for crops and grazing. Water funds find a way to compensate this loss by providing access to alternative resources. By providing for people and for nature, water funds will make conservation efforts last into the future.

Predicting ecological impacts of alternative policy scenarios on a rural landscape in northern Idaho, USA.

Land use change driven by rural residential development and changes in agricultural practices can lead to dramatic alterations in the structure and function of landscapes. We simulated land use change under a variety of policy scenarios in a rural, northern Idaho region that is increasingly experiencing residential development. To predict ecological effects of these potential policy changes, we designed habitat models for a variety of at-risk and socially-valued species based on field surveys and literature reviews. Policies that increased the amount of land enrolled in the Conservation Reserve Program benefited many species. Policies to protect productive agricultural lands, however, led to intensified residential development on nearby shrublands, reducing habitat for development-sensitive species in those marginal areas and increasing the development threat to remaining native Palouse Prairie patches. While a conservation planning option maximized habitat for most target species, impacts to Palouse Prairie and unglulate winter range were minimized under the alternative urban growth boundary policy. Predicting the effects of potential land use policies on species’ habitat is a complex process that can illuminate the tradeoffs local communities must evaluate in making planning choices and empower the decision-making process.

The first five years of the Programme for the Conservation of Cuban Cacti

Cuba supports the highest cactus diversity of the Caribbean hotspot. Thirty three of the total 60 species are endemic to the island and are somewhat threatened by its very small population sizes, very narrow distributions and human activities. In 2005, the National Botanic Garden started a conservation project focused to protect and enforce the unique know population of Melocactus actinacanthus in partnership with the protected area this species is located. This initiative grew up to date enlarging its scope to promote the conservation and sustainable management of other cactus species and to their habitats by building capacity, monitoring populations and habitats and enforcing depleted populations, providing advice and information, and raising public awareness and education. In this presentation we briefly summarize the achievements of this programme till its fifth anniversary this year. These achievements include the enforcement of two population of Melocactus actinacanthus and Dendrocereus nudiflorus, the establishment of ex situ collections of the five most threatened cacti, the identification of the important areas for cacti conservation, and results on the impact of fires on the diversity and structure of dry habitat vegetations. We also provide information on the training courses and raising awareness activities we have organized.
Measuring the cost-effectiveness of better maps of natural resources: scale, benefits, costs and outcomes for conservation.

Conservation planning is always limited by biodiversity data but few studies have addressed the costs and benefits of improving data. Often conservation planning exercises are conducted at regional scales using broad resolution maps (e.g., 1:250,000), but implementation occurs at local scales. Fine resolution data (e.g., 1:25,000) are rarely available across entire planning domains. Most often they cover only small parts of planning domains where they show that biodiversity within regional, broad resolution map units is highly heterogeneous. We demonstrate that as one moves from broad-resolution to fine-resolution data within study areas, priority areas for conservation change in extent and location. This raises important unresolved questions: when and at what resolution should finer-scale data be collected to conduct cost-effective priority setting exercises?, and, given the high costs of fine-scale data, what are the trade-offs between better data and more conservation action? We use three different measures of the benefit of improved data at finer scales and work at two different resolutions to demonstrate the effect that additional information has on the choice of priority areas. We discuss the dilemma that conservation practitioners are facing when having to decide how to make best use of their limited budgets for conservation planning.

Degradation of forests by non-native herbivores in Newfoundland’s National Parks: Recommendations for ecosystem restoration

Introductions of species to novel environments where natural predators are absent often leads to population irruptions and sometimes to the development of alternate stable states. On the island of Newfoundland, Canada, introduced moose, red squirrels and other herbivores are modifying forest composition and structure through selective browsing, seed depredation and by facilitating the establishment of invasive plants. Effects are particularly acute in the two National Parks (Terra Nova and Gros Morne) where past management has restricted the use of hunting as a mechanism to regulate moose numbers. Our research has documented a disruption of natural forest regeneration and a decline in a dominant trees species, balsam fir. Following canopy disturbance by insects, chronic browsing by moose is converting forested areas to alternate stable states dominated by species that inhibit the re-establishment of boreal tree species. Recommendations for ecosystem restoration including lethal control of moose, and supplemental tree planting are discussed.

Understanding the ethical basis of stakeholder support for conservation actions, such as biodiversity preservation, can help conservationists challenge assumptions, respond to, or engage stakeholders’ fundamental views about biodiversity. Although social science and ethical insights are critical components of sound conservation, serious work blending these human dimensions is lacking. We now know the wolves of Isle Royale (IR) possess congenital bone deformities for which no natural genetic mitigation option exists. We used content analysis to analyze arguments on a 2009 public online discussion board (n=147 posts) posing the question: “Do IR wolves need genetic rescuing?” We coded content to characterize solution frames, argument appeals, attributions of responsibility, and scope of moral commitments invoked to justify claims. Nearly 6% of posts supported genetic rescue. Two-thirds appealed to consequences of genetic deformities, 37% to motives (e.g., rights) 22% to peer authority, 21% to natural law, and 1% to divine command to justify their opinion on genetic rescue. One-third noted the needs of both populations of and individual wolves; half supported human intervention for resolving inbreeding depression. Correlations between stakeholders’ solution frame and moral justification illustrate widespread disagreement and tension in ethical reasoning about conservation action. More deliberate and quantitative integration of ethics into conservation may foster efficacy.

Farming, Biodiversity and Ecosystems Conservation: trade-off or win-win? a qualitative model approach

One of the greatest challenges of modern science is to find a balance between agricultural production and biodiversity conservation. Recently, the debate on agriculture and conservation has divided experts in two groups. Defenders of the Land Sparing approach argue that maximum production should be achieved in already farmed areas, saving land for conservation purposes. Biodiversity Friendly Farming defenders point out the negative impacts of agricultural intensification on both biodiversity and human development, arguing that non-intensive farming may produce large quantities of high quality food and still protect biodiversity. Education is essential to move forward in this debate and to support public involvement in conservation measures. Qualitative Reasoning modeling is a valuable tool for exploring conceptual knowledge about ecological systems in educational settings (see Ecological Informatics, 4(5-6): 261-412, 2009). This work presents a qualitative simulation model built in the workbench Garp3 (www.garp3.org), to compare the impacts of these two approaches on both farmed and natural areas, with respect to productivity, water resources, soil properties, greenhouse gases emissions and biodiversity. The results explain the inefficiency of intensive agriculture in protecting wildlife while biodiversity friendly agriculture protects biodiversity and increases productivity. Due to the diagrammatic approach, the explicit representation of causality, and the possibility of exploring all possible behaviours of the system, qualitative models are seen as important tools for education in conservation. (This work received financial support from Project DynaLearn (EU-FP7 contract 231526: www.dynalearn.eu).
P2.107 Gourguet, S*; Doyen, L; Macher, C; Guyader, O; Thebaud, O; MNHN-IFREMER, CNRS, IFREMER, IFREMER, CSIRO-IFREMER; gourguet@mnhn.fr

A stochastic viability approach for ecosystem-based management of mixed fisheries: the case of the Bay of Biscay demersal fisheries.

Marine scientists and stakeholders are increasingly advocating ecosystem-based fishery management (EBFM). However, the way to operationalize such EBFM remains controversial. The viability approach can be a relevant modelling framework for EBFM as it accounts for dynamic complexities, uncertainties, risks and sustainability objectives balancing ecological, economic and social dimensions together with intergenerational equity. Mixed fisheries operating in the Bay of Biscay provide a challenging example to illustrate these issues. The present paper focuses on the case of the demersal fisheries catching nephrops, lake, sole and monkfish. A bio-economic multi-species and multi-fleets model is developed to examine the capacity for the stochastic viability framework to assist in developing practical approaches to EBFM. The model integrates the dynamics of the harvested stocks with an uncertain recruitment and technical interactions through joint catches. It relies on data from ICES and IFREMER. A co-viability analysis of the fish populations/fisheries system is performed to investigate how to simultaneously preserve the species (using Bpa precautionary referenced points) and guarantee economic incomes for the fleets. First results suggest that the viable harvesting intensities require a significant reduction in the effort of some fleets, as compared to reference year 2006.

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Effects of Underplanted White Spruce on Understory Vegetation and Environment in Aspen-Dominated Stands of the Western Boreal Forest

Underplanting white spruce (Picea glauca) in aspen (Populus tremuloides)-dominated stands (mimicking natural boreal succession) was introduced as an alternative to single species management but little is known about impacts to the understory. Previous research has shown differences in understory richness, diversity and composition related to canopy composition, with mixedwoods being more similar to conifer-dominated than broadleaf-dominated forests. The objectives of this study were to determine the influence of underplanting white spruce on understory vegetation and environment; and if changes are observed, if the spatial extent and strength increase with time passed since planting. The study was conducted in the Alberta Boreal Mixedwood in nine mature aspen stands which were underplanted in 1994, 1999 and 2004/05. Vegetation and environment measurements were taken in plots set up 0-1m and 1-2m outward from the underplanted spruce and in control plots established in unplanted areas of the stands. Based on initial analysis of 150 plots, significant differences (p<0.05) were not observed in richness (total, shrub, herb), diversity (Simpson, Shannon-Weiner, Whittaker) and edaphic conditions between underplanted and non-underplanted areas by 15 years after planting. Research will continue in stands planted in the 1960s to provide insight into processes controlling understory plant community diversity in mixedwoods and the impacts of an increasingly popular management option.

SY65 Granek, E.*; Rodriguez del Rey. Z.; Portland State University; graneke@pdx.edu

Getting lost between land and sea: Changing our science and changing our minds about how we fit in “transitional” systems

Synthetic chemicals have been detected in wastewater, surface water and groundwater, yet the input of these chemicals into coastal marine waters - linking terrestrial water bodies with our coastal oceans - has received minimal attention. We measured the concentrations, distribution and fate of chemicals ranging from DDT and flame retardants to caffeine and examined potential sources of input including wastewater treatment plants, septic leakages and combined sewer overflow systems. In coastal waters, these chemicals may present an exposure risk to organisms, though toxicity levels are unknown. To examine sublethal effects of introduced chemicals we conducted tank experiments to quantify the effects of caffeine on the intertidal mussel, Mytilus californianus. We exposed mussels for 10, 20, or 30 days to 4 levels of caffeine previously recorded in coastal marine systems. Levels of the heat shock protein Hsp 70 were then measured to indicate sublethal stress. Hsp 70 response indicated sublethal stress at all experimental levels of caffeine exposure, though the response was affected by quantity and exposure time. These findings indicate that current levels of environmental exposure to land-based chemicals may have sublethal effects on coastal marine organisms and highlight an area in need of further research and management.
Wherever political boundaries traverse ecosystems, managing for landscape-level connectivity becomes more complex: information flows are slowed, administrative regimes are fractured, decisions are delayed and often executed with little or no coherence, and responsibilities are masked. As climate change alters species distributions and ecosystem processes, the administrative difficulties of maintaining cross-border connectivity might limit the ability of human and natural systems in North America to adapt to change. Over 40 transboundary conservation practitioners developed a short list of specific, targeted, priority actions to be taken in the next 2-5 years to strengthen transboundary conservation programs, policies and institutions. The highest priority was an international agreement for transboundary conservation and climate change. Other next steps include incorporating climate change adaptation into regional compacts, restructing transboundary water agencies to include water for nature (in-stream flows).
Critical habitat and the role of peer review in government decisions

The U.S. Endangered Species requires designation of critical habitat for all listed threatened and endangered species. Critical habitat provides important protection for species, placing requirements on federal agencies to avoid modifying habitat and providing an opportunity to protect areas where species no longer occur for the purpose of recovery. The designation of critical habitat involves a two-step process in which scientists with the U.S. Fish and Wildlife Service identify areas essential to the conservation of listed species and issue a proposed designation, which is then opened to peer review and public comment. This proposal is then finalized by the Secretary of Interior after determining the economic and other impacts of designation and whether the benefits of excluding specific areas outweigh the benefits of designation. We reviewed proposed and final critical habitat designations finalized between 2002-2008 to determine the direction and magnitude of change in the area designated. We also reviewed scientific peer reviews of these designations to determine whether changes reflected expert advice. Sixty-seven percent of critical habitat designations were reduced between proposed and final by an average of 49%. Of 163 peer reviews analyzed, 80 called for adding habitat, which was ignored in all but four cases. These results highlight the limitations of peer review of government decisions, where there is no arbiter to ensure that reviews are followed.

Transboundary Marine Protected Areas for Coral Reefs and Humpback Dolphins in East Africa

Transboundary marine protected areas (TBMPA) require cooperation between States, and knowledge of marine resources' ecology and institutions. Common pool resource (CPR) theory was used to identify biophysical and institutional aspects of marine resources to be protected by future TBMPAs between Mozambique-Tanzania (Mz-Tz) and Moz-South Africa (Mz-SA). Two CPRs of different mobility were selected to study existing near-border MPAs: coral reefs (CR) and humpback dolphins (HD). Interviews were conducted with local communities, tourism operators and state officials, and triangulated with other sources. Results suggest that existing MPAs in the Mz-Tz region have not avoided the main threats to CRs, such as overfishing by local and migrant fishermen. Variations in currents location imply that CR health in both States is mutually dependent. HDs are not a conservation priority, despite some threats and their likely cross-border movements. In the Mz-SA region, results suggest CRs are targeted by intense tourism activities, and uneven conservation measures (i.e., MPAs) that contradict local currents and unidirectional ecological dependence. HDs are affected by fishing and land-based pollution, but cross-border movements are unknown. Future TBMPAs may address most threats to CRs and HDs in these regions, but are inapt to deal with land-based pollution. CPR theory can inform TBMPA planning about the implications of (TB)MPAs for CPRs with different ecological and institutional attributes.

Climate change is now widely acknowledged as a global problem that threatens marine and coastal conservation, management, and policy. Mitigation and adaptation are the two responses commonly taken to address actual and projected climate change impacts. While mitigation (reducing greenhouse gas emissions) is essential, adaptation (reducing vulnerability to climate change) has also become a necessity in order to prepare for and respond to the unavoidable effects of climate change. The field of adaptation is developing rapidly but in an ad hoc fashion, and organizations and governments are often hard put to make sense of the dispersed information that is available. This talk will present the efforts of EcoAdapt to survey, inventory, and assess adaptation projects from different regions, jurisdictions, and scales throughout North American marine and coastal environments. We will provide context and examples of how climate change is being addressed in conservation, management, and policy, review the adaptation options available to and in use by coastal and marine practitioners, and introduce the case studies provided by other symposium panelists.
Many native fisheries in the western United States are impacted by introduced or invasive fish. Millions of dollars have been spent on suppression programs, as in many locations throughout the United States Mountain West; these fish have significantly altered both the aquatic and terrestrial ecosystem. To date no current fisheries management strategy such as gill netting, poison application or physical barriers have yielded successful outcomes at eliminating these invasive predators from these or other large lakes. Current methodologies are costly and have significant environmental implications. Unintended consequences include mortality in non-target organisms from by-catch or piscicides, further alterations in food web dynamics, and the impediment of genetic material and nutrient movement in a watershed. Additionally while eradication strategies tend to target adult organisms few methods address other life history stages such as recruitment from the embryo and larval stages of fish. New conservation and integrated suppression technologies must be employed to address recruitment of new individuals into a population. This presentation will discuss new physical, biological and chemical suppression technologies that offer promise to inhibit recruitment of invasive fish.

**Innovative Suppression Technologies for the eradication of invasive fish from the western United States.**

SP7.12 Gross, JA; USGS-Northern Rocky Mountain Science Center; jgross@usgs.gov

What have we here? A preliminary review of the Reconciling Biodiversity and Development through Direct Payments for Conservation (ReDirect) Project

SY10 Gross-Camp, ND*; Martin, A; Kebede, B; McGuire, S; Munyarukaza, J; International Development Group UEA; n.gross-camp@uea.ac.uk

We report the findings from the initial stages of ReDirect, an experimental Payment for Environmental Service (PES) project that addresses the PES’s ability to achieve conservation and poverty alleviation goals. Our PES scheme seeks to reduce household dependence on products from the Nyungwe National Park, Rwanda, as a proxy for biodiversity conservation. We randomly selected four cells (a unit of 300-1300 households), each paired with a control cell. Key design features of our PES are the public tenure of the resource, for which access is legally prohibited, and the collective basis of the incentive and performance contracts. Our preliminary findings come from baseline data including: household surveys, meetings with residents, public goods games (PGGs), and assessments of anthropogenic threats. Some important lessons to date relate to the diversity of local contexts around the Park and the need for different incentives and monitoring structures in each cell. For example, the experimental PGGs demonstrated different attitudes towards collective action and this may in turn influence a cell’s ability to cooperate for support activities such as investing in a nursery for medicinal plants, bamboo, or trees. Threats were also found to vary from cell-to-cell with a minority controlling lucrative (often illicit) goods that pose challenges this project is unable to address. One of the key difficulties has been to develop shared understanding and goals, amongst groups with different interests and power status. For example, we have spent considerable resources on relations between our partner organization (RDB) and communities, namely to quell unsubstantiated rumours and clarify project objectives.

**Keeping arthropod conservation relevant in sustainable forest management: tips from Tasmania, Australia**

SY76 Grove, SJ; Baker, SC*; Forestry Tasmania; simon.grove@forestrytas.com.au

Arthropods are frequently given short shrift in forest conservation planning and management compared to more charismatic organisms, yet this makes little sense ecologically. Obstacles to wider consideration of arthropods include: lack of knowledge of their ecology or taxonomy; sampling, curation, analytical and data management issues; and public indifference or revulsion towards creepy-crawlies. Keeping arthropod studies on the agenda will require demonstrating their advantages in facilitating practical management outcomes. This presentation introduces some of the approaches that have been successfully adopted in Tasmania. For instance, we have allayed the taxonomic impediment through (a) restricting much of our sampling to the vicinity of the Warra Long Term Ecological Research Site in southern Tasmania; (b) restricting our taxonomic focus to the beetles (1200 species and rising); (c) developing a comprehensive repository for beetle specimens arising (the Tasmanian Forest Insect Collection); and (d) adopting standard code-names for the two-thirds of sampled taxa that remain undescribed. Likewise, we have focused ecological studies on the same subset of taxa, and have used these to explore a range of responses to different aspects and scales of forest management. Narratives concerning the behaviour and ecology of individual flagship species from these studies have the potential to turn the yuck-factor into a wow-factor, while our growing knowledge of this fauna has enabled us to turn the sheer magnitude of arthropod biodiversity into a research asset and a conversation piece, enabling channels of engagement between conservation biologists and forest managers and the wider public.

**Keeping arthropod conservation relevant in sustainable forest management: tips from Tasmania, Australia**

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Keeping arthropod conservation relevant in sustainable forest management: tips from Tasmania, Australia

We compared the utility of two time-series data measures for applied conservation biology by investigating how well each could predict future local persistence of a diverse set of non-rare bird species with varying survey efforts. We used 37 years of data from an eastern subsection of the North American Breeding Bird Survey. We first calculated abundance from yearly point-counts and variations of permanence (i.e., consistent occupancy over time) from yearly presence-absence data in six different length survey intervals from an early time period (1970-1981). We then used a contemporary time period (2001-2006) to empirically evaluate how well each measure predicted local persistence two decades later, and each measure's sensitivity to survey interval length. We found that permanence could only match the ability of abundance to accurately predict local species persistence if many multiple within-year repeated observations directly contributed to its calculation. All measures remained fairly robust to reductions in data from 12 to 4 years of survey intervals, but only the abundance measure and the best permanence measures were similarly effective at predicting persistence with fewer than 3 years of surveys. Thus, to best ensure biodiversity persistence, we recommend both the yearly and within-year repeated collection of abundance estimating data for use in applied conservation biology, such as protected area selection.

**With many repeated surveys, consistent occupancy can predict local species persistence nearly as well as abundance**

12.5 Grouios, CP*; Manne, LL; Biological Sciences, University of Toronto Scarborough, Biology Department, College of Staten Island / City University of New York; chris.grouios@utoronto.ca

We used data from nearly 120000 point-counts of non-rare bird species with varying survey efforts. We compared the utility of two time-series data measures for applied conservation biology: abundance from yearly point-counts and variations of permanence (i.e., consistent occupancy over time) from yearly presence-absence data. We first calculated abundance from yearly point-counts and variations of permanence from yearly presence-absence data in six different length survey intervals from an early time period (1970-1981). We then used a contemporary time period (2001-2006) to empirically evaluate how well each measure predicted local persistence two decades later, and each measure's sensitivity to survey interval length. We found that permanence could only match the ability of abundance to accurately predict local species persistence if many multiple within-year repeated observations directly contributed to its calculation. All measures remained fairly robust to reductions in data from 12 to 4 years of survey intervals, but only the abundance measure and the best permanence measures were similarly effective at predicting persistence with fewer than 3 years of surveys. Thus, to best ensure biodiversity persistence, we recommend both the yearly and within-year repeated collection of abundance estimating data for use in applied conservation biology, such as protected area selection.

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Putting lines on a map: an approach for classifying species occurrence models to identify critical habitat for endangered species

Conservation efforts require understanding of species resource needs across space and time, and increasingly involve detailed quantitative models to delineate important habitat areas for protection, management, or broader-scale planning. Resource selection function models are frequently developed to estimate the relative probability of occurrence of a species across an area of interest. Inevitably, however, it becomes necessary to classify the resulting habitat map into categories for further analysis or interpretation. Common approaches to classify habitat areas are based on frequency histogram analysis or confusion matrices, and typically utilize arbitrary thresholds. We expanded on commonly used methods for testing the validation of species occurrence models as the basis of a more meaningful approach for classifying habitat models. This approach assesses the predictive capability of model classifications at maximizing the proportion of species occurrence records captured. We tested this approach using a nest occurrence model for Greater Sage-Grouse (Centrocercus urophasianus) and identified habitat that contained 87% (95% CI 76-95%) of nest sites within 49% of the study area in southeastern Alberta, Canada. This approach is likely to be useful for classification of detailed habitat models for other endangered species where the challenge is to use the best available information to identify critical habitat.

The carpathian larch natural forests between the High Conservation Value Forests from Romania

Identified sometimes as a subspecies (Larix decidua ssp. carpathica), but mostly only as a variety (Larix decidua var. carpathica) of the european larch (Larix decidua), the carpathian larch is present in spontaneous status in Romania on almost 4500 ha of natural forests, mostly mixed stands with spruce, beech, scotch pine and other species, where the larch represents less than 50 % in composition, but also stands dominated by this rare taxa (60% or more in composition) or even small pure stands. The floristic and phytocoenological investigations realised along the years, and, most recently, our researches, relieved that in the Romanian Carpathians the natural, pure or mixed, larch forests shelt 24 endemic species (12 for Romania and 12 for the entire Carpathians chain), one endangered and one vulnerable species, 6 vulnerable/rare species and 42 rare taxa, according the Romanian Red Lists, justifying entirely, in our opinion, their conservation management and also the High Conservation Forests level.

Folk classification and local knowledge of shea tree (Vitellaria paradoxa subsp. nilotica (Kotschy) A. N. Henry et al.) varieties in Uganda

Local knowledge of plant variation has been used for the domestication of many plant species including potatoes, sorghum, yams, cassava and rice. The process involves documentation of apparent variation of different phenotypes and subsequent selection of superior plus individuals of such plants. One useful plant of high economic value in Uganda for which local classification knowledge and variation have not yet been documented is Vitellaria paradoxa (the shea tree). Local farmers point to a high variation in form, yield and fruit taste of the shea tree. To document shea tree folk classification and ethno-varieties, we used 300 questionnaires, 15 focus groups and 41 key informants in three farming systems of Uganda (Kotschy) A. N. Henry et al. ) varieties in Uganda

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There is need to complement farmers’ classification criteria with more detailed studies involving biochemical and molecular markers.

Considerations for the surveillance of Cauca Guan (Penelope perspicax) populations, an endangered and endemic species to Colombia

The Cauca Guan (Penelope perspicax) is an endemic and endangered species of the Colombian Andes, with only six confirmed populations. An essential aspect to design adequate management strategies is to continuously assess population status (e.g. size and density), however accurate population estimates are difficult to obtain especially when birds are rare, inconspicuous and shy. Accurate estimates, needed to detect significant changes in a population, require rather large efforts in terms of time, personnel and resources. In order to guide sampling design to obtain reliable and comparable population estimates (in space and time) for the Cauca Guan, on aspects such as sampling design and effort, we conducted a series of simulations based on data from previous studies on three of the six known populations. In these previous studies encounter rates contributed the most to the total variance. Considering the costs and benefits of each option, simulations suggest that line transects are recommended over other sampling methods, single observer is preferred over double observer and more transects (despite shorter) are helpful in order to reduce total variance.
The Carpathian basin is one of the main migrating and wintering area of several wild goose species in Europe. The typical habitats of the Hortobágy are mainly grasslands, wetlands and marshes which are favourable assembling places for several migrating bird species. Most of the migrating geese are White fronted goose (Anser albifrons), but the endangered Lesser White fronted goose (Anser erythropus) and the Red breasted goose (Branta ruficollis) also observed annually. The Greylag goose (Anser anser) is the only breeding goose species in the area and regular in the migration periods. Hungary has a temperate continental climate that is influenced by three main factors, these are the Eastern-European continental, the Western-European oceanic and the Mediterranean influences. The winter temperature is fluctuating between wide ranges caused by the diverse effects and the basin character. The study period was the last twenty years since 1989. We analysed the correlation of the climate change on extinction dynamics than we currently have. To increase this understanding, we have been exploring a novel modeling approach, which integrates downscaled global climate model ensembles, single and ensemble bioclimate models, and stochastic metapopulation models with dynamic spatial structure. This approach is applied to a set of vascular plant species with a broad range of life history traits, as well as other groups of animals and plants. The results allow assessing climate change impacts on species viability through limited dispersal (causing some suitable habitat to remain unoccupied), increased fragmentation (causing local extinctions due to demographic and environmental stochasticity), increased fluctuations due to increased frequency of extreme weather events (causing increased risk of local extinctions), reduced vital rates (survival, growth, and fecundity), and changes in species interactions (e.g., reduced prey base). The ultimate goal is to provide general rules for red-listing species that may be threatened by climate change, based on a meta-analysis of the results of the application of the integrated model to several taxonomic groups and geographical regions.
Corridors have been widely implemented to promote species persistence in fragmented landscapes. In spite of their popularity, longstanding concerns exist that corridors may have negative consequences. Raised over 20 years ago by Simberloff (1987), these concerns include increasing the dispersal of antagonists, such as the predators and diseases of conservation species; the spread of invasives; and the spread of disturbances, like fire. These concerns have never been rigorously tested. Working within the Savannah River Site Corridor Experiment, we tested these potentially negative effects of corridors. Our experiment included eight replicate landscapes, each with ~1ha patches that were either isolated or connected by corridors. We found that corridors did not increase plant invasions. Negative effects of corridors on predation were, when present, primarily attributed to the effects of edges, a side effect of the creation of narrow corridors. Corridors increased prevalence of animal-dispersed parasites, but not wind-dispersed disease. Finally, corridors facilitated hot fires by increasing the temperature at which fuels burned, likely by funneling and increasing speed of wind. Despite the potential for some negative effects of corridors on edge effects and spread of animal dispersed parasites, there remains no evidence that corridors reduce population persistence; on the contrary, our data show they help maintain populations of native species.
SY41 Haim A; University of Haim; ahaim@research.haifa.ac.il

**Chronobiological disruption and nature conservation**

Most organisms are adapted to the daily and seasonal light variations that result from planetary motion. The biological clock of such organisms is entrained by these variations, acts both as a clock and a calendar. Light at night (LAN) and Light interference (LI) disrupt these circadian rhythms with deleterious effects. Several studies in our laboratory show that to short day acclimated rodents, LAN signals a long day acclimation and thereby disrupts seasonality. This creates a "seasons-out-of-time" effect, discovered in the thermoregulatory system of the social vole Microtus socialis. LAN may change conductance properties of the integument, meaning that exposure to low ambient temperatures will result in hypothermia if heat production cannot compensate for heat loss. These changes can be attributed to the interruption of melatonin production and secretion by the pineal gland. Rapid increase in light intensity (via an on/off switch) from minimal levels to 450 lux forms a source of stress and in M. socialis resulted in an increase of stress hormones levels. A comparative thermoregulatory study (diurnal versus nocturnal) Gerbils revealed different patterns likely stemming from activity time. LAN and LI also have a negative impact on the immune system. With the modern increase in LAN and LI, conservation biologists should be aware of these negative impacts on animal welfare in relation to light intensity, wavelength and duration of exposure.

SY4 Hall, J; U.S. Department of Defense; john.hall@osd.mil

**We have 40 questions-now what?**

In combination, the 40 questions reflect the considered input of many knowledgeable individuals and address a wide range of conservation science, policy-relevant issues. But questions left unanswered are simply unfulfilled musings. Themes emerged during the workshop discussions that indicated successful use of the questions relies on three key elements. First, translation and education are necessary. As scientists we struggle communicating our ideas and understanding to the public, policy-makers, and even the resource managers that are the consumers of research. To make an impact these questions need to be understood and appreciated for their relevance to biological resource management issues faced by society. Such understanding and appreciation would be facilitated by improvements in the ecological literacy of the public. Second, adequate and sustained funding will be needed to address the questions. Public and private funding institutions must evaluate, each subject to their own constraints and missions, which questions they will choose to apply resources against to address. Third, those entities that represent the end users will need to consider their support for the research to address each question and their willingness and ability to implement the understanding that results amidst all the other requirements and constraints they confront.

4.2 Hall, Jonathan C*; Chhangani, Anil K; Waite, Tom A; The Ohio State University, Columbus, OH, The School of Desert Sciences, Jodhpur, India; hall.1073@buckeyemail.osu.edu

**The impacts of La Niña induced drought and the Bishnoi people on Indian vulture populations in Western Rajasthan**

Previous research on the catastrophic decline of the Gyps species complex has identified diclofenac, an anti-inflammatory drug administered to livestock, as the primary cause. Large-scale climatic phenomena, such as El Niño Southern Oscillation induced drought, might exacerbate diclofenac-caused declines; however, these phenomena have not been examined. Here, we ask whether El Niño Southern Oscillation (ENSO) contributes to the population dynamics of the critically endangered Indian vulture (Gyps indicus). Based on time series analysis of annual count data, 1996-2005, we provide evidence that ENSO synchronized population dynamics throughout western Rajasthan. We attribute this impact largely to two La Niña events, including the major event spanning 1999. Although these climatic events apparently affected local populations in a parallel way across the region, we explore whether one particular local population might have been partially buffered by the presence of the Bishnoi people who practice a religion with specific conservation tenants. Our results show that the Indian vulture population in the Bishnoi village of Khejerli was buffered from drought events.

SY57 Hall, K*; Doran, PJ; The Nature Conservancy; kimberly_hall@tnc.org

**Ecosystem-based Adaptation to Climate Change Impacts in the Laurentian Great Lakes**

The Laurentian Great Lakes cover more than 94,000 square miles, drain more than twice as much land, and hold one-fifth of the world’s usable fresh surface water supply. While healthy, this vast resource faces a variety of threats including incompatible development, invasive species, dams and barriers, and non-point source pollution. Changes in climate are predicted to enhance many of these existing stressors, and add new ones. For this freshwater resource, ecosystem based adaptation not only involves re-evaluating current practices (e.g., agricultural best management practices) where we seek mutual benefits for people and nature through creative partnerships, but it also involves engaging in new strategies to deal with emerging issues (e.g., lake level changes). Here we discuss climate change impacts, formulate “hypotheses of change” that link impacts to biodiversity features, and subsequently discuss a variety of ecosystem based adaptation strategies. Additionally, we discuss decision support tools intended to inform climate adaptation strategies. We will focus on three case studies that include aquatic systems imbedded in an agricultural matrix, large freshwater bays and estuaries, as well as Great Lakes coastal habitats - each of which lie at the intersection of social, economic, and ecological interests. Efforts thus far highlight great potential for “win-win” strategies, and some daunting challenges in terms of losses of biodiversity that appear unavoidable.
**SP1.14** Hall-Beyer, M.; Department of Geography, University of Calgary; mhallbey@ucalgary.ca

*Interannual variability patterns in vegetation density derived from AVHRR GMMS data, 1982-2006: Alberta Canada*

Monitoring effects of climate change often concentrates on total change through time, but increasing emphasis is placed on more frequent outlier events or greater overall variability resulting in the ecosystem. We used the globally validated 8km GIMMS AVHRR dataset of NDVI for half-month repeats over 25 years April through October. The amount of variability and its seasonal pattern were compared for different land covers and different ecoregions of Alberta, Canada. All types of forested ecosystems show maximum interannual variability in spring and fall, but timing differs with ecoregion. This pattern may show temperature dependence. Grass ecosystems' peak variability is in midsummer, likely moisture-dependent. Some areas show elements of both patterns. Agriculture-dominated areas follow the grasslands pattern even where irrigated. These measurements are the only spatially-explicit baseline available, since globally equivalent satellite data has only been produced since the 1980s. These 25 years span several major El Nino and La Nina events, and can provide a baseline to compare future variability. AVHRR and comparable MODIS and SPOT Veg data will allow continued equivalent data gathering and monitoring. Results suggest that monitoring needs to be spatially stratified by both ecoregion and landcover. It requires continued updating of validated land cover products in the public domain.

**SP1.11** Hamilton, CM*; Radeloff, VC; Pidgeon, AM; Heglund, PJ; Thogmartin, WE; Helmers, D; University of Wisconsin - Madison, U.S. Fish and Wildlife Service, United States Geological Survey - Upper Midwest Environmental Sciences Center; cmh@wisc.edu

*Midwestern Housing Growth Surrounding the United States Fish and Wildlife Service National Wildlife Refuge System*

Biodiversity conservation requires protected areas to provide habitat for fish and wildlife populations. The mission of the United States National Wildlife Refuge System (NWRS) protected areas is to provide ecological benefits and it has a recognized role in preserving biodiversity. However, the refuges are typically surrounded by private land, a substantial portion of which is developed. Development may influence the ecological benefits of refuges. Our goal was to quantify housing development in the surroundings of all National Wildlife Refuges in the U.S. Midwest as an indicator of the threat that development poses to the biodiversity conservation function of the refuges. We quantified housing growth surrounding the Upper Midwest NWRS for each decade from 1940 to 2000 using detailed spatial housing growth data. We found housing units within 50 km of NWRS protected areas increased from 5.8 to 13.3 million. The average decadal rate of housing growth varied between 18.1 and 21.5% within 1, 5, 10, 25, and 50 km of NWRS areas. Growth was highly variable among refuges, reaching up to 651% (120 to 970 housing units from 1940 to 2000) within 1 km of Sherburne NWR. Housing growth threatens to isolate National Wildlife Refuges and diminish their ability to protect biodiversity.

**SY76** Hanula, JL*; Horn, S; Campbell, JW; USDA Forest Service, Southern Research Station, Shorter College; jhanula@fs.fed.us

*Altering Deciduous Hardwood Forests to Improve Bee Diversity and Abundance*

Pollinators, particularly bees, have declined in many regions of the world. In the southeastern United States one factor that may be contributing to fewer pollinators is increasing forest cover and changes in forest structure and composition. We conducted two studies on the impact of removing a dense shrub layer from deciduous hardwood forests on pollinator diversity and abundance. In the Appalachian Mountains of North Carolina a century of fire exclusion resulted in a thick cover of native shrubs. Treatments included prescribed burning only, shrub cutting followed by burning, shrub cutting only, and no treatment. Cutting and fire alone had no effect on pollinators but when cutting was combined with prescribed burning nearly twice as many pollinators and ~30% more species were caught. In a second study, an invasive shrub was removed from bottomland hardwood forests in Georgia. This resulted in a 10-fold increase in pollinators and 4-fold increase in pollinator species. Both studies resulted in similar forest structure and density despite very different methods. These studies suggest that pollinators would benefit from lower tree densities and less shrub cover.

**SY33** Hard, JF*; Allendorf, FW; NOAA NW Fisheries Science Center, University of Montana; jeff.hard@noaa.gov

*Adaptation to Human Exploitation and the Challenge of Evolutionarily Sustainable Harvests*

Humans are highly efficient predators of wild organisms. Evidence is mounting that selection imposed by human harvest could be limiting the adaptive capacity of exploited populations, but with few exceptions harvest management has not taken evolutionary effects of harvest into account. When sufficiently selective, exploitation imposes “unnatural” selection that can reduce the abundance of individuals with characteristics favored by natural and sexual selection in the wild. Successful adaptation to unnatural selection requires three things. First, genetic variability must be conserved to maintain evolutionary potential. Second, harvest cannot be too selective: removing individuals with high fitness as potential breeders directly threatens viability as well as diversity. Finally, harvest-induced mortality must not be so high that it limits productivity. Harvest that maximizes short-term yields is often too high and too selective on key life history traits to avoid maladaptive evolution. Because it is likely that some undesirable changes in exploited populations have been caused by harvest-induced selection, there is an urgent need to identify management interventions that could arrest or reverse these changes. Identifying evolutionarily sustainable harvest practices remains a formidable challenge for natural resource managers—but it is a challenge that can no longer be ignored.
Exploring the Consequences of Climate-induced Changes in Cloud Cover on Reproduction and Offspring Phenotype of a Temperate-zone Ectotherm

Historically, studies predicting the response of organisms to climate variability have emphasized changes in temperature, with few considering other climatic changes. Ectotherms depend on external heat for most biological processes, and basking behaviour is an absolute requirement for lizards from temperate-zones for processes such as digestion and embryogenesis. Given that predicted changes in cloud-cover will alter basking opportunity in many locations, we measured the reproductive and phenotypic consequences of a large increase or reduction in basking opportunity during pregnancy in a live-bearing temperate-zone lizard. This is the first study to suggest a potential negative influence of climate change on reproductive and offspring production. Thus, changes in basking opportunity through increased cloud cover may have detrimental and long-lasting impacts on the population dynamics of live-bearing temperate-zone species.

Marine predators, projections, and global conservation targets

High seas marine conservation planning is coming of age. The Convention on Biological Diversity in 2004 catalyzed a major conservation planning exercise to establish an ecologically representative network of marine protected areas by 2012. Traditional conservation strategies focus on where biodiversity is and incorporating variability and estimating effects of climate change on species distributions are now important steps in conservation planning. The efficacy of traditional place-based approaches to open ocean conservation thus depend on species-environmental relationships. Here we undertook an effort to describe the distribution of 10 species of Pacific Ocean top predators in the high seas, characterize the spatio-temporal relationship between species and their environment, identify multi-species hotspots, and estimate hotspot occurrence under IPCC climate change scenarios. We utilized electronic tagging technology to describe the movements of wide-ranging marine predators including laysan and black-footed albatrosses, northern elephant seals, sooty shearwaters, and salmon and white sharks from 2004-2008. We processed data with a state-space model, described species distribution and identified hotspots with weighted density plots, kernel density and Moran’s I statistics, modelled species-environment relationships using Environmental Niche Factor Analysis, and estimated distributions and hotspot occurrence under IPCC scenarios. We identified seasonally dynamic multi-species hotspots in the North Pacific Transition Zone, sea surface temperature was a primary correlate. Species distribution and hotspot occurrence and timing shifted under climate change scenarios. Incorporating variability in marine conservation planning will be one of the major challenges in establishing a “representative network,” particularly with respect to wide-ranging marine predators.

Island prioritization for alien invasive species eradications

Invasive alien species eradications are increasing, both in numbers and success rate. Yet, invasive alien species remain the greatest threat to insular biodiversity. A consensus is emerging that we need to undertake eradication strategically to minimize insular biodiversity loss. In response to this, we present a very simple framework for prioritizing islands for invasive alien species eradication, with an emphasis on reinvasion risk as the primary threat to long-term conservation potential. To construct a prioritization list, managers need only to assign weights to importance levels of reinvasion risk factors (we make an important distinction between natural and human-aided reinvasion), conservation value and any other factors of choice. The framework can also be used to compare conservation gain per unit eradication effort under different management scenarios, such as implementing biosecurity to reduce human-aided reinvasion risk. The resulting priority list will be able to maximize conservation outputs in the long term. It may also be useful to help raise funds for eradications, or to direct collection of missing data. We illustrate our system with the case of invasive rodents in New Caledonia but our framework can be generalized to any invasive taxon able to disperse naturally between islands, and to any archipelago.

Stochastic Modeling to Design Appropriate Interventions to Promote Recovery of the Hawaiian Monk Seal

We use stochastic simulation modeling to explore a novel two-stage translocation strategy for improving the population status of the endangered Hawaiian monk seal. Approximately 80% of the roughly 1,100 monk seals reside in six remote Northwestern Hawaiian Islands (NWHI) subpopulations, where abundance is declining 4% annually, due to poor juvenile survival. In contrast, the remainder of the seals inhabits the main Hawaiian Islands (MHI), where abundance is increasing 7% per year and juvenile survival is quite high. We model scenarios in which weaned female pups from the NWHI are translocated to the MHI where they stay until age 3 yr, thus boosting the proportion surviving the juvenile phase. Thereafter, these seals are returned to the NWHI, where sub-adult and adult survival rates are comparable to the MHI. We evaluate the potential positive impacts of such actions on metrics such as abundance and population reproductive value. We also track potential negative impacts on individual subpopulation depletion and sex ratio. These simulations will help us to formulate effective intervention strategies that will aid recovery while also informing us about the magnitude of the expected benefits that will accrue from their application.
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**Non-governmental Organizations and Multi-Sited Marine Conservation Science: A Case Study**

The study of how non-governmental organizations (NGOs) interact with local, national, and international actors to play a role in multi-scalar marine environmental solutions has grown in popularity in the academic literature. However, despite the growing body of NGO literature, little has examined the structure, function, and outcomes of NGO initiatives that primarily focus on marine science production, with a full analysis of the local, national, and international drivers of programmatic decisions and outcomes. This study has examined the processes of a major NGO initiative that has had the goals of producing marine protected area science, building local capacity, and influencing marine policy at four main sites: Belize, Brazil, Panama, and Fiji. Multi-sited international research has uncovered processes and outcomes unique to particular countries as well as those that are systematic. Methods have included participant observation, semi-structured interviews, document analysis, and social-network analysis. Preliminary results reveal that (1) marine research is more effective in moving policy when rolled into ongoing, in-country processes, (2) strong partnerships with in-country organizations, established at the earliest possible point in research design, are essential to get local buy-in into projects, and (3) integrated multi-disciplinary research initiatives that include social science are more useful to local stakeholders than those that focus on biological studies alone.

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**The Nexus Between Conservation Practices and Carbon Markets: What counts now and where, and where will things count in the future**

The global carbon market is growing rapidly and is currently valued at over $126 B USD (World Bank 2009) - a tripling over the last few years. Carbon markets are established by government's choosing to place a price on carbon or greenhouse gas emissions through regulatory mechanisms known as emissions trading systems. Many jurisdictions, particularly in North America, are also considering allowing Carbon Offsets in a Cap and Trade emissions trading system. Offsets are GHG emission reductions undertaken by companies outside of the capped sectors (ie, actions taken voluntarily by those who do not have regulated targets, like the agriculture sector). Regulated companies can offset their emissions by purchasing these offset credits from others who have reduced their greenhouse gas emissions or have sequestered soil carbon, through Offset Projects. In this way, conservation agriculture, forestry or habitat projects can provide offsets to large emitters of greenhouse gases who are regulated. The role biological systems can play in reducing carbon is significant. The IPCC 4th Assessment Report, Volume 3 indicated that if the global Agriculture and Forestry sectors were mobilized with a price of carbon at $100/tonne, over 50% of the manmade fossil fuel emissions could be removed from the atmosphere on an annual basis (over 3 Gt of CO₂ emissions) - simply by carbon sequestration in soils, forests and other biological systems. Agriculture and Forestry activities are a key component of all Offset Systems either in place or under consideration worldwide, both voluntary and compliance-based - indeed, they have been a pivotal cornerstone of Bills in both US congressional houses. Conservation, improved management and restoration of these systems are all part of the mix. However, the trick is the accounting process and the policy criteria that defines an eligible offset. Quantification methods, policy decisions, and program criteria needed to generate compliance-quality offsets are in development. This presentation will discuss these issues and more as it explores the nexus between conservation and carbon.

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**First to Go or Last to Show? Comparing Turnover Rates of Multiple Taxa in Response to Human Disturbance**

Predicting which components of biotic communities are lost first in response to human-caused habitat loss is vital in conservation and land management, however, we lack data on how species turnover rates compare between taxa. To address this deficit for the boreal forest of Alberta, we compare the community structure of five taxa (vascular plants, lichen, mows, birds and soil mites) at pristine sites to sites with increasing amounts of disturbance. Rapid, standardized survey methods were used to measure occurrence and relative abundance, and turnover rates were calculated using distance/similarity metrics. Over 85% of the samples were collected from sites within a systematic provincial grid monitored by the Alberta Biodiversity Monitoring Institute; the remaining 15% were chosen to supplement the human disturbance gradients. In addition to comparing the sensitivity of different taxa to disturbance, we address whether rare species exhibit greater turnover than common species. This is an important extension of the categorical comparisons and limited taxonomic depth of most disturbance studies. In addition, recent research has focused on defining critical thresholds for individual species. Our analyses extend threshold theory into potentially a more powerful direction, where there is more information on the trajectories of altered communities that managers can use to define biologically-informed targets.

**P1.82 HAUZER, MELISSA*; Dearden, Philip; Geography Department, University of Victoria; mhauser@uvic.ca**

**Artisanal Fisheries Management, Conservation, and Livelihoods in the Comoros Islands**

Tropical small-scale fisheries represent the main livelihood and protein source for a substantial portion of the global population. Growing pressures on marine resources, however, have left many fishing communities faced with declining catches and increased environmental degradation. Effective management strategies are thus critically important, yet few studies offer feasible solutions for traditional managers in lesser developed nations. This study took place on the island of Ngazidja in the Union of the Comoros. The purpose was to determine how effective fishing communities are at managing their fisheries, and why certain approaches are more effective than others. Qualitative methods were used to collect data on local knowledge and beliefs, management structures, and resource conflicts in four major fishing villages. Results show that marine resources and habitats have declined significantly over the past generation. Local fishing associations responded to the decline by imposing informal gear restrictions. Compliance rates to local regulations are high, primarily due to participatory decision-making, self-monitoring, and strong feelings of solidarity among fishers. Perceptions of the benefits of these regulations are also high. This suggests that by working within these pre-established informal management systems, as opposed to the more orthodox approach of instigating exogenous, formal management systems, improved conservation and livelihood outcomes should result.
Snow vole in Armenia: one or three species?

It is known that there is one species of snow vole dwelling in Armenia. It is European snow vole (Chionomys nivalis; Thomas, 1906). Chionomys gud (Satunin, 1909) and Cheonomys roberti (Martins, 1842) are living in South-west Georgia and North-east Turkey, Azerbaijan. The main habitats of these species are forests and grasslands. The North-west region (Shirak Marz) of Armenia has boarder with both Georgia and Turkey. Ecological and zoogeographical parameters of this region are compatible with parameters which need Chionomys gud and Cheonomys roperti species. But there are not any data about these species in Shirak Marz. It’s because of not enough research. Now we will try to identify key areas for snow voles in Armenia and by using the new genetic and biochemical methods to find out the possibility of presence of Chionomys gud and Cheonomys roperti in Armenia.

Estimating extinction rates: Habitat loss, species-area curves and the “extinction-debt”

Accurate forecasting of species extinction from habitat loss is of fundamental importance to biological conservation. Because of the lack of reliable direct methods for verifying extinctions, there is considerable uncertainty in extinction rate estimates. The most widely used indirect method estimates extinction rates by reversing the species-area accumulation curve, running it “backwards” to smaller areas to calculate expected species loss. However, this method yields estimates of extinction rates that are typically much higher than those observed. The overestimation arises because the sampling problem when constructing a species-area curve is very different from the inverse sampling problem when loss of habitat occurs due to patchy or geographically scattered habitat destruction. Only in the special case when species are randomly and independently distributed is the species loss rate the exact inverse of the species addition rate. Because most species are aggregated in geographic distribution, the extinction rate estimated using the usual approach is the maximum theoretical rate, often far exceeding the actual extinction rate at equilibrium for a given loss of area. Here we present a novel, simple method for estimating species extinctions due to habitat destruction.

Are the ranges of some taxonomic groups more in equilibrium with climate than others? A global meta-analysis

Key applications of species distribution models (SDM) include guiding conservation efforts and predicting future shifts of species ranges in response to forecasted climate change; however, a major assumption of SDMs is that present-day species’ ranges are in equilibrium with climate. Given the variation in physiological tolerance and life history strategies among taxonomic groups, they likely vary in their distance from equilibrium with climate. To test this hypothesis, we conducted a comprehensive meta-analysis using accuracy statistics from SDMs based only on climate, as an estimate of the mismatch between a species’ distribution and climate. The analysis revealed a significant difference between taxonomic groups in model accuracy, where birds and mammals were the most accurately modeled of all groups, while butterflies were furthest from equilibrium. Therefore, we can not expect the same degree of accuracy in predictions of future suitable habitat across groups of different species if only broad-scale climatic factors are used. We also explored potential hypotheses for these taxonomic differences and found that the spatial scale and latitude of the SDM were important methodological considerations. We propose that interactions between dispersal limitation, model resolution and microclimatic variation could explain taxonomic differences in equilibrium with climate and could provide insights into improving predictions of species’ range shifts in response to future climate change.

Reviewing the Conservation Science of Critical Habitat

One of the challenges in the implementation of critical habitat is the scientific problem of defining it for an endangered species. After reviewing the individual cases of critical habitat designation challenges for Canada lynx, Sage grouse, killer whales, spotted owls, Banff springs snail, and other examples in this symposium, our goal in this paper is to review the conceptual definition of critical habitat to identify the scientific implementation gaps in critical habitat science. Starting from niche theory and the theory of density dependent habitat selection, we develop a quantitative definition of habitat quality for endangered species. We then extend habitat quality to an operational definition of critical habitat to identify the scientific implementation gaps in critical habitat science. Starting from niche theory and the theory of density dependent habitat selection, we develop a quantitative definition of habitat quality for endangered species. We then extend habitat quality to an operational definition of critical habitat by considering concepts of minimum viable populations, thresholds for extinction, and other general conservation biology â€œ rulesâ€ for preventing extinction. This emphasizes that critical habitat itself does not conceptually exist in the absence of a population target or goal, as recognized in both SARA and the ESA in the link between critical habitat and a recovery goal. Therefore, the concept of critical habitat is ultimately tied to the recovery goal, and so we conclude by reviewing some of the different standards of â€œ recoveryâ€ as exemplified in the various case studies discussed in the symposium. For the science of critical habitat to develop, more focus on the link between populations and habitats is needed, one of the most challenging scientific aspects of endangered species recovery.
Reciprocal translocations and 'genetic rescue' of bottlenecked populations of the New Zealand robin

Many endangered species around the world have passed through severe population bottlenecks due to anthropogenic influences such as habitat loss or fragmentation, the introduction of exotic predators, and excessive hunting. As a result, inbreeding is expected to increase as gene flow between populations is interrupted and survivors are more likely to mate with relatives. Conservationists are thus faced with the problem of protecting a number of fragmented and inbred populations. Theoretical models suggest that crossing individuals from one inbred population with those of a second inbred population should decrease the severity of inbreeding depression in the hybrid offspring. To test the applicability of this method for the conservation of endangered species, we conducted experimental reciprocal translocations between two isolated, inbred populations of the New Zealand robin. A total of 33 females were translocated and differences in reproductive success, parasite burdens, immunocompetence, fluctuating asymmetry, gamete quality, and male song complexity were compared between “hybrid” offspring (crosses of the two populations) and inbred control offspring. Preliminary results suggest increases in a variety of measures of reproductive success among the hybrid young but whether these persist in future generations is not clear.

For endangered species that survive only in small, inbred populations, crosses of inbred birds from different populations may be the only method to ‘rescue’ an inbred population through the introduction of novel alleles. Our results suggest such methods may be worth trying in species showing severe inbreeding depression.

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Linear Density Estimation for Population Monitoring of Grizzly Bear along Salmon Rivers

Sampling requirements for population estimation can be a significant barrier to the use of DNA-based mark-recapture approaches in remote landscapes, particularly for relatively low density species such as grizzly bear (Ursus arctos horribilis). We took advantage of seasonal grizzly bear concentrations along rivers supporting spawning Pacific salmon (Oncorhynchus spp.) and a noninvasive DNA sampling design to develop linear population density estimates using a mark-recapture framework. The approach significantly reduces the logistical requirements compared to an area-based estimate. Linear arrays of hair snares were monitored along the Taku River (British Columbia, Canada) within two study areas: Upper River (UR) and Lower River (LR). Genotyping of DNA and the capture-recapture histories of individuals were used in closed population models. Resulting annual abundance estimates (±SE) in the LR were 19.8 (+11.1), 19.5 (+9.0), and 25.7 (+3.8) and abundance estimates for the UR were 52.3 (+32.5), 62.6 (+11.9), and 84.2 (+30.7) for 2000, 2001, and 2003, respectively. We used estimated bear movement distances along the river corridor to calculate a linear density estimate, which ranged from 0.34 - 0.44 grizzly bears/km and 1.08 - 1.45 grizzly bears/km for the LR and UR, respectively. The difference in population densities between the two study areas is explored.

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Local stakeholders’ opinion on MPA success for a proposed National Marine Conservation Area in the Southern Strait of Georgia, British Columbia

Marine protected areas (MPAs) are increasingly established worldwide following a call for a global system of MPA networks by 2012 (United Nations 2003). In order to prevent the establishment of so-called “paper parks” or ineffective MPAs, clear statements are needed by management agencies of the outcome they expect to achieve by creating MPAs and how they will demonstrate MPA success over time. Based on different stakeholder groups’ opinion, MPA success indicators for a proposed National Marine Conservation Area on the West coast of Canada are identified. The application of the framework for assessing management effectiveness of protected areas developed by Hockings et al (2006) illustrates that the framework is not only useful for evaluating existing MPAs but also to define MPA success prior to the establishment of a new protected area. Success indicators for all management cycle stages of the framework are outlined including stakeholders’ opinion on the design and planning process as well as expected outcomes that should be achieved by the proposed marine protected area. Results further show that local stakeholders identify MPA success equally in terms of good governance indicating how the area will be managed and future achievements of expected environmental and social outcomes. Hockings, M., S. Stollton, F. Leverington, N. Dudley, and J. Courrau. 2006. Evaluating Effectiveness. 2nd edition. IUCN, Gland.
Coral reefs, among the most diverse ecosystems on the planet, are in accelerating global decline, threatened by climate change, pollution, disease, overfishing, and destructive fishing. Blast fishing has destroyed many coral reefs in Southeast Asia by creating large fields of dead coral rubble where new coral recruits settle but cannot survive and grow. Possible management responses include reef rehabilitation of damaged areas, and/or increased enforcement to protect still-living ones. Here we show that in Komodo National Park, a marine protected area (MPA) in Indonesia, rehabilitation by installing locally-quarried rocks on blasted rubble fields can be relatively low-cost (~US$4.80/m²), but unlikely to be economically viable at large scales. Although rehabilitation without enforcement is unlikely to be effective, we compared rehabilitation data (costs and coral growth over 8 years) and enforcement costs to conduct three economic analyses: cost-per-area calculations, a cost-effectiveness model over 7 years, and a willingness-to-visit growth over 8 years) and enforcement costs to conduct three economic analyses: cost-per-area calculations, a cost-effectiveness model over 7 years, and a willingness-to-visit growth over 8 years. We found that rehabilitation costs ~70 and ~5-times more, respectively, than marine patrols to enforce blast fishing bans. Hence, we recommend that MPA managers prioritize investment in achieving compliance with regulations above investment in rehabilitation to better enable reefs to generate biodiversity and fisheries benefits and tourist revenues.
SY25 Henry Travers*, Tom Clements; Aidan Keane; EJ Milner-Gulland. 1 Centre for Environmental Policy & Division of Biology, Imperial College London, Silwood Park, Buckhurst Road, Ascot, SL5 7PY, UK, 1 Centre for Environmental Policy & Division of Biology, Imperial College London, Silwood Park, Buckhurst Road, Ascot, SL5 7PY, UK, 2 Department of Zoology, University of Cambridge, Downing Street, Cambridge, CB2 3EJ, UK 3 Wildlife Conservation Society.; henry.travers@gmail.com

Rules of the game: incentives for rule compliance under different institutional structures

Resource extraction, from hunting to the expansion of agricultural land-use, remains a major threat to the planet's wildlife and natural landscapes. The institutions which are charged with governing these resources typically depend on systems of formal and informal rules for their success. Here we present the results of experimental economic games investigating human behaviour under different institutional conditions. A series of experimental treatments were employed to mimic some of the policy interventions commonly used in conservation to provide incentives for rule compliance, including social sanctioning, enforcement penalties and individual and collective financial payment agreements. The responses measured demonstrate the importance of the ability of the targets of such interventions to self-organise: to devise, monitor and enforce their own system of rules. In addition we show that the imposition of weakly enforced rules by external agents, a condition commonly found in conservation throughout much of the tropics, performs poorly in comparison to the other interventions considered. We conclude that a greater consideration of the effects of rule enforcement on human behaviour is required.

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Uncovering the Secret Life of an Imperiled Butterfly: Mardon Skipper Oviposition Selection

Lack of basic biological information about at-risk species is a key limiting factor in butterfly conservation. The habitat requirements of the Washington state endangered mardon skipper (Polites mardon) have only been studied in the southern Washington Cascades. To examine oviposition selection in the Puget Sound prairies, we observed eighty-eight oviposition events during the 2009 flight season. We sampled vegetation at oviposition (n=88) and random locations (n=88), measuring 22 habitat variables with respect to the oviposition plant, vegetation structure, and the plant community. Eighty-six of the sixty-eight eggs were laid on Festuca roemeri, a native, perennial bunchgrass. Discriminant function analysis revealed significant differences in egg-laying sites based on habitat characteristics. Females laid eggs in small F. roemeri bunches in sparsely vegetated (low vegetation density) areas of the prairie. These results are contrary to those in the Cascades where mardon are generalists and females oviposit in densely vegetated areas suggesting that the species has geographically specific habitat requirements. In the south Puget Sound, mardon habitat is severely degraded and understanding the factors influencing oviposition selection is crucial to develop effective restoration strategies. Our results emphasize the importance of managing for appropriate habitat structure in addition to hostplant and nectar resources to maintain viable mardon populations.

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Restoration of boreal limestone barrens - what will success look like?

Globally limestone habitats suffer a high rate of conversion associated with human use; yet few ecological restoration techniques are available. On the island of Newfoundland (Canada) limestone barrens are highly fragmented, treeless open ridges dominated by cold-soil processes. These northern limestone barrens are hotspots of native biodiversity harbouring 3 nationally listed endemic plant species (Braya longii, B. fernaldii, Salix jejuna) and many rare plant species but comprise 65% over the short term, but compaction represents a significant challenge. The need to restore large-scale disturbances presents significant challenges including restoring natural hydrology, soil formation processes, and biological diversity.

SP11.2 Hernandez-Santin, L*; Harveson, P.M.; McKinney, B.R.; Onorato, D.P.; Borderlands Research Institute for Natural Resource Management, SUL Ross State University, Box C-16, Alpine, Texas, 79832, USA, Cemex-El Carmen Project, P.O. Box 420608 Del Rio, Texas 78842, Research Institute, Florida Fish and Wildlife Conservation Commission, Naples, Florida, 34114, USA.; lhernandes@yahoo.com

Distribution Model for Black Bear in the Chihuahuan Desert Ecoregion of Texas and Northern Mexico: Implications for Recolonization

Black bears (Ursus americanus) were heavily persecuted and consequently eliminated from Texas and almost eradicated from Mexico by 1960’s. However, their numbers have bounced back in northern Mexico and Texas, resulting in a natural expansion to their former range starting in the late 1980s. We used MaxEnt to create a model that predicts black bear potential distribution in Texas and its bordering states in Mexico (Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas). For this, we used telemetry data from two studies conducted in west Texas, and digital maps readily available (elevation, NDVI, Vegetation Continuous Field, world climate data, Landsat images, and vegetation and soil maps), and coverage layers we generated in ArcGIS (hillshade, slope, Vector Ruggedness Measure, and distance and density to rivers, roads, and cities). Our models performed well within the Chihuahuan Desert Ecoregion and its surroundings (semiarid plains and prairies, and dry tropical forests), where predicted suitable habitat coincided with historic and current black bear records. This model represents a stepping stone to adequately assess their current and potential distribution, as shaped by their ecological needs and anthropogenic limitations. Our model will aid in the management of black bears as they continue to naturally recolonize the region.
Mapping and Monitoring of Native and Exotic Vegetation in Trans-Pecos, Texas

Over the last century, many factors have influenced the hydrology of the Rio Grande Basin (RGB), with desertification and land-use change being the more influential. What used to be productive grasslands, savannahs, and woodlands have now changed to erodible shrublands with low grass production. Brush encroachment alters the ecosystem's structure and function. Brush species are considered invasive in most grassland ecosystems because they consume more water than grasses and are less effective for water infiltration. Eventually, native grasslands succumb. This holds true for the fragile riparian habitats; for example, the Asian salt cedar (Tamarisk sp) has become a dominant element in the Rio Grande corridor. Landscape changes are difficult to quantify due to large temporal and spatial scales where vegetation and land-use changes are detectable. Thanks to remotely sensed data scientists are now able to quantify such alterations, providing essential information that aids the creation of better conservation and restoration strategies. The objective of this ongoing project is to evaluate vegetation changes in the RGB including native and exotic invasive vegetation. This project is divided in two parts: 1) vegetation mapping and 2) assessment of invasive brush encroachment. Vegetation mapping is possible through eCognition software using satellite imagery, aerial photos, soil survey and ecological site maps. Historical analysis of invasive brush encroachment will be assessed by comparing historical satellite images to current images using soil/vegetation indices and change detection techniques.

Vegetation and land-use changes are detectable. Thanks to remotely sensed data scientists are now able to quantify such alterations, providing essential information that aids the creation of better conservation and restoration strategies. The objective of this ongoing project is to evaluate vegetation changes in the RGB including native and exotic invasive vegetation. This project is divided in two parts: 1) vegetation mapping and 2) assessment of invasive brush encroachment. Vegetation mapping is possible through eCognition software using satellite imagery, aerial photos, soil survey and ecological site maps. Historical analysis of invasive brush encroachment will be assessed by comparing historical satellite images to current images using soil/vegetation indices and change detection techniques.

Convenient Solutions to an Inconvenient Truth: Advocating ecosystem-based approaches to climate change from a development perspective

The world's poorest people live at the rural frontier. They depend directly on the utilities and goods that ecosystems provide. They are also most vulnerable to the effects of climate change. However, current efforts to address climate change focus mainly on reducing GHG emissions by adopting cleaner energy strategies and on reducing risk by improving infrastructure to meet new energy and water needs. Examples from the World Bank portfolio provide a compelling development argument for including ecosystem-based approaches as an essential pillar in strategies to address climate change. Such strategies offer cost-effective, proven, and sustainable solutions that contribute to, and complement, other national and regional adaptation strategies.
SY23 Hicks, C C*; Cinner, J E; James Cook University; christina.c.hicks@gmail.com
Identifying key trade-offs in ecosystem service values under alternate management regimes in the Western Indian Ocean
Managing trade-offs, across scales and user groups, is increasingly inevitable in conservation. Trade-offs occur as a result of conscious, or unconscious, attempts to maximize key ecosystem services at the cost of those considered less desirable. Here we attempt to make those trade-offs, within coral reef conservation, explicit. Nineteen communities, across a range of management regimes, were examined. Values were assigned using a combination of conventional and newly developed valuation techniques at an individual, group and community level. Where conservation management had been implemented at a national scale, such as was the case with conventional no-take marine reserves, some fishery benefits were evident in the proximate communities at an individual level. However, the greatest benefits were felt in recreation services at a national level. In addition, this appeared at the cost of a wide range of individual and community values, including bequest, option, other cultural services, perceived habitat and biological control. More recent attempts at management, a result of the devolution of fisheries governance to fishing communities, have resulted in community initiated and controlled no-take areas springing up. Here, key social characteristics are found to relate significantly to which ecosystem services are considered a priority and hence the motivation for the initiation of these conservation measures. Decisions concerning natural resource conservation and management need to consider the motivations and values of individuals involved to avoid unexpected and undesirable trade-offs within the surrounding land or seascape.

SY77 Higgins, K; Quest University Canada; kellina.higgins@questu.ca
A proposal to reduce agriculture’s impact on the environment in the form of two environmental taxes
Agricultural land use and associated artificial fertilizer applications respectively divert land from natural ecosystems and cause eutrophication of surrounding ecosystems. There are alternative options that reduce the environmental impact of agriculture, such as consuming products that require less land and using farming methods that conserve soil and reduce the need for chemical fertilizer. However, these alternatives are currently not cost effective because the market does not reflect the full environmental impact. Taxes can provide financial incentives for consumers and farmers to shift towards more sustainable practices. Here, I propose two environmental taxes on agricultural inputs as well as public policy measures. The first is a tax on land use by crop (in ha/kg) and the second is on artificial fertilizer use (per kg of fertilizer). For six sources of protein, I calculated average land use (in ha/kg), average fertilizer use (in kg fertilizer/kg crop) and average retail prices ($/kg) with preliminary data on Canada. Using that data, I did a sensitivity analysis to evaluate how much of an effect applying the taxes would have on prices. These preliminary results suggest that such environmental taxes may prove to be an effective price mechanism to represent the full cost of agricultural production. The taxes might encourage consumers and producers to reduce the environmental impact of agriculture.

SY73 Hik, DS; University of Alberta; dhik@ualberta.ca
Conserving Canada’s Taiga Plains, Taiga Shield, Taiga Cordillera, and Hudson Plains: Still intact, but for how long?
The vast subarctic conifer and shrub-dominated Taiga regions of northern Canada extend from Labrador to Yukon. Sandwiched between boreal ecoregions to the south and Arctic tundra to the north, the landscapes and species of the Taiga are experiencing rapid changes associated with climate warming and increased human activity. Although most of these landscapes are still intact, they have and will continue to experience industrial development associated with dams, pipelines, petroleum and mineral exploration, and road construction. Natural forces will also have a marked influence on the biodiversity of these ecoregions, including those associated with increasing thawing of permafrost and forest fire frequency; the advancing phenology of river, lake and sea-ice; and changes in the numbers and distribution of animals (e.g. geese, caribou) and plants (e.g. woody shrubs). Issues requiring greater attention in the northern Taiga and Hudson Plains include: invasive species; bioaccumulation of contaminants; the influence of increased or decreased primary production; and human needs (e.g. subsistence harvest, ecosystem services). This region also contains two poorly known northern great lakes. In recent decades, several new protected areas have been established but there has been little commitment to sustained monitoring or collection of baseline ecological information. However, there is some potential to make better use of existing research and monitoring efforts.

P2.93 Hik, DS; University of Alberta; dhik@ualberta.ca
Life without snow: a conservation challenge for alpine herbivore populations in the 21st Century?
Accumulating evidence suggests that the extent and phenology of seasonal snowcover plays a critical role in determining the demography, behaviour and growth of mammalian herbivores in northern alpine environments. Stochastic, periodic and directional variation in seasonal temperature and precipitation may have very different effects on mammalian herbivores depending upon their life history strategies and capacity to adapt to variable and changing conditions. I will present an analysis of the responses of four herbivores living in alpine environments of the Yukon, (collared pikas, hoary marmots, arctic ground squirrels and Dall sheep) to interannual and decadal patterns of temperature and precipitation. In various ways, the timing of snowmelt appears to directly influence overwinter survival, reproduction and growth of these species. At a larger scale, the best predictor of these responses is the Pacific Decadal Oscillation index. Recent efforts to improve measurement of snowcover and to better integrate the role of snow on the dynamics of arctic and alpine herbivore populations will help to determine if the anticipated reduction in snowcover during the next decades will create significant conservation challenges in these ecosystems.
**SY25 Hilborn, R; University of Washington; rayh@u.washington.edu**

**Conservation impacts of wild meat harvest in the Serengeti Ecosystem**

Wild meat harvest has been identified as a serious threat to conservation, both within and outside of protected areas. Using census numbers from the Serengeti Ecosystem we estimated the amount of wild meat harvest for other abundant herbivores. Harvest increased dramatically in 1978 when the budget for anti-poaching activities was greatly reduced. Beginning in the 1990s harvest declined when budgets increased. There was a direct relationship between the level of expenditure on anti-poaching and the resultant wild meat harvest. At its peak wild meat harvest was a serious conservation threat for most resident species, but not for the migratory or plains oriented species. At present levels of funding for anti-poaching, wild meat harvest does not appear to be a conservation concern for the primary herbivores, but may locally reduce resident herbivores and be an ongoing threat to rare herbivores and predators.

**P2.131 Hird, J; Castilla, G; McLane, A; Linke, J; McDermid, G*; University of Calgary; gecastill@ucalgary.ca**

**Is a Sampling Approach Sufficient to Monitor the Human Footprint on the Boreal Forest?**

The human footprint of a natural region can be summarized both by the proportion of the region transformed or altered to serve some human use (e.g., surface mining, forestry) and by the density of different infrastructures within the region (e.g., roads, gas and oil wells). This may be estimated by a complete census based on full coverage data, or through a sampling approach wherein only a small part of the region is monitored. The latter approach has obvious economic advantages, but how accurate are the resulting estimates? We answer this question for the boreal forest of Alberta and for natural subregions within it, by deriving estimates of their most common human footprint features (forest clear-cuts, seismic cutlines, well-sites and roads) under different sampling intensities, from 0.25% to 16%, applied to full coverage datasets. The standard error of the estimates follows an inverse power law when plotted against sampling intensity. The sampling intensity required to achieve a 90% accuracy decreased with the size and the uniformity of the spatial distribution of the human footprint features within the region. Our results indicate that the sampling approach, while suitable for the entire boreal region, may not be sufficient for monitoring the human footprint at the management (local) scale, i.e. for small regions, or even for larger regions if the feature being monitored is unevenly distributed across the region.
Strategies for Maintaining Saproxylic Biodiversity in a Future Characterized by Intensified Forestry

One consequence of modern forestry is a dramatic decrease in the amount and diversity of dead wood in many forest ecosystems. This has had negative effects on biodiversity, especially for wood-living (saproxylic) species, because different forms of dead wood are among the most important structural components for maintaining biodiversity. Recent changes in legal demands and certification requirements, resulting in more conservation-oriented forest practices, are likely to mitigate these negative effects. However, the political ambitions to reduce our dependence on fossil fuels by using forest products for energy production, along with an overall ambition to increase forest production by, e.g., fertilization, use of exotic species, harvest of short stumps and slash, are likely to put additional strain on biodiversity. In this presentation, we will discuss changes that are likely to occur in Fennoscandian forestry in the near future and how this might influence biodiversity. Our focus will mainly be on saproxylic species and we will present results from the few studies currently available that address the ecological consequences of intensified forestry. The preliminary evaluation from these studies indicates strong negative effects on biodiversity at local/stand level, whereas the landscape effects are difficult to predict. The latter is depending on uncertainties regarding the proportion of the forest landscape subjected to intensified forestry. We suggest strategies to reduce overall species losses in managed forest landscapes.

16.5 Hocking, MD*; Reynolds, JD; Simon Fraser University; mhocking@sfu.ca
Pacific salmon subsidize riparian plant communities

Spawning Pacific salmon provide a large subsidy of marine-derived nutrients to terrestrial habitats. Declining salmon populations and the loss of nutrient subsidies are a concern for conservation and management because they may ultimately lead to shifts in key ecosystem processes. For example, bears and other top predators may function as ecosystem engineers by transporting salmon carcasses into forests and controlling the spatial distribution of nutrient subsidies to riparian plants. We use a combination of experimental additions of salmon carcasses and vegetation surveys across 50 watersheds in coastal British Columbia to test how salmon may influence: 1) nitrogen resource use (%N, δ15N) in indicator plant species, and 2) riparian plant community structure. We observe increased plant foliar nitrogen content and δ15N signatures as a result of both experimental additions and watershed-level gradients in salmon density. These effects are stronger in species that are more abundant on nitrogen-rich sites. Within 35m of the stream channel, the combination of canopy community and salmon density best predict understory plant community structure. Overall, salmon can increase the nutrients available to riparian plants and shift community dominance towards species that can compete effectively for these nutrients. Conserving intact salmon runs, and their associated top predators, is necessary to maintain the biodiversity and ecosystem processes of linked terrestrial-marine systems.

SY63 Hoberg, George; Department of Forest Resources Management, University of British Columbia; george.hoberg@ubc.ca
Delineating the Science-Policy Gap in Critical Habitat Designation: Social Science Insights

Conservation biologists, as well as other scientists in similar situations, are frequently frustrated when governments fail to act, or act promptly, when science demonstrates the existence of a clear problem demanding a management response. While the metaphor of the "bridging the science-policy gap" suggests mutual responsibility between scientists and government resource managers, the complexity of the constraints on effective government action are frequently not appreciated. This paper uses the social science literature on "science in policy" to help delineate the nature of this gap. At least three different types of constraints can occur: uncertainty in science, political resistance, and an unfavourable legal framework. After synthesizing the theoretical basis for each constraint, the paper will develop operational measures for each constraint and apply them to two cases of species at risk shared by Canada and the United States.

SY53 Hodges, KE; University of British Columbia Okanagan; karen.hodges@ubc.ca
Critical habitat: possible ways forward

Habitat loss is a dominant threat to species worldwide. Both the US Endangered Species Act and the Canadian Species at Risk Act require protection of the critical habitat of listed species. Although this insistence on habitat protection is based on sound biology, the designation and protection of critical habitat have been deeply problematic under both laws. Effective designation requires sound biological information as well as consistent and transparent application of that information to the policy decision of what to include and exclude. There have been problems on both of these fronts, precipitating a number of lawsuits with respect to critical habitat. Resolving 'the critical habitat problem' will require much better consistency in using existing biological information than has occurred so far. We propose that the Society for Conservation Biology take a lead role in developing a working group that will address specific questions that have emerged with respect to critical habitat as a way to bring sustained and unified effort to bear on improving our management of imperilled species via habitat protection.
SY73 Hodges, KE; University of British Columbia Okanagan; karen.hodges@ubc.ca

Boreal and montana cordilleras

The montane and boreal cordilleras encompass the mountain ranges and associated plateaus and deep valleys of western Alberta, central and eastern British Columbia, and much of the southern Yukon. These ecoregions contain a wide range of microclimates that result from both latitudinal variation and the highly variable topography; in turn, these microclimates collectively support a high diversity of species. Although several large provincial and national parks occur throughout the ecoregion (including Banff, Jasper, Yoho, and Kootenai National Parks in the southeastern montane cordillera), unprotected parts of these ecoregions are used for forestry, mining, and cattle grazing. In addition to these substantive human impacts, other major threats within these ecoregions include climate change, mountain pine beetle outbreaks, invasive species, and even increased pressures from tourism. Aquatic systems are under strain, with changes in hydrology via damming and diversions disrupting salmon migrations and affecting other freshwater species. Another major concern is the ongoing severe declines of mountain caribou herds, which are negatively affected by habitat loss, changing predator-prey dynamics, and human activities.

2.3 Holzer, KA; City of Portland; holzer.katie@gmail.com

Amphibians in the City: Factors Influencing Pond-breeding Frogs and Salamanders in Portland, OR

Urban environments are increasing in number, size, and intensity around the world. As many organisms are able to persist within these areas, it is important to determine what habitat factors benefit urban wildlife populations. I measured the abundances and densities of eggs and tadpoles of six pond-breeding amphibian species in Portland, OR in 83 ponds. In these ponds I also measured 21 physical, chemical, and location factors. I conducted statistical analyses to determine which factors were influential for which species. I found no difference between the abundance and densities of amphibians in natural vs. man-made ponds. Native species were more abundant and more dense in ponds with greater amounts of aquatic vegetation and physical refugia. Ponds with high nitrate levels had lower densities of tadpoles. Two species of concern (Rana aurora aurora and Ambystoma gracile) were more dense in ponds with pH

SP9.6 Hojnowski, C.*; Hotte, M.; Murzin, A.; Miquelle, D.; Wildlife Conservation Society, Tigris Foundation, Wildlife Conservation Society, Pacific Institute of Geography; cherylojnowski@gmail.com

Implementing Institutional Change to Address Long-Term Conservation Threats: Reducing Impact of Fires on Leopards and Tigers in Primorsky Krai, Russia

Reversing long-term, human-induced patterns of habitat transformation is an especially difficult task because it requires lasting changes in policy and human behavior. Southwest Primorsky Krai is one of Russia’s biodiversity hotspots, the last refuge of the critically endangered Far Eastern leopard and a small, isolated population of Amur tigers that is a potential source population for re-colonization of Northeast China. However, the forests of this region are gradually being destroyed by a long history of man-made fires. Originally set to clear land for agriculture, ground fires in Southwest Primorsky Krai have become a tradition tolerated by local and regional administrations, and until recently, ignored by conservationists. We used remote-sensing data from 1996 to demonstrate the impact of fires not only to wildlife habitat, but to human welfare as well, and then worked collaboratively with willing local stakeholders to demonstrate that fires can be controlled in a model project site. We believe that current trends can be reversed but that doing so will require significant effort, a combination of education and enforcement, and effective cooperation between the numerous local landowners and government agencies in the region to induce institutional change.

2.3 Holzer, KA; City of Portland; holzer.katie@gmail.com

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5.4 Homstol, LORI*; St. Clair, Colleen Cassady; University of Alberta; homstol@ualberta.ca

Whistles and sling shots may increase the wariness of American Black Bears

In British Columbia, bear managers kill approximately 800 black bears and 35 grizzly bears annually because of conflicts with humans. Municipalities are under increasing pressure to manage non-lethally, typically using aversive conditioning (AC). We tested two novel techniques intended to increase the efficacy and practicality of AC by alternately assigning 19 black bears in conflict to one of three treatment groups: one that paired pain with sound (whistles), one with pain alone, and a control group. Whistles were used to signal pain delivery because such an association could subsequently be used to dissuade bears temporarily from attractants to prevent the food conditioning that leads to conflict. Our second innovation was to induce pain with marbles fired from sling shots, which we compared to rubber bullets fired from shotguns. Bears quickly associated whistles and pain and were as likely to run from marbles as from rubber bullets. After conditioning, treated bears were significantly more wary than control. Our results suggest that AC efficacy might be increased by exploiting a sound-pain association and by using a non-registered form of projectile to increase the number of people, and hence frequency, with which bears in conflict could be treated.
Using a post hoc study design, I evaluate the effectiveness of aversive conditioning (AC) as a non-lethal management technique to reduce bear-human conflict, and ultimately reduce bear mortality. I found a decrease in developed site use by radio-collared grizzly bears in Peter Lougheed Provincial Park (PLPP) after the onset of AC. Also, wariness of collared bears increased with application of AC, both short-term and long-term. Wariness of non-collared grizzly bears also increased after application of AC. Grizzly bear mortality and relocation rates in the period after AC began decreased by half within PLPP, while at the same time increasing five-fold on adjacent lands where AC was not a commonly used tool. Finally, there was a decrease in the number of bear-related facility management actions after the onset of AC. I conclude that AC is an effective management tool to reduce human conflicts with grizzly bears and promote bear population stability.

Beaver (Castor canadensis) mitigate the effects of drought on the area of open water wetlands

Wetlands provide critical habitat for numerous species, yet they have become increasingly vulnerable to drought and warming temperatures and are often reduced in size and depth or disappear during drought. We examined how temperature, precipitation and beaver (Castor canadensis) activity influenced the area of open water over a 54-year period in the mixed-wood boreal region of east-central Alberta, Canada. This glacial landscape, with intermittently connected drainage patterns and shallow wetland lakes, lost all beaver in the 19th century, with beaver returning to the study area in 1954. We assessed the area of open water in wetlands and shallow lakes using 12 aerial photo mosaics from 1948 to 2002, which covered wet and dry periods, when beaver were absent on the landscape to a time when they had become well established. The number of active beaver lodges explained over 80% of the variability in the area of open water during that period. Temperature, precipitation and climatic variables were much less important than beaver in maintaining open water. In addition, during wet and dry years, the presence of beaver was associated with a 9.8-fold increase in open water area than when beaver were absent from those same sites. Thus, beaver have a dramatic influence on the creation and maintenance of wetlands and shallow lakes even during extreme drought. Given the important role of beaver in water preservation and in light of a drying climate in this region, their removal should be considered a landscape disturbance that should be avoided.

Applying GPS tracking to indigenous hunting and its implications for wildlife conservation in Taiwan

Indigenous hunting and its impact on wildlife represents one of the most controversial conservation issues in Taiwan. This study aims to track the geographic distribution of hunting activities of the Truku Tribe in Taiwan, through applying Global Positioning Systems (GPS) methods. The results show that, compared to the Truku’s traditional hunting territory, the current hunting zone of the studied Truku area has shrunk to a great extent in recent years. The hunting zone currently lies in the eastern half of the area between the central edge and eastern edge of the Central Mountain Chain. The dramatic decline of the hunting zone can be attributed to complex interactions among numerous factors, including traditional hunting territories, internal hunting norms of the Truku society, traffic accessibility, governmental institutions, and wildlife abundance; governmental conservation institutions play a pivotal role. Based on empirical findings, we draft a re-designation of strictly protected and sustainable use areas that may secure both wildlife conservation and indigenous rights.

Applying HexSim to Evaluate Release Alternatives

To result in a successful elk reintroduction. We found HexSim to be a very useful tool for this type of reintroduction planning and believe that it will prove to be successful for other conservation planning studies as well.
Using movement behaviors to assess dispersal routes in complex landscapes.

Wetland species often use isolated habitat patches, so effective management requires identifying how changes in land cover affect potential dispersal corridors and barriers. We demonstrate a simplified approach to quantifying dispersal across a landscape for two sets of species inhabiting wetlands on Ft. Bragg, NC. Our approach addresses a significant challenge to understanding dispersal: because dispersal is a rare event, it is difficult to measure directly. To overcome this challenge, we use movement simulations of individual movements by wetland butterflies and amphibians to project potential dispersal routes. To fully characterize dispersal through the landscape, we calibrated our models from observations of short-term movement in different habitats and at habitat edges. We use the model to identify isolated habitat patches, connected habitat patches and focal landscape features that promote or inhibit dispersal. We found an important role for upland forests in promoting dispersal for both butterflies and amphibians. In contrast, we found that riparian corridors promote dispersal for wetland butterflies but act as dispersal barriers to ephemeral pond-breeding amphibians. The latter result highlights a major challenge in managing landscapes for multiple species: different species perceive the landscape in different ways so that landscape features that may promote or inhibit dispersal of one species may have little or opposing effects on dispersal of another.

Does participation improve conservation and livelihoods?

Local population participation has become an almost compulsory principle for conservation projects or protected areas. It is now included in most PAs in many forms (participatory management, co-management, community-based management, ICDPs, etc.). But it is seriously contested form two streams of arguments. On one side livelihoods objectives sought after by local populations compete with conservation and make it ineffectual. On the other side, it is dismissed as a trick to make conservation acceptable to locals. The problem is that there are few evidence-based studies to establish the facts, no standard methodology to do so, and not even a consensus on the approaches that can be considered as participative and those that cannot. Based on a research (EEPA) in collaboration with IUCN, IUCN-Sur, MAB, WCPA, and IRD, we have (1) developed clear criteria to define and assess participation; (2) developed a methodology to observe the links between participation, conservation and livelihoods; (3) developed a political ecology and governance perspective on participation and conservation; (4) tested this approach in 10 protected areas in Latin America (among them 5 biosphere reserves). Results confirm the confusion in the definition of participation and the practical difficulties to implement participatory schemes. Success-stories have been found only in community-driven conservation projects.

Biodiversity evaluations for individual managed sites

As part of programs to assess ecological sustainability, management agencies must evaluate the condition of biodiversity in declared or restored areas, at conservation offset sites, or as part of adaptive resource management. We developed a new likelihood-based method that uses relationships between species and levels of visible human disturbance (“footprint”) to assign a biodiversity-based measure of human disturbance level to individual sites. The underlying relationships between biota and human footprint levels are derived from regional monitoring programs, and can include covariates for ecosystem type and geographic location. The method uses one or more standardized surveys of biota at the target site, and includes estimates of uncertainty in the human disturbance level. The method highlights the information value of single or multiple surveys of different taxa, which can be used to design a cost-effective survey of the target site. The equivalent human disturbance measure can be standardized to a 0-100 scale of intactness that is easily interpreted by managers and the general public, and can be used to assess the management agency’s success at conserving or restoring native biodiversity. We demonstrate the approach using information on vascular plants, mosses, lichens, birds and soil arthropods collected by the Alberta Biodiversity Monitoring Institute (ABMI) to assess ecological condition at 191 sites in the boreal forest of Alberta.

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Listing of Species at Risk

The Species at Risk Act (SARA, 2003) fulfilled a key obligation by Canada to the Convention on Biological Diversity. Under the auspices of this national legislation, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was legally established as an independent national advisory body responsible for the assessment of species at risk in Canada. Although membership is inclusive of a broad swathe of expertise (including academia, government, aboriginal knowledge, ENGOs), species assessment advice is based on the best available science, independently of members’ professional affiliations and irrespective of the political and socio-economic consequences of the advice. COSEWIC’s assessments are communicated to the public at the same time that they are communicated to government. Receipt of COSEWIC’s advice by the federal Minister of the Environment triggers a process culminating in a legal listing decision by the national government. From 1977 to 2009, COSEWIC had assessed 598 species as being at risk. With the exception of most northern and exploited marine species, COSEWIC's listing advice has generally been accepted (>85% of assessments). As a means of linking conservation science with policy, COSEWIC may be unique in its breadth of mandates, extent of membership in and outside of government, incorporation of aboriginal traditional knowledge, and capability to assess species status.

Motivations and barriers for individuals promoting biodiversity in urban and rural areas of east-central Alberta, Canada

The long-term success of many biodiversity conservation initiatives depends on the active involvement of willing participants, such as volunteers and landowners. In order to enhance their satisfaction and retention, the goal of this study was to determine and evaluate the motivations and barriers of participants who promote biodiversity. Using snowball sampling, we conducted semi-structured interviews with nine rural landowners and eleven urban Purple Martin landlords in east-central Alberta (13-60 minutes each). Participants promoted biodiversity in various ways, including maintaining bird nest boxes, direct seeding, rotational grazing, rotating crops, and reducing the use of pesticides and fertilizers. Almost all participants wanted to engage in more biodiversity-friendly practices on their properties. Participants were motivated by moral or religious obligations, consideration of future generations, self-fulfillment, personal stimulation, recognition by peers, social interactions, interactions with wildlife, and, rarely, economics. However, landowners faced several barriers in promoting biodiversity, such as social ridicule and the lack of money, time, and knowledge. This study will help organizers manage volunteers or landowners involved in biodiversity conservation projects. Organizers of such programs can increase recruitment, satisfaction, and retention by addressing participants’ motivations and barriers, ultimately supporting long-term biodiversity conservation objectives.

The Promises and Perils of Paying for Conservation in a Changing World: a Conceptual Overview

Conservation finance has become more dependent upon economic growth. But economic growth is implicated in our current ecological crises. Can we escape these difficulties by making economic growth compatible with ecological stewardship through payments for ecosystem services? This is certainly the assumption behind initiatives such as UN-REDD and the cap and trade movement. It is also an increasingly pervasive assumption at conferences, congresses, and other professional/policy forums. The promise of a green, sustainable and prosperous future is no doubt and enticing one. But is it really possible to manage processes and relationships at so many scales and locations, and are markets really the best mechanisms for making this happen? This is a vital question in light of the current state of world markets and the poor prognosis for their recovery. At the very least it is worthwhile to consider whether we may be foreclosing possibilities of imagining and implementing alternatives to market-driven conservation if it turns out ultimately that this is not the best way to go.
The water bodies in the Kyiv city and vicinities as main places for waterbirds 
conservations (Ukraine)

In the territory of the Kyiv city many natural and artificial water bodies are located such as 
rivers (the largest among them is the Dnipro river), lakes, ponds, reservoir coolers, channels 
and some others. During the last decades, some changes in water bodies occurred. In the 
places, where human impact is less, Mallard Anas platyrhynchos, Black-Headed Gull Larus 
ridibundus, Moorhen Gallinula chloropus and others are breeding usually in the 
spring-summer period. Numbers of birds increase during the season migrations on the city 
water bodies (especially on the Dnipro river) mostly for the expense of the transit birds. In 
winter time, due to the fact that water bodies are not frozen by a hot water discharge, streams 
and some other factors, many wetlands birds are wintering on these territory. Namely it is 
Mallard, Garganey Anas querquedula, Pochard Aythya ferma, Tufted Duck Aythya fuligula, 
Goldeneye Bucephala clangula, Coot, Moorhen, Water Rain Rallus aquaticus, Grey Heron 
Ardea cinerea, Great White Egret Egretta alba, Green Sandpiper Tringa ochropus, Kingfisher 
Alcedo atthis, Cormorant Phalacrocorax carbo, Little Grebe Podiceps ruficollis, 
Yellow-legged Gull Larus cachinnans, Common Gull Larus canus, Black-Headed Gull and 
White-tailed Eagle Haliaeetus albicilla, and in the reed beds - Bearded Tit Panurus 
biamicus. All this can be the result not only the human activities impact, but climate 
changes as well.
Marine life conservation effort at south eastern coast and marine areas of Bangladesh

South eastern coastal areas of Bangladesh is Ecologically Critical Area (ECA) declared by Government of Bangladesh in 1999. The area is quite a biodiversity hotspot. To restore the charismatic mega fauna and other endangered species MarineLife Alliance has taken initiative to conserve the marine biodiversity. Current programs are taken to conserve sea turtle, cetaceans, water birds, and coral habitat. Included are monitoring and conservation of sea turtle, cetacean, whale shark and water bird as a major group, we conduct scientific monitoring, habitat restoration and protection through community participation. With education, training and awareness to the community. More than two thousand school children has been motivated and educated thought community education, offshore fishermen has been trained for bycatch reduction. More than seven thousand local people have been motivated by awareness program. Further initiative under this program is setting up education and research center, remote monitoring station, museum along the entire coast. Five education and research center has been established. MarineLife Alliance is going to establish education centers along the entire coast to establish community based sustainable marine conservation. Around 90,000 olive ridley and green turtle hatchlings have been released so far during Oct 2005- Jan 2010 into the Bay of Bengal.

Patterns of livestock depredation by wolves in central Mongolia

Active persecution by humans in retribution for real or perceived livestock depredation by wolves represents a driver of wolf decline worldwide. In Mongolia, little information exists on the extent and magnitude of depredation. An understanding of the factors affecting livestock depredation are crucial for developing wolf conservation strategies and mitigating human-wildlife conflict. We elucidate relationships between landscape features and conflict occurrence in the vicinity of Ikh Nart Nature Reserve Mongolia. We conducted a questionnaire survey in 2007, which canvassed all households (n=43) in the northern part of the reserve. Respondents reported 182 domestic animals killed by wolves over 61 separate incidents during the summer of 2006 through the summer of 2007. Depredations were in all habitat types, but occurred significantly more in rugged, rocky terrain than other habitat types when accounting for habitat availability. This trend is probably explained by the cover afforded to wolves in rocky habitat, which allows them to approach prey undetected, and more effectively avoid herders. Depredation occurred predominantly in winter and spring. Our results suggest that conservation efforts should involve reducing livestock numbers and increasing herder vigilance in rocky areas, especially during winter, and improving husbandry practices to reduce overgrazing and wild ungulate habitat loss.

Human-wildlife conflict. We elucidate relationships between landscape features and conflict occurrence in the vicinity of Ikh Nart Nature Reserve Mongolia. We conducted a questionnaire survey in 2007, which canvassed all households (n=43) in the northern part of the reserve. Respondents reported 182 domestic animals killed by wolves over 61 separate incidents during the summer of 2006 through the summer of 2007. Depredations were in all habitat types, but occurred significantly more in rugged, rocky terrain than other habitat types when accounting for habitat availability. This trend is probably explained by the cover afforded to wolves in rocky habitat, which allows them to approach prey undetected, and more effectively avoid herders. Depredation occurred predominantly in winter and spring. Our results suggest that conservation efforts should involve reducing livestock numbers and increasing herder vigilance in rocky areas, especially during winter, and improving husbandry practices to reduce overgrazing and wild ungulate habitat loss.
SP1.2 Jacome-Flores, ME *; Blazquez, MC; Maya-Delgado, Y; Sosa-Fernandez, V; CIBINOR, INECOL; mjacome@cinor.mx

Spatial model to predict distribution patterns of Orange Throat Whiptail lizard (Aspidoscelis hyperythra) in Mexico

One of the most important tools for conservation biology and planning management is the detailed knowledge of ecologic and geographic distribution of the native species. The current geographic and ecological distribution of the species allows understand the evolutionary and ecologic constraints for the adaptation, fitness and survival of the species in one area along the time; and it also provides information concerning the spatial patterns of the biodiversity in certain region. General Linear Models (GLM) constitute one of the most flexible family regression models which predict individual’s occurrence probability in large areas based on environmental variables, and their results can be added to a geographic information system (GIS) by diverse techniques of spatial interpolation. We conducted a research about the current distribution of Orange Throat Whiptail (Aspidoscelis hyperythra: Teiidae) in 318 localities of South Baja California, Mexico. The species is native and endemic of Baja California peninsula and its distribution and phylogeography remains unclear. We obtained the values of vegetation, soil, elevation, slope, average precipitation and temperature range for each locality from digital maps with a GIS. We use the R software to generate two types of GLM, with binomial and Poisson distribution, using the environmental variables as explanatory variables and the presence/absence and abundance information as dependant variables. Finally we use a Kriging interpolation to the models results to generate an occurrence map and a most probable abundance map.

P2.66 James, Joanna*; Mineau, Pierre; Boutin, Celine; Dept. of Biology, Carleton University, National Wildlife Research Centre, Environment Canada; joanna.a.james@gmail.com

Native bee diversity in organic and conventional hedgerows in eastern Ontario

Agricultural intensification has resulted in reduced biodiversity on farmland. A serious consequence of this decline is the potential loss of essential ecosystem services. Native bees provide pollination services to many wild plants as well as crops, but the effects of intensification on native bees in agricultural habitats are not well understood. The objective of this study is to compare native bee diversity in hedgerows on conventional and organic farms in order to assess how different management techniques affect bee populations. Bees were sampled by pan trapping in hedgerows adjacent to soybean fields on 9 pairs of organic and conventional farms in eastern Ontario, Canada during the summer of 2009. Preliminary results indicate that bee diversity is significantly higher on conventional farms than on organic farms. This suggests that the relatively low pesticide inputs in the soybean systems under study are less important than other variables, such as repeated tillage on organic farms. These data will be analyzed in relation to other field management variables, floral diversity and landscape structure. The results from this study will be used to make recommendations regarding native bee conservation in agricultural landscapes.

SY23 James Watson*; Josie Carwardine; Richard Fuller; Liana Jospeh; Dan Segar; Rod Fensham; Hugh Possingham; Spatial Ecology Lab, University of Queensland; rod.fensham@derm.qld.gov.au; james.jameswatson0@gmail.com

What is the capacity of Australia’s protected area system to conserve threatened species? Protected areas are an important tool in threatened species conservation. However, acquisition of new protected areas are often based on ecosystem criteria, and it is unclear how well threatened species are conserved within protected area networks. Here, we assess how effectively Australia’s protected areas (89 million ha, 11.6% of the continent) overlap with the geographic distributions threatened species and compare this against both a null (random) and a spatially â€œefficientâ€ solution, using the spatial prioritization tool Marxan. We define minimum area targets for each species based on range size and level of vulnerability. While the current configuration of protected areas performs better than a random solution, 167 threatened species (12%) occur entirely outside protected areas and only 223 (16.8%) achieve target levels of protection. Critically Endangered species are among those most under-represented, with 21% occurring entirely outside protected areas. Spatial prioritization analysis revealed that an efficient protected area system of the same size (11.6% of Australia) could meet representation targets for 64% of threatened species and at least partially represent all threatened species within protected areas. Moreover, we show that by protecting 18.6% of Australia, all threatened species could achieve target levels of representation, assuming all current reserves are retained.

10.1 JAMES, NATALIE*; de Blois, Sylvie; Darveau, Marcel; Department of Plant Science and the McGill School of the Environment, McGill University; and Ducks Unlimited Canada, Department of Plant Science and McGill School of the Environment, McGill University, Ducks Unlimited Canada; natalie.jamer@mail.mcgill.ca

Modelling the Effects of Climate Change on the Distribution of Wetland Plants in Quebec

At coarse resolutions the geographic ranges of plant species can be modelled using climate variables (Pearson et al. 2002). The aim of this study is to develop predictive models that quantify the climatic and edaphic tolerances of wetland plant species in northeastern North America, and to predict the potential geographic shifts of the environmental envelope of these species according to future climate change scenarios. Plant species occurrence records were compiled from forestry and riparian inventories, species at risk databases, and natural history collections. Obligate wetland plant species were selected based on ecological criteria such as associated wetland type (marsh, swamp, peatland) and the extent of their geographic range. Climate data consists of recent (1961-1990), interpolated, weather station data (Rehfildt, 2006) and future (2041-2070, 2071-2100) projections by global and regional climate models. Edaphic data was obtained from forestry surveys in Quebec and the Soil Survey Geographic Database in the US. A combination of regression, classification, and machine learning methods are used within the BIOMOD platform to construct species distribution models (Thuiller et al. 2009). Due to the particular nature of wetlands, the results will serve first, to identify gaps in ecological modelling for wetland conservation, and ultimately to help inform wetland managers in a context of rapid climatic changes. This research is conducted in collaboration with Ducks Unlimited Canada. Pearson, R. G., T. P. Dawson, P. M. Berry, and P. A. Harrison. 2002. SPECIES: A Spatial Evaluation of Climate Impact on the Envelope of Species. Ecological Modelling 154:289-300. Rehfildt, G. E. 2006. A spline model of climate for the western United States. United States Department of Agriculture Forest Service, Fort Collins, Colorado. 21 p. Thuiller, W., B. Lafourcade, R. Engler, and M. B. Araújo. 2009. BIOMOD - a platform for ensemble forecasting of species distributions. Ecography 32:369-373.
Vernal pools are a management challenge. They are small, ephemeral, widely distributed, difficult to remotely identify, and species depending on them require both wetland and terrestrial habitat. Regulatory restrictions protecting vernal pools on private land generate considerable controversy, and significant socio-economic barriers impede full implementation of legislative protections. In Maine, Significant Vernal Pools are regulated at the state level, but enforcement agencies do not have the personnel to handle the demand for vernal pool assessments or to monitor permits once they have been granted. Residential development pressures, concerns over private property rights, and a strong tradition of local home rule further impede regulatory compliance. In response, Maine Audubon Society and the University of Maine jointly initiated a community-based education and outreach project to assist municipalities in proactively mapping and assessing vernal pools using trained citizen scientists. This project provides a unique opportunity to examine the conditions under which municipalities and landowners will participate in proactive conservation planning. By understanding the behavior of landowners, town officials, and community members, we document the extent to which multi-stakeholder engagement in natural resource planning influences land use decisions at the local level and suggest strategies to increase stakeholder cooperation and improve conservation outcomes.
Evaluating the Effectiveness of Conservation Strategies through Collaborative Scenario Building and Landscape Modeling

Conservation and land management organizations are developing conservation strategies to distribute protection efforts over large areas and a broad range of ownership and management techniques. These distributed conservation strategies, such as working forest conservation easements, are based on the premise that blending resource extraction and conservation should yield socioeconomic benefits without compromising biodiversity or ecosystem service conservation. However, evaluating the efficacy of such strategies remains difficult, as traditional monitoring efforts span decades or longer. Therefore, we developed an integrated scenario-building and landscape modeling approach to provide insight into the potential outcome of different conservation strategies in response to anthropogenic and climate change pressures. We applied this approach in two large study sites in the Northern Great Lakes region of the U.S. Via in-person and online workshops, scientists, local experts, and stakeholders collaboratively defined scenario conditions and parameters for landscape models and selected a suite of biodiversity and ecosystem service targets. By comparing potential outcomes of different strategies on selected targets, this approach enables informed conservation decision-making about how to best utilize scarce financial resources, reduce risks associated with innovative strategies, and determine when and where concentrated versus distributed conservation may be most effective.
Improving and Using Existing International and Domestic Law to Recover Endangered Species, Restore Ecosystems and Mitigate Climate Change

Within the Convention on Biological Diversity, especially articles 3 and 8(l), other international conservation and trade law, and existing domestic law, such as the U.S. Endangered Species and Clean Air Acts, we have most of what we need to greatly reduce greenhouse gas emissions and restore biological diversity much more quickly and efficiently than most people realize. In the U.S., for example, as long as Congress does not block or weaken existing laws, we can file scientifically-documented petitions for rules and persuade the Executive Branch to adopt regulations to better implement these laws. For example, we can increase efficiency, back out coal-fired power plants fairly quickly, and restore and connect ecosystems to sequester more greenhouse gases. Nations and other actors can minimize net emissions in the developed and developing worlds and reflect these policies fairly in our trade practices. The knowledge and technology are available. This will require creative use of existing treaties, statutes, customary and common law (e.g., public nuisance actions). It will require timely filing of comments, petitions or other actions to present that knowledge in powerful ways. SCB and our allies can lay out the plan and begin a series of actions to get us there.

Reaching the unconverted: Using the Great Migrations series as a hook for corridor conservation

In these days of a thousand channel universe how does one build a constituency for migratory species and the healthy ecosystems upon which they, and we, depend? This talk covers an upcoming program that leverages a high investment TV series with strategic multimedia coverage and partnerships to deliver conservation commitment and action. In this case, viewers inspired by high-def, thousand-frames-a-second glory of animal migration replete with challenges will be directed to bear witness and act locally (through Freedom to Roam) in response to a global call. Books, games, magazine articles, educational products, plus broadband and social media will converge on the topic of animal migrations to reach the broadest possible audience. With long-term planning and diverse partners, responsible programming can help move the masses and make our natural systems whole.

When and How Can Scientists Inform Policy Makers and Help Form and Implement Policies:

Public Policy is like a public contract. In forming a marriage contract, the opportunity for public comment is once and brief at best. Scientists must know when to speak and how, and do so, or it seems, forever hold their peace. The US Administrative Procedures Act forces the expert executive agencies to use rulemaking procedures for adopting regulations to implement in detail the general principles set out in legislation. This process provides several opportunities for scientists to inform agencies and then the courts that review what agencies do. These procedures use well-understood standards of evidence and proof. Litigation over policy or harm it may cause is also controlled by a generally open and established set of rules for review. When a legislative or international negotiating body acts, it generally only has a very limited amount of direct review. In the US a bill faces only the possibility of a Presidential Veto. Very detailed legislation is often difficult to understand fully during the days or weeks devoted to its public debate or even during judicial review years later. We could improve our limited controls over the legislative and negotiating process by setting up review procedures for the science used, but for now, the best time to educate legislators, negotiators (and their constituents) is before they begin to "mark-up" or consider legislation or treaties and protocols actively. I will draw lessons about this process from each speaker.
Hanging in there: Population Changes and Genetics of Chum Salmon in the Southern Extent of their Range - Impacts of Climate and Other Changes

Spawning populations of chum salmon (Oncorhynchus keta) historically extended as far south as the San Lorenzo River in California and 322 km upstream in the Sacramento River. In 1905-06 chum salmon juveniles were the most abundant salmon species in streams surveyed between the Sacramento and Columbia rivers. Today, these populations have greatly declined, and in the Columbia River are now listed under the ESA as a threatened species. Little life history, genetic, or other biological information has been developed on these fish. In cooperation with ODFW, WDFW, USFWS; we collected life history, genetic, and demographic data (such as presence or absence of spawning populations and timing of migrations) from 2003 through 2009. Preliminary microsatellite genetic data indicate population structure among coastal populations is different from interior and Puget Sound runs. Run timing and other life history traits are also different between these southern populations and others. This information is important as southern runs may represent remnants of historical populations and contain unique genotypes and adaptations essential to the successful restoration of depleted other present-day salmonid populations.
SY23 Joseph, LN*; Watson, JEM; Maloney, R; Possingham, HP; University of Queensland, Department of Conservation; l.joseph@uq.edu.au

Strategies for effective management of threatened species in Australia and New Zealand

After nearly two decades of “recovery planning” in Australia and New Zealand, we are no closer to recovering our threatened fauna and flora. In fact, every year more species are added to the threatened species list and the status of others deteriorate further. To recover the greatest number of threatened species, government, NGOs and communities must be engaged to effectively and efficiently manage both on- and off-reserve populations. In this presentation, I will discuss the projects that we are working on in collaboration with government departments in Australia and New Zealand to evaluate past plans and deliver new strategies for threatened species recovery. Firstly, we review the Australian recovery planning process and identify correlates of success. We develop a set of recommendations which includes identifying recovery planning systems that have demonstrated to be effective in the past and developing methodology to integrate these successful practices into a nationally-lead plan for management of all threatened species. Secondly, we develop a methodology for identifying priority actions that will guide the spending of government, NGOs and community groups. The Department of Conservation in New Zealand is well down the track of identifying priority actions for recovery of over 600 of the nation’s most threatened species using this technique. I will discuss the national strategic plan for threatened species in New Zealand.

24.3 Josh Nowak; Steve Cumming*; Eliot McIntire; Université Laval; stievec@sbf.ulaval.ca

Demographic models of woodland caribou populations under historical disturbance regimes.

Several recent studies have boreal woodland caribou populations have modelled demographic parameters as functions of the levels of disturbances on mapped ranges. Although these models describe between-herd variation in the response variables quite well, are they consistent with the survival of these herds to the present day, given the actual histories of industrial development and the fire regimes? We evaluated one model by projecting six Alberta caribou populations under simulated and historical fire regimes and a reconstruction of the industrial footprint since 1940. We used the cumulative annual density of drilled oil and gas wells as a surrogate for industrial activity. We simulated natural disturbance regimes by sampling from beta distributions fit to archival fire data, corrected for fire suppression. We found that caribou populations would persist under natural conditions and would be expected to have survived to the present under the actual history of industrial development. However, the future persistence of most herds is highly unlikely, even if no further development occurs. If such models are to be used for caribou management, reliable estimates of the natural population densities are needed. We also recommend that histories of industrial development be estimated, for example from time-series aerial photography.
Forest Pest Invasions: Trends and Impacts

Non-indigenous forest insects and pathogens affect a range of ecosystems, industries, and communities in the United States. Evaluating temporal patterns in the accumulation of non-indigenous forest pests and quantifying their impacts and costs are critical to informing regulatory and policy decisions. We compiled a comprehensive species list to assess the accumulation rate of non-indigenous forest insects and pathogens established in the US and used this information as part of a novel approach to estimating costs. We separated our analysis by pest guilds and cost categories and calculated total average costs. Approximately 2.5 established non-indigenous forest insects were detected in the US annually between 1860 and 2006. At least 14% of these insects and all 16 pathogens have caused notable damage to trees. Detections of insects that feed on phloem or wood have increased markedly in recent years; these insects are also causing an order of magnitude more economic damage than the other guilds.

Stakeholder Perceptions of Risk and Vulnerability Associated with Human-Wildlife Conflicts in Namibian Conservancies

In Namibia, human-wildlife conflicts (HWCs) create management challenges for conservancies mandated to conserve wildlife and promote sustainable economic development. The aim of this research was to investigate stakeholder's risk perceptions and vulnerability associated with HWC, in order to foster deeper understanding of HWC-related decision-making. Our objectives were: (1) characterize local perceptions of HWC-related risks and; (2) investigate the extent to which conservancy characteristics, gender, and expertise influenced attitudes about HWC-related risks. We used participatory risk ranking in a case study approach to explore factors influencing local HWC-related risk perceptions and vulnerability to livelihoods and wildlife in two conservancies in Caprivi, Namibia (n = 50). Expertise, gender and conservancy influenced perceptions of HWC risk severity and acuteness to livelihoods and to wildlife. Non-HWC-related risks (e.g., lack of employment) were cited as exacerbating both human and wildlife vulnerability to HWC. Results provide baseline information about stakeholder attitudes associated with HWC and assert that in community-based management systems successful HWC mitigation may be more broadly tied to improvements in local livelihoods and well-being. Understanding perceptions of risk to and from wildlife and factors that influence vulnerability can help managers design HWC-related interventions that more effectively reduce risks to livelihoods and biodiversity.
**Relationship Between in Tiger and Leopard Population in Dry and Disturbed Ecosystem: A Case study from Parsa Wildlife Reserve- Nepal**

Parsa Wildlife Reserve has a low density tiger population in comparison to other protected areas in low land area of Nepal. Recent camera trap survey showed estimated population of 4 adult tigers with an estimated density of 0.72 (SE 3.23) tigers/100 km$^2$. Leopard is other big cats found sharing same habitat with tigers in Parsa wildlife reserve. Comparison of spatial distribution of leopard and tigers showed some pattern in occurrence of cats and their habitat was found to be over lapping in the reserve. However, based on the same camera trap study, population density of leopard was found to be higher than in comparison to tiger population. Inverse relationship was found between population estimates of tiger and leopard when compared to population in Suklaphanta Wildlife Reserve. Beside prey density, dominance effect may be the cause for this inverse relationship between two co-predators.

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**Impacts of climate change on the life cycle, distribution, and host range of the winter tick (Dermacentor albipictus) in the Arctic and Subarctic**

Fluctuations in climate can directly affect the ecology and phenology of animals and plants, including ticks. Dermacentor albipictus, the winter tick (WT) is an important parasite of deer, elk, woodland caribou, and moose. During the 1980s its northern distribution was limited to southern Yukon (62°25'49"N; 140°19'32"W); however, in recent years, it has been detected further north. This expansion may be associated with climate driven shifts in WT life cycle and host distribution, and may pose threats to the barren ground caribou (BGC) population in the Canadian north that are facing a significant decline. The objectives of this research are: (1) to develop a serological assay to detect eventual exposure to WT in BGC, (2) to determine current WT host range and geographic distribution, and (3) and evaluate climate factors linked to WT distribution. 19 engorged females ticks are being raised in laboratory conditions to lay eggs until become larvae. Captive reindeer will be experimentally infested and used as model species to validate the test. The serological technique will be developed extracting a protein from WT saliva using Western blot; and the protein will be used as antigen in ELISA test to detect WT exposure on BGC serum. Chemical digestion of hides from hunted moose and BGC together with serology will be used to delineate current WT distribution in Northwest Territories and Yukon, as well as to define its host range and the climate constraints to its potential expansion.
P2.46 Kasim, M; Haluoleo University; marufkasim@hotmail.com
The effect of community based Marine Protected Area establishment on Fish population and coral reef condition in Indonesia
Coral reef condition and fish population were observed in 39 community based Marine Protected Areas (MPA) in Southeast Sulawesi Eastern Indonesia. During our research in MPA in eastern Indonesia, in 2007 there are 30.16 % of live coral, 40 % of dead coral, 17.23% of other fauna, 10.46 % of abiotic (sands and stones), and 2.15 % of macro algae covered entire coral reef in the region observed. In 2008, the covered of live coral reef have become 33.3 %, dead coral have become 36 %, other fauna have become 6.6 %, abiotic (sands and stones) have become 19.5 % and algae have become 4.9 %. This figures describe that within 1 year, community involvement through this program, have successfully increase 3.14% of live coral, 4% decreasing of dead coral, 10.6 % decreasing of other fauna, 9 % increasing of abiotic (sands and stones) and 2.8% increasing of algae. The amount of species of fish target increase from 52 species in 2007 to become 62 species in 2008 and 108 species in 2009. Community marine protected areas were provides the best protection for species of coral reef, fish and wildlife. This is one of the excellent strategies on marine conservation in Indonesia.

SY25 Keane, A.*; Jones, J.P.G.; Milner-Gulland, E.J.; Imperial College London, Bangor University; aidan.keane05@imperial.ac.uk
Modelling approaches to understanding rule-breaking behaviour and enforcement in conservation
There is a large body of theory concerning the enforcement of and compliance with rules, spread over several disciplines, including psychology, economics and sociology. To open the symposium, I review approaches to understanding why individuals break rules and how optimal policy choices can reduce rule-breaking, highlighting research which has specifically dealt with natural resources. Despite the importance to conservation success of achieving compliance with rules, there have been few attempts to extend existing theories of compliance to conservation applications and consequently there is little practical guidance for managers and conservation planners on the optimal design of enforcement programmes. The difficulty of studying rule-breaking behaviour directly means that much of our understanding of the factors which affect compliance with rules comes from models of human behaviour. Consequently, there an urgent need to establish new techniques and empirical approaches to understanding the decision-making processes which lead to rule-breaking, and alter incentives towards compliance. There is also considerable scope for novel approaches to interpreting empirical data in the light of theoretical models. I illustrate this with the example of a ‘virtual ranger’ simulation model which can be used to interpret patrol data and explore robust strategies for law enforcement.

SY61 Keenleyside, K*; Dumouchel, C; Johnson, M; McLennan, D; Pellatt, M; Woodley, S; Wong, M; Parks Canada; Karen.Keenleyside@pc.gc.ca
Policy Directions for Climate Change and Protected Areas in Canada: A Perspective from Parks Canada
Increasingly, individual countries, the scientific community, and conservation organizations are recognizing that healthy, well-managed natural ecosystems, including parks and other protected areas, are an essential part of the response to climate change. Actions that enhance ecosystem resilience also enhance the capacity of these systems, and the communities and economies that depend on them, to adapt to change. In refining its own policies, and in contributing to the development of Canada’s climate change agenda, Parks Canada is bringing focus to the importance in Canada of ecosystem-based adaptation approaches that include a key role for well-connected, well-managed, resilient networks of parks and other protected areas. The Agency is examining how its programs can adapt to climate change. It is also identifying the potential contribution of protected area establishment, monitoring, and restoration efforts to enhancing Canada’s resilience and adaptive capacity more broadly and it is examining policy options that will contribute to enhancing this role. While maintaining a focus on the role of national parks and other protected areas in contributing to climate change adaptation, Parks Canada is also evaluating potential synergies between actions that contribute to climate change adaptation and those that contribute to climate change mitigation through, for example, carbon storage and sequestration.
Ecologically Restoring Plains Bison to Large Landscapes in Western North America: Current Opportunities and Challenges.

There are over 450,000 plains bison today, yet less than 10,000 occur in conservation herds with high genetic integrity, experience natural selection, and influence ecosystem dynamics as they did historically. Based on expert opinion WCS identified some of the priority landscapes where bison might be ecologically restored within 20, 50 and 100 years (Sanderson et al 2002). Through additional screening of potential landscapes and a review of published grassland assessments several priority landscapes become evident where bison might be restored within 20 years. There are less than 10 sites where restoration strategies could be applied within relatively short time frames to restore the ecological function of bison at various scales. Three important strategies could lead to ecological restoration including: 1) reintroducing genetically reproductible bison to large intact grasslands under a multi-jurisdictional framework 2) expanding numbers and range of existing bison herds to fully occupy large multi-jurisdictional landscapes, 3) designing and implementing intermediate sized reintroduction projects anticipating they could be incrementally expanded over a longer time frame. Bison restoration in North America could rapidly advance using each strategic approach on 5-6 appropriate western landscapes.

HERBIVORES CAN MITIGATE THE EFFECTS OF NUTRIENT LOADING ON CORAL REEFS. ASSESSMENT OF IMPACTS AND FUTURE IMPLICATIONS FOR CORAL RECOVERY ON MAUI

Phase shifts from coral to algal-dominated reef ecosystems have occurred on coral reefs around the world as a result of human impacts. Coral cover at Kahekili Reef, Maui has declined from 55% to 33% over the past 15 years while algal abundance has increased, likely due to two local stressors: land-based nutrient loading and overfishing. In July 2009, the Hawaii Division of Aquatic Resources designated Kahekili an Herbivore Fisheries Management Area (HFMA), which banned the removal of herbivorous fish and urchin species in an effort to reverse the decline in coral cover on this reef. Algal growth rates, herbivore grazing rates, and algal production were assessed upon the designation of the HFMA. Current data on herbivore grazing rate and preference of algae species show that the most significant blooming algal species were grazed an order of magnitude faster than non-blooming algae, which suggests that the ban could be effective in reducing algal cover. However, algal production on the reef exceeds the grazing capability of the current fish population on Kahekili. Therefore, future increase in herbivorous fish biomass on the reef will be essential to return the reef to a coral-dominated ecosystem and to increase the resilience of this reef system to global stressors like climate change. The success of the HFMA could provide a model for coral reef area management.

SERENDIPITY, ADAPTABILITY, AND POLITICAL HORSE TRADING IN COLLABORATIVE CONSERVATION

Across the U.S., disintegration of the industrial forestland base has created opportunities for alternative forest tenures to emerge. In this paper we analyze factors leading to development of one such innovative ownership, the 12,000-ha Skyline Community Forest, at the edge of Bend, Oregon. Recognizing opportunity in the collapse of the existing forest ownership pattern and the imminent threat of parcelization, a local land trust led creation of a community forest to maintain wildlife habitat, to provide recreation access, and to protect an economically valuable viewshed. While the Skyline Community Forest deal has yet to be completed, its story illustrates the complex, messy process commonly hidden beneath genteel monikers such as "collaborative conservation." Working with strategic allies from the forestry and investment sectors, the land trust formed an adaptive local network that could respond to multiple political pressures and opportunities. The network was not entirely inclusive, nor did it function with ideological purity, but it capitalized upon, and changed with, emerging contingencies. We identify key factors that contributed to the development of the Skyline, including local leadership, political savvy, risk-taking, and human and social capital, among others. We conclude with lessons about collaboration in an era of unprecedented formerly industrial forest land availability and rising land trust prominence.
Habitat loss, climate change, and the evidence of their impacts on ecosystems and species at risk across Canada.

In Canada, habitat loss and climate change are exerting disproportionate effects on native flora and fauna due to the unique intersection of species richness gradients, climatic gradients, and patterns of habitat loss. The vast majority of Canada's species at risk are found in the south, a highly agricultural region with expanding urban areas. As climate change accelerates, altitudinal and elevational shifts in range will become increasingly necessary for species. However, the loss of habitat connectivity throughout Canada's southern areas could slow northward range expansion, particularly for species at risk. Even without the limits on dispersal ability imposed by highly concentrated habitat losses, climate change will impose dispersal requirements on many species that exceed their maximum capacities. Furthermore, climate change is causing phenological shifts and the resulting disparity between trophic levels lowers reproductive success. It is evident that habitat loss and climate change, individually and through their interaction, could disrupt biological systems pervasively in Canada, a trend that evidence indicates is currently underway.

The sustainable use of wildlife is a pillar and major driving force for conservation. Not raised in a hunting family, I’ve had the privilege of helping hunters, anglers, trappers, and guides invest tens of millions of their donated money in conservation projects, research, and environmental education. Experiences in India, Siberia, Mongolia, and southern Africa helped forge my understanding of the essential linkages between rural people, land health, biodiversity, and the sustainable use of wildlife. Similar relationships of rural people intent on conserving the health of lands and wild populations that they, in turn, rely on for economic and cultural sustenance were pivotal in my past decade as a natural resource manager in Alaska. A lifetime of professional experience, observation, and personal reflection has brought me to the inescapable conclusion: biodiversity conservation is possible only if people care enough, and the sustainable use of wildlife is an essential part of the equation.

Cross-validation (CV) is widely and increasingly used by conservation biologists to assess the predictive ability of habitat models. The problem is that there remains little guidance for choosing an appropriate CV method, and it is unclear how parameter choices affect results. We used simulations to determine how estimates of prediction error (PE) depend on CV method. Using multiple linear regression, we varied sample size (n = 10, 30, 100, or 1000), number of variables in the model (1, 3, or 6), and co-linearity (two variables having correlations of 0.3, 0.6, or 0.9, or all variables independent). For each combination of model properties, we simulated 1000 data sets, and implemented 7 CV methods: k-folding with k = 2, 3, 5, 10, or n; and the standard and 0.632+ bootstraps, each with 1000 re-samplings. Mean estimates over all simulations were compared to the true PEs. The standard bootstrap had the best overall accuracy (maximum absolute deviation from true PE of 2%), though 10-folding also performed well (maximum deviation 5.7%). Sample size was the most important property. For n = 1000, 100, 30, and 10, the maximum deviations were approximately 0.3%, 2%, 7%, and 15%, respectively. Accuracy was higher when the ratio of variables in the model to the sample size was small. We recommend limiting the number of predictors relative to sample size, and cross-validating models using the bootstrap or a k-folding procedure with a large number of folds.
Identifying distinct populations, or groups of populations, within a threatened species is a critical step in conservation planning. Regardless of the criteria used to define subspecific units for conservation, good decisions are critically dependent on sufficient and appropriate sampling across the geographic range of the species being considered. Where populations within a species range have recently become extinct, our ability to accurately infer the phylogeographic history from remaining extant populations may be impeded. This, in turn has implications for, or can hinder, the designation of taxonomic and/or management units. In such situations, analysis of historical specimens from extinct populations may be critical for the designation of such units. We have used morphological and genetic data from historical specimens representing extinct populations, in addition to data from extant populations, to infer the historical relationships among, and conservation status of, populations of a declining butterfly, the regal fritillary, Speyeria idalia. This species provides a case study of how data from populations that have very recently become extinct may be necessary to inform the definition of taxonomic and management units, and thereby conservation strategies for remaining populations.

In Pakistan, reptiles are a blend of Palaeartic, Indo-Malayan and Ethiopian forms, and have 179 species of reptilian fauna consisting of turtles, tortoises, crocodile, gavial, lizards and snakes. Pakistan also has long been known to support a large population of Green Turtles (Chelonia mydas) in Sindh and Balochistan coastal areas. In this study, total twenty seven reptilian species including 3 turtle species, Green Turtle (Chelonia mydas), Olive Ridley (Lepidochelys olivacea), and Hawksbill Turtle (Eretmochelys imbricata), 9 lizard species such as Common Tree Lizard (Calotes versicolor versicolor), Spotted Barn Gecko (Hemidactylus brooki), Yellow Bellied Common House Gecko (Hemidactylus flaviviridis), Persian House Gecko (Hemidactylus persicus), Blotched House Gecko (Hamadactylus triedrus), Mediterranean House Gecko (Hamadactylus turcicus), Blue Tail Sand Lizard (Acanthodactylus cantorius), Spotted Lacerta (Mesaralina watsonana), and Bengal Monitor (Varanus bengalensis) were recorded from Manora, Sandspit, Hawksbay and Cape Monze areas. Fiveen snakes species viz Beaked Sea Snake (Enhydrina schistosa), Blue Green Sea Snake (Hydropis caeruleascens), Annulated Sea Snake (Hydropis cyanocinctus), Persian Sea Snake (Hydropis lapemoides), Broad Band Sea Snake (Hydropis mamillaris), Reef Sea Snake (Hydropis ornatus), Yellow Sea Snake (Hydrophis spiralis), Pygmy Sea Snake (Lapemis curtus), Spotted Small Headed Sea Snake (Microcephalophis cantrois), Pelagic Sea Snake (Pelamis platurus), Spotted Viperine Sea Snake (Praescutata viperina), and Blotched Diadem Snake (Sphalerophis diadema diadema) were recorded, while three species Cliff Racer (Platycercus rhodorachis) Saw-scaled Viper (Echis carinatus) and Black Cobra (Naja naja) were recorded from Manora, Hawksbay and Cape Monze area only.

In the United States, local planners make most of the decisions concerning the pattern and extent of development, significantly influencing the amount of land conserved for habitat. However, most of these development decisions are made without the participation of conservation experts. We conducted extensive market research – including 60 targeted interviews and a survey of over 500 planning professionals, elected officials, planning board members, and conservation biologists - to determine how to motivate local decisionmakers to make conservation-minded land use decisions. We found that community planners are often eager to incorporate conservation into their community's vision, plans, and policies, but that they can be significantly hindered by a lack of political will as well as a failure of conservation experts to participate in the process. We also found that conservation experts need to be better informed and engaged in the planning process if they want their information to be applied. In order to better integrate conservation principles into land use planning, planners need information to help them make the case for conservation; case studies about how nature conservation has been successfully incorporated in other communities' visions and plans; and connections to conservation experts who are willing to participate in the planning process.
Furbearer management in Canada is the oldest sustainable use of wildlife in North America. The number of furbearers today equals or exceeds the numbers that early settlers experienced when Canada was first settled by Europeans. Trapping today employs scientifically proven humane methods and equipment to harvest the 19 furbearing species in Canada. In addition, the wild fur market is strongly regulated by provincial and federal regulations as well as international humane trap standards. Trappers have the role of top predator in the territory they manage. Sustainable management of furbears relies on harvesting the annual surplus that exceeds a habitat’s carrying capacity. By ensuring the habitat is not over-utilized furbearers will continue to thrive and produce healthy young. Sustainable management involves not just harvest but a deep knowledge of animal behaviour and habitat potential. A trapper’s connection to the land is strong and consists of decades of knowledge and time spent walking the land. Regulated trapping has left no landscape footprint in all the 400+ years of wild fur harvesting in Canada. Managing a trapline is a lifelong learning experience. No other person in most cases has the ecological appreciation for a given territory than the trapper. Despite maintaining such successful management, trapping continues to be challenged by interest groups that are based on emotion and not science.
SY28 Knopff AA*; Knopff KH; Boyce MS; St Clair CC; University of Alberta; aknopff@ualberta.ca

Cougars in the backyard: preserving ecological integrity in developing landscapes

Maintaining large carnivores and their ecological functions in human-dominated landscapes poses a significant conservation challenge. In these areas, large carnivores are often extirpated by anthropogenic habitat modification or direct persecution by people. Persecution is especially likely when people believe carnivores threaten human lives or property. To better understand how carnivores and humans might co-exist, we studied cougar habitat selection and human perception of cougars simultaneously in west-central Alberta, Canada. Cougars varied in the degree of avoidance they exhibited to human development. Individuals that were exposed to higher levels of anthropogenic development at the home-range scale exhibited less avoidance of anthropogenic features than cougars with limited exposure to development and altered habitat use temporally to accommodate die variation in human activity. Survey results indicated that west-central Albertans substantially overestimated the risk posed by cougars to humans. Nevertheless, they were tolerant of cougars, provided cougars did not occur near their homes. Our results suggest that cougars can persist in moderately developed rural and exurban landscapes. However, managers must exert caution to avoid exceeding development thresholds and educate the public so that intolerance, which historically drives predator extirpation, is not increased by inflated risk perception.

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Recent declines in tall-grass prairies in Manitoba and effects of patch structure on community persistence

Tall-grass prairies are one of the most critically endangered ecosystems in North America. We evaluated changes, between 1987-1988 and 2006, in number, size and quality of 65 remnant tall-grass prairies in Manitoba, Canada. In 2007 and 2008 we conducted more detailed surveys of vegetation composition at 580, 0.2 x 0.5 m quadrats within 24 remnant prairies, to evaluate the potential roles of patch structure (prairie size, matrix type and edge effects) on community persistence. We found that northern tall-grass prairies continue to suffer from serious threats: 37% of remnant tall-grass prairies present in 1988 had changed to other habitat types by 2006, and quality of most remaining prairies, particularly small ones, declined over time. Both native and alien species responded more strongly to distance to edge than to prairie size or matrix type. Prairie quality may be lower in smaller remnants because of edge effects. Richness of native plants was also negatively correlated with cover of alien species at both quadrat and patch spatial scales, suggesting that alien species may displace native species. Active management is required to manage and conserve the fragments of native tall-grass prairie that remain.

SY33 Koizumi, I; Hokkaido University; itsurow@cris.hokudai.ac.jp

The struggle for survival by native Japanese salmonids versus dams, sediment, introduced species, climate change, and urbanization

I review the current status of Japanese salmonids, including masu salmon, white-spotted char and Sakhalin taimen, endemic to Far East, to show how these fishes survive, or not, in such a highly populated country. All Japanese salmonids have suffered from human activities in the past few decades, but the causes and consequences are quite different depending on their life history, habitat, and commercial importance. Although most salmonids have been diminished, population size has been dramatically increased in chum and pink salmon since the 1970’s due to extensive hatchery release. Such hatchery activities have resulted in loss of wild populations, although recent genetic analysis showed that the signature of local genetic structure still remains. Contrary to chum and pink, masu salmon has been declined regardless of hatchery efforts, probably due to stronger dependence in freshwater. Because of hilly topology, there are many erosion control dams in Japan, which have resulted in serious local extinction for white-spotted char. Japan held the southern-most populations of white-spotted char and Dolly Varden. Therefore, they are predicted to suffer significant impacts from global warming. The main cause of population degradation of the largest salmonid, Sakhalin taimen, is sediment loading from farmlands, which dramatically reduces spawning sites and egg survival. In addition, many native salmon, char, and taimen are affected by introduced rainbow, brown and brook trouts.

P1.51 Koscinski, D; Crawford, LA; Keller, HA; Keyghobadi, N*; University of Western Ontario; daria.koscinski@uwo.ca

Non-lethal tissue sampling in two butterfly species shows no effects on flight behaviour and survival

Genetic data are increasingly used to inform conservation and management plans for wildlife species. For smaller invertebrate animals, tissue material for genetic analyses is typically sampled by collecting whole individuals (i.e. lethally). Increasingly, researchers around the world are using non-lethal means of tissue collection (e.g. leg, wing clips) within the context of genetic studies on threatened butterflies, although few studies have examined the impact of such sampling. We investigated the effects of non-lethal tissue sampling on flight behaviour and long term survival of two butterflies, the cabbage white (Pieris rapae) and the inornate ringlet (Coenonympha tullia inornata), in the wild in Southwestern Ontario. We applied three treatments: handling and release (control), wing clipping and leg removal. We followed each butterfly immediately after release and measured a variety of flight behaviours. All butterflies were also individually marked for mark-recapture analyses. We found no differences in the number of movements, flight speed, the time spent flying and sitting across treatments in either species. We also found no differences in survival across treatments in either species. Our study suggests that both types of non-lethal sampling have little impact on the flight behaviour and survival of wild butterflies.
Community protecte areas creation: case of "sitatunga valley" in south of Benin

Community-based natural resource management is a relatively new in Africa. The project of community protected areas creation "sitatunga valley" is an initiative of CREDI-NGO started since 2007 in the south of Benin. Located inside the RAMSAR site 1017, this ecosystem shelters an astonishing and impressive diversity. This project aimed to integrate the riparian populations of this wetland about 1000Ha in the conservation of its natural resources especially the sitatunga, Tragelaphus speki registered in IUCN redlist. A dozen of villages with a total population of 17000 habitants live around this ecosystem. The actions of CREDI-NGO are sensitization, biologic resources inventory, development of management tools and setting up of management committee. The main targets group is the hunters who have been organize in a committee of hunters and working for responsible hunt charter development. Otherwise, CREDI-NGO makes advocacy and lobbying by the political authorities for the obtaining an official status of this protected areas. One of the major difficulties of setting this approach is mainly illiteracy of more than 90% of the population whose life depends closely on the natural resources. The similar experiences are welcome so that our project can succeed in Benin.

Potentials of set-asides in promoting farmland insect and plant diversity in Hungary, Central-Europe

The establishment of set-aside fields might provide important non-cropped habitats for farmland flora and fauna, suffered largely from agriculture intensification in Europe. In Hungary, special agri-environment schemes require the establishment of sown set-asides on 5-10% of the total cropped area of farms. We studied the benefits of these fields for farmland plants, orthopteran (Orthoptera), bee (Apidae) and butterfly (Rhopalocera) fauna, comparing 1, 2 and 3 year-old set-asides, winter cereal fields and semi-natural grasslands in 39 sampling sites. Species richness, abundance and species composition of insects were tested against field type and plant species richness. The wheat fields were the poorest habitats. The species richness and abundance were usually higher in set-aside than in cereal fields with no significant difference between set-aside of different age. We found the highest number of orthopteran species and butterfly individuals in semi-natural grasslands. At community level, field type had a significant effect on the orthopteran and butterfly assemblages, but not on bee communities. Orthopteran assemblages were affected by plant species richness. Our results show that set-asides are important habitat patches for insects, similar to that of semi-natural grasslands. Unfortunately, because of the increasing commodity prices and the need for bioenergy crop plantations, set-aside was abolished and set-aside fields almost disappeared from the EU during the last years. Respect their high potential in conservation of farmland biodiversity we support the importance of set-asides within the Hungarian agri-environment scheme and suggest set-aside establishment in other Central European countries as well.
Climate change-enhanced conflicts over the EU's Natura 2000 protected area system call for a shift towards a more adaptive and integrative management

Initially, the EU's Natura 2000 system of protected areas was designed to safeguard the sustainable management of cultural landscapes. Another key objective was to include the wider landscape in targets for biodiversity conservation. The current shift in strategy of Natura 2000 promotes the protection of static representations of narrowly defined targets. A vulnerability analysis of Germany's Natura 2000 sites exposed failings in attempts to resolve conflicts between land use and conservation. Furthermore, spatial and management fragmentation, and lack of documented adaptive management plans also contributed to vulnerability. These issues are compounded by effects of climate change on biodiversity and land use. Conservation problems caused by stakeholder conflict in densely populated Europe can be reduced by returning to the original integrative concept, and by prioritising ecosystem functionality. A proactive strategy of climate change adaptive management that engages land users from the entire landscape would promote ecosystem cohesion thus contributing to a true Natura 2000 network. Participatory strategies recognise the fundamental values of biodiversity in maintaining ecosystem functionality, and the need to conserve and manage it sustainably. Under this system conservation action would work towards goals and targets agreed by all stakeholders, a coalition process that encourages collective responsibility and full participation.

What is farmland bird?

Effects of agriculture on biodiversity have been well-documented in Europe at various spatial and temporal scales. Thirty-three percent of native bird species (150 of 453 species) are classified as dependent on farmland for their persistence; 36 species defined as farmland birds are used by the European Bird Census Council as an environmental indicator. These species have exhibited continent-wide declines and continue to be at risk from intensification or farm abandonment. In contrast, in North America, large scale transformation of agriculture is more recent than in Europe, has progressed more rapidly and few refer to farmland birds per se, preferring instead to define species by their original native association such as grassland, forests, shrublands or wetlands. Based on the comparison of existed literature and review by subject experts, we propose a list of 72 species that should be considered as farmland birds in North America. 24 of 28 farmland specialists shown decline in population numbers especially in the regions with intensive agriculture. A Farmland Bird Index as in Europe could be used in North America to monitor effects of agriculture on biodiversity and for designing and implementation large scale management and mitigation measures, such as agri-environmental schemes.

Conservation assessment of remnant fescue grasslands in Saskatchewan, Canada

Native grasslands, the most threatened habitat in North America, has experienced dramatic decline as a result of the agricultural intensification and changes in land use. Most of the prairie in Canada is mixed grasslands with small inclusions of native fescue grasslands. These remnant fescue grasslands should be the primarily focus of nature conservation efforts because they are hotspots of biodiversity and possess high richness and occurrence of many rare plant species. Despite the high conservation value of fescue grasslands alteration effects on their flora and vegetation have not been sufficiently quantified and described. Rigorous scientific investigation of habitat conditions, vegetation communities' and plant species' abundance and distributions are required. The objective of our research is to conduct a conservation assessment of remnant fescue grasslands in Saskatchewan with the aim to: 1) identify rare plant species, 2) delineate rare plant communities, 3) determine threats to rare plant species, communities and their habitats, and 4) prioritise them for conservation plans and monitoring. The short-term research will focus on remnant fescue grasslands at the local and regional levels and intends to assess experimentally the link between habitat disturbance, native plant species decline and exotic species invasion. Our long-term goal is to investigate how these factors affect threatened fescue grasslands in different temperate regions of the world.

GENETIC AND PHENOTYPIC VARIATION IN ALBERTAN BROOK STICKLEBACK (CULAEA INCONSTANS)

Understanding the remarkable fits between organisms and their environment represents a major challenge for evolutionary biologists. In heterogeneous landscapes, populations may be locally adapted and may respond differently to environmental change. In this study we investigated local adaptation in Albertan brook stickleback (Culaea inconstans) populations. We discovered significantly high estimates of phenotypic divergence (PST average = 0.86) in comparison to among population estimates of neutral genetic divergence (FST = 0.14, 95% CI = 0.09, 0.24) estimated with 8 microsatellite loci in four lakes (N = 50 stickleback per lake). These comparative estimates of phenotypic differentiation against neutral expectations revealed pronounced departures in at least nine traits (including geometric shape, dorsal spine number and pelvic girdle length), consistent with the hypothesis that directional selection has driven the divergence of these phenotypic characters between environments. Moreover, genetic population structure estimates revealed evidence for dispersal between lakes despite an apparent lack of inflows or outflows. This divergent selection may be the result of physical characteristics of the lakes, as well as the annual introduction of rainbow trout (Oncorhynchus mykiss) into certain lake systems.
Critical Habitat Under the United States Endangered Species Act: Lessons Learned From Over 30 Years of Implementation

There is a statutory requirement under the Endangered Species Act (ESA) to designate critical habitat for listed species to the maximum extent prudent and determinable. Extensive confusion and differences of opinion exist regarding the designation process and conservation value of critical habitat that has resulted in significant litigation and expenditure of resources as well as inconsistencies in the designation process. Court rulings and legal opinions have influenced the process further by invalidating regulatory definitions and providing their interpretation of statutory definitions and the designation process. The implementation of a consistent national policy by the Fish and Wildlife Service and National Marine Fisheries Service (Services) that incorporates clear definitions and guidance for specific key terminology, criteria, methodology and procedures would facilitate a more consistent, efficient and defensible approach to designating critical habitat, while focusing expenditures of valuable resources. In short, following over 30 years of implementing the critical habitat provisions of the ESA, the Services have determined that there may be a more efficient manner in which to designate critical habitat under the ESA, and revisions to the current approach are needed.

Vulnerability of Chronic Wasting Disease Infected Male Deer (Odocoileus hemionus) to Mountain Lion (Puma concolor) Preation

The possibility that predators choose sick and weak prey, we examined whether mountain lions (Puma concolor) selectively prey upon mule deer (Odocoileus hemionus) infected with chronic wasting disease (CWD). We estimated CWD prevalence among kill sites from GPS collared mountain lions and compared this to estimated prevalence among sympatric mule deer killed by hunters in the vicinity of those kill sites. Hunter-killed female deer were less likely to be infected than males (odds ratios (OR) 5 0.2, 95% confidence intervals (CI) 5 0.1-0.6; p 5 0.015). However, both female (OR 5 8.5, 95% CI 5 2.3-30.9) and male deer (OR 5 3.2, 95% CI 5 1-10) killed by a mountain lion were more likely to be infected than same sex deer killed in the vicinity by a hunter (p

Build a Preliminary Conservation Assessment of Plant Species

The Global Strategy for Plant Conservation calls for a preliminary assessment of the conservation status of all known plant species by the year 2010. To date insufficient progress has been made on meeting this target. New efforts are needed to develop a preliminary list beyond using the full IUCN criteria in plant assessments. Here we present an algorithm that provides a preliminary assessment of the conservation status of plant species using spatial, temporal, and abundance data from herbarium records. We use specimen data for species of two economically important, over-harvested plant families (the Cactaceae and the Orchidaceae) as examples of the application of the algorithm. Preliminary results indicate that up to two-thirds of the species are potentially threatened with extinction, but further evaluations using additional data are necessary (e.g., herbarium material, field work and taxonomic expert assessment). Conversely, approximately a third of the species is clearly not threatened and will not require any additional evaluations for full assessment. This methodology provides a rapid means of determining preliminary conservation assessment of a large number of species in a short period of time and greatly decreases the number of species requiring full and labor intensive assessments.

Climate Smart Connectivity Planning for Washington State and the Pacific Northwest

From local to continental scales, efforts to design and implement landscape connectivity plans to counteract the negative effects of habitat fragmentation have risen rapidly in recent years. At the same time, increasing connectivity has become recognized as a valuable tool for biodiversity conservation in a changing climate. This raises the important question of how to design landscape connectivity plans that will continue to provide functional connectivity as climates change, and will furthermore have the capacity to accommodate large-scale, climate-driven shifts in species' geographical ranges. Methods for incorporating climate change into landscape connectivity plans are still in their infancy, and feature a wide variety of possible approaches. Perhaps the most important distinction among approaches is the degree to which models of future climate change and associated species responses are included. We will discuss the Washington Habitat Connectivity Working Group's effort to address such issues as it begins the process of incorporating climate change into its statewide and regional connectivity plans. We will present results from the group's statewide connectivity analysis, and discuss the modeling framework that will be used to incorporate climate change into this analysis, including an overview of preliminary results and plans for future research.

Achieving the Goals of Target 2 of the GSPC: Using Data from Herbarium Specimens to Build a Preliminary Conservation Assessment of Plant Species

The possibility that predators choose prey selectively based on age or condition has been suggested but rarely tested. To test the idea that predators choose sick and weak prey, we examined whether mountain lions (Puma concolor) selectively prey upon mule deer (Odocoileus hemionus) infected with chronic wasting disease (CWD). We estimated CWD prevalence among kill sites from GPS collared mountain lions and compared this to estimated prevalence among sympatric mule deer killed by hunters in the vicinity of those kill sites. Hunter-killed female deer were less likely to be infected than males (odds ratios (OR) 5 0.2, 95% confidence intervals (CI) 5 0.1-0.6; p 5 0.015). However, both female (OR 5 8.5, 95% CI 5 2.3-30.9) and male deer (OR 5 3.2, 95% CI 5 1-10) killed by a mountain lion were more likely to be infected than same sex deer killed in the vicinity by a hunter (p

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The influence of subsurface thermal structure on the foraging behavior of northern fur seals (Callorhinus ursinus)

Oceanographic features have been shown to influence the distribution and behavior of marine species. In the Bering Sea, one key feature is the summer thermocline that forms from melting winter sea ice. The objective of this study was to determine how this thermal structure influences the dive behavior of the threatened northern fur seal. In 2007 and 2008, fur seals (n=34) from St. Paul Island (AK) were equipped with time-depth recorders that sampled water temperature. For each dive bout, mean dive parameters (e.g. depth and duration) and bout parameters (e.g. dive frequency and bout duration) were compared with respect to thermal characteristics (thermocline presence, intensity, and depth). Fur seals foraged primarily within the water column (74% epipelagic bouts) and in association with mixed and stratified water. However, for bouts in stratified water, stronger thermoclines resulted in longer bottom times (22.8% increase, p
Deer me! : Assessing White-tailed Deer (Odocoileus virginianus) Impacts and Movement in the Oak Savanna

P1.88 Kuntz, AR*; Root, KV; Bowling Green State University; akuntz@bgsu.edu

The Oak Openings Region of northwest Ohio is a unique mosaic of diverse communities that are closely intertwined, from Twigrush wet prairie to Midwest sand barrens. The globally rare oak savanna is important to the federally endangered Karner Blue (Lycaenidae melissa samuelis), state endangered Frosted Elfin (Incisalia irus), and state endangered Persius Dusky Wing (Erynnis persius) butterflies as their larvae all feed on the perennial wild blue lupine (Lupinus perennis) that is characteristic of this savanna community. Previously, the effects of the white-tailed deer (Odocoileus virginianus) on this unique, transitional habitat have not been investigated, though deer are common in the region and population statewide is increasing. Deer browse on a wide variety of plants and have been shown to browse oak seedlings even when other forage is available. We evaluated deer abundance, proximity to lupine, and intensity of effect among different sites. We also measured relative abundance of deer using road based surveys. Our data indicate that deer browse opportunistically on lupine and oaks once in a savanna. The effect of the deer on the oak savanna is twofold. Deer help maintain this unique community through consumption of oak seedlings but, they also hinder the growth of lupine by reducing reproduction. Movement of deer was influenced by landscape variables such as roads and trails. This study yields insight into the interactions between deer and the rare oak savanna community.

Insights From Gwich’in and Inuvialuit knowledge on predator-prey relationships in a northern alpine ecosystem

8.4 Lambert Koizumi, C*; Derocher, AE; Department of Biological Sciences, University of Alberta, Biological Sciences, University of Alberta. cathlambert@ualberta.ca

Wildlife research in northern Canada is often limited in temporal and spatial scales and can be augmented with the knowledge held by Gwich’in and Inuvialuit people, who have inhabited the area for generations. To address the recent decline of a Dall sheep (Ovis dalli dalli) population and investigate the potential predatory impact of grizzly bears (Ursus arctos) and wolves (Canis lupus), we conducted twenty-three semi-directed interviews with elders or active hunters about the trends in abundance, habitat use, diet, limiting factors, and relationships between these species. Gwich’in and Inuvialuit interviewees shared a wide range of knowledge, from specific geographic locations (e.g., lambing areas, mineral licks, den sites), to historical trends in population, foraging and predator avoidance behaviour, traditional and contemporary harvest, as well as anecdotes and cultural beliefs. The breadth of knowledge shared by interviewees was linked to their personal experience, and often related to time spent on the land and harvesting of the species. When paired with findings from scientific techniques such as aerial surveys, GPS-telemetry, and behavioural observations, Gwich’in and Inuvialuit knowledge are an invaluable source of information that can help design future research and build partnership towards a sustainable management and conservation of these species.

Persecution of Two Species of Critically Endangered Gyps Vultures in Assam, India

SP6.11 LAHKAR, KULOJYOTI*; Phukan, Mridu Paban; Risebrough, Robert W.; Wildlife Conservation and Study Centre, The Bodega Bay Institute; kulojyoti@rediffmail.com

Poison to kill rabid dogs and jackals. Vultures feeding on carcasses of animals on roads and railroad tracks are themselves being killed accidentally by speeding vehicles and trains. We conclude: 1) the continuing existence of the small pockets which would be the nuclei for future recovery is threatened by this diversity of persecution and mortality factors; and 2) the future genetic diversity of each species should be maximized by increasing whenever possible the numbers of birds now in captivity.

Pines and pastures: population connectivity and genetic diversity of an arboreal marsupial, the Common ringtail possum, in a fragmented Australian landscape

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Habitat fragmentation can reduce dispersal and lead to a loss of genetic diversity, changes to the social structure and mating system of a species, and an increased risk of local and regional extinction. In south-eastern Australia, land clearing for exotic softwood plantations and agricultural practices has resulted in the fragmentation of continuous eucalypt forests into smaller, isolated patches. We studied the effects of habitat fragmentation in the Common ringtail possum; an arboreal marsupial frequently found in modified or degraded forest habitats. Using genetic markers (15 microsatellites), we explored the connectivity and genetic diversity of possums within 14 remnant patches (seven surrounded by pine and seven by agricultural land) and compared our findings with possums residing in a large, continuous native forest. Both land use types hindered dispersal and gene flow of possums, with a more severe effect observed in the agricultural landscape. The degree of isolation and patch size were important in explaining variation in genetic diversity persisting in remnant forest patches. Identification of dispersal events enabled us to quantify distances possums were capable of moving in both modified landscape types. These findings contribute to our knowledge of species responses to landscape alteration and will be used in the management and conservation of this and related species.
Developments of biodiversity of natural habitats in the municipality Marchegg focusing on the vegetation of this area

The Central European landscape has been heavily influenced by human intervention. This highly structured cultural landscape is a result of people making use of the land for their own benefit, with technical and socioeconomic factors playing integral roles in its development. This intense manipulation of the landscape caused by general changes in human society has had a noticeable impact on biodiversity. The case study is focused on changes in the distribution of biodiversity in the municipality of Marchegg in Austria. Analysis of historical maps as well as other historical documents made it possible to compare the development of habitats over a period of 200 years of a 590 ha area. Biotope development was evaluated using indicators such as regional distribution of different habitats; predominance; type of fragmentation and compound factors; as well as degree of homorexy over time and space. The study found that biodiversity of habitats decreased because the land’s use changed over time. Notable exceptions to this result include areas protected by the WWF-nature reserve “Marchauen”. Further conclusions include social and economic interests changing the natural scenery of the municipality of Marchegg while also affecting the biodiversity of these habitats.

Bycatch Issues Associated with Inland Commercial Fisheries of Southeastern Ontario

One of the main concerns associated with commercial fisheries is the potential mortality of bycatch. Bycatch refers to organisms that are non-targeted species, undersized, or under harvest restrictions. This can include fish, turtles, mammals, and birds, some of which can be threatened. Investigation of fisheries bycatch reduction and survival has primarily focused on marine systems, but with increasing interest in expanding inland commercial fisheries and mitigating their potential impacts, there is need for scientific information to aid in the creation and support of regulations for inland waters. During a typical fishing season in southeastern Ontario, we simulated commercial fishing in small warm water lakes and quantified rates of capture for both bycatch and targeted species. In addition, blood physiology, behavioural impairment, and injury were measured for fish captured in the nets. Turtles represented the largest proportion of non-fish bycatch (i.e. 90%), while non-target fish species represented 11% of the total catch throughout the season. As a result of the capture rate of turtles, including some species at-risk (i.e. northern map turtles), research was conducted to understand the behaviour of turtles captured in the nets and gear modifications have been applied to increase survival of those captured. This research has improved the understanding of the bycatch rates occurring in these fisheries and will be useful for future management and conservation decisions.
The implementation of the State Wildlife Action Plans: Tailoring the Network to the Needs

All states and territories in the United States developed State Wildlife Action Plans (SWAPs) to identify ways of protecting species before they become threatened or endangered. Collectively, the SWAPs provide a comprehensive blueprint for fish and wildlife conservation. Nevertheless, because of their comprehensiveness, SWAPs typically call for action beyond the capacity of state wildlife agencies to implement on their own. Collaboration is critically important to the implementation of elements of these plans. We conducted case studies of six collaborative conservation efforts linked to the SWAPs to assess how the structures of partnerships influenced their success. We interviewed individuals who played key roles in these efforts and collected survey data on their collaborative interactions. We found that in contexts where collaborators were initiating activities to protect or restore ecosystems at a larger scale, they depended on more structured and balanced interactions among collaborators. In contexts where collaborators were working to expand and extend existing conservation efforts, particularly at smaller scales, interactions among collaborators were less structured and tended to occur only when essential. We present recommendations for structuring collaborative efforts depending on the scale and status of conservation efforts.

Evaluating the effect of climate change, altered fire regimes and habitat loss on Ceanothus verrucosus

C. verrucosus, a rare shrub species of coastal southern California, is vulnerable to both long and short fire intervals. Fire, required for germination, kills all adult plants and stands re-establish from seed banks that take decades to restock. In addition to shifts in suitable habitat, climate change poses risks from increases in fire frequency. Its entire U.S. range is embedded in an urbanized landscape, where, since 1955 the average patch has decreased from about 1,900 to 28 ha. Fire regimes, an important driver of ecosystem processes in these systems have been substantially changed by human activities. Climate change is predicted to further alter fire regimes and species distributions, leading to habitat loss and threatening biodiversity. We linked a spatially-explicit stochastic population model to dynamic bioclimate envelopes to investigate the effects of climate change, habitat loss and fragmentation and altered fire regime on population abundances. We tested a range of fire return intervals, two future climate scenarios and further habitat loss and fragmentation based on land identified as developable by local governments. Our results show climate change to be the most serious threat facing obligate seeding shrubs embedded in urban landscapes, resulting in population decline and increased local extirpation, and that likely interactions with other threats increase risks to these species. Taking account of parameter uncertainty did not alter our conclusions.

Using Biodiversity Science in Natural Resource Law

U.S. law includes an express biodiversity conservation mandate for the 191 million acre National Forest System. Implemented through planning regulations drafted with the advice of a committee of scientists, this requirement has famously preserved habitat for viable populations of species at risk from resource utilization. The regulations also call for maintenance of plant and animal communities, ecologically sound responses to disturbance events, and recommendations for wilderness set-asides, among many other provisions. Procedurally, they also require an interdisciplinary approach and utilization of the best available data. Input from the scientific community has been decisive in implementation of these regulations. After several attempted rewrites, the regulations are again under review. Revision is being proposed, in part, to help meet the challenges of climate change and to promote restoration of degraded lands. Additional broad legal authority, beyond these planning regulations, exists for safeguarding biodiversity on national forest lands. The Secretary of Agriculture has plenary power to adopt rules for their management. The Roadless Area Conservation Rule, adopted to end degradation threats to 58 million acres of federal wildlands, is a case in point. And the President, under the Antiquities Act, can directly protect blocks of land as national monuments for, among other reasons, their "scientific interest."

Measuring Nature's benefits: current progress in developing ecosystem service indicators

People rely on benefits provided by nature. Our reliance on these ecosystem services gains resonance with policy-makers, providing opportunities to shape policies that prioritize healthy ecosystems to meet human needs while also maintaining biodiversity. Metrics and indicators that effectively communicate the quantity and quality of services provided by ecosystems will be a necessary element in fully mainstreaming this approach in public policy. Recent evaluations of ecosystem service indicators used in the global and over 20 sub-global assessments done as part the Millennium Ecosystem Assessment and subsequent work have identified significant gaps that, if left unaddressed, will hinder the uptake of ecosystem service concepts. However, new approaches are being developed and applied in diverse ecosystems and political landscapes. The presentation will focus on three elements: the findings from analyses of existing ecosystem service indicators including the strengths and weaknesses of indicators for different services; a review of concepts in development to fill existing indicator gaps; and an overview of tools helping to develop and apply ecosystem service indicators.
The Calayan Rail Gallirallus calayanensis is an island-endemic species classified as Vulnerable under IUCN (2009) but may need to be uplisted to Critically Endangered if there are evidences of population decline. Hunting through snares for local consumption or pet trade is one of the threats to the species apart from habitat loss due to intensive commercial forestry. Ptilochronology was determined by measuring the average width of growth bars from naturally grown and induced tail feathers of adults. The fluctuating asymmetry of wing and tail feathers of both adult and nestling birds was associated to habitat fragmentation by calculating landscape indices from a 500m radius around each nest box from classified Landsat images. We did not find any relationship between feather growth rates and habitat amount or configuration, but we did find an indication of increased numbers of deformed growth bars in fragmented habitats. The analysis of fluctuating asymmetry showed that habitat amount had a stronger influence than composition. In conclusion, our results show that biomarkers related to growth deformities and asymmetry may respond more to habitat fragmentation than those relating to growth rates in the Eurasian treecreeper.

Gathering local knowledge in quantifying local pressures on the Calayan Rail (Gallirallus calayanensis)
The Calayan Rail Gallirallus calayanensis is an island-endemic species classified as Vulnerable under IUCN (2009) but may need to be uplisted to Critically Endangered if there are evidences of population decline. Hunting through snares for local consumption or pet trade is one of the threats to the species apart from habitat loss due and introduced predators. Hunting is usually done for subsistence of local families. Although the use of snares is intended for the Red Junglefowl, Calayan Rails are also caught opportunistically wherein one hunter can reportedly trap more than 60 rails per year. Through an island-wide interview of local residents, we give here a picture estimating the number of Calayan Rails hunted per year and at what rate it is being caught. The results will also show us where the rails are frequently seen and hunted, and by which demographic group. This has an implication to the conservation of the species, as it will tell us the impact of hunting to the rail, and in one hand, where conservation work will be most needed to thwart any further decrease in the species' number.

Measuring the Impact of Information Education Campaigns on the Calayan Rail Gallirallus calayanensis
After the discovery of the Calayan Rail Gallirallus calayanensis in 2004, a conservation project involving awareness on the species and the environment was undertaken in the remote island of Calayan, northern Philippines. From 2005, the team conducted information education campaigns (IEC) throughout the Island as part of our strategy to convey the uniqueness of and threats to this species. But how much of our effort has been well-targeted and how do we measure the success of our IEC work? We solicited the help of barangay (village) health workers in doing an objective, third-party survey through questionnaires to monitor and evaluate the impacts of IEC activities conducted between the years 2005 - 2008. 350 (3% of total population) took part in the survey. Questions were designed to know the respondents' knowledge on the rail's physical characteristics and habitat and the where these information were gathered from. We also included questions on resource use, perceptions on the environment and environmental responsibilities and policies. This will help us quantify the awareness our project has generated for the Calayan Rail. It will also help us identify gaps and strengths in our IEC campaigns so we could focus our strategies more effectively in our work ahead.

The aim of this study was to determine whether ptilochronology (an estimate of growth) and fluctuating asymmetry (reflecting developmental instability) of feathers can be used as phenotypic biomarkers of habitat fragmentation, measured as habitat loss and changes in configuration, in a forest-dwelling bird. We sampled feathers from Eurasian treecreepers (Certhia familiaris) between 2000 and 2002 in central Finland where forests are subject to intensive commercial forestry. Ptilochronology was determined by measuring the average width of growth bars from naturally grown and induced tail feathers of adults. The fluctuating asymmetry of wing and tail feathers of both adult and nestling birds was estimated by contrasting the lengths of matching feathers on the right and left sides of individuals. Ptilochronology and fluctuating asymmetry were associated to habitat fragmentation by calculating landscape indices from a 500m radius around each nest box from classified Landsat images. We did not find any relationship between feather growth rates and habitat amount or configuration, but we did find an indication of increased numbers of deformed growth bars in fragmented habitats. The analysis of fluctuating asymmetry showed that habitat amount had a stronger influence than composition. In conclusion, our results show that biomarkers related to growth deformities and asymmetry may respond more to habitat fragmentation than those relating to growth rates in the Eurasian treecreeper.

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Measuring the fate of biodiversity under global changes: the mean species trait approach
Although biases and pitfalls of biodiversity indicators are recurrently debated, their ecological meaning and their relationships with well-known human induced pressure on biodiversity are often not clearly established. In this context, a new type of biodiversity indicators, reflecting variations in explicit species-specific traits in species assemblages has been proposed (Mean Species Traits, MST). Here, we highlight the strengths and weaknesses of MST indicators both from practical and ecological perspectives. Using the European trend of a community specialisation index as a case-study. We show that this metric is sensitive to human pressures at various spatial scales and can be easily adapted on several taxonomic groups, either with presence/absence or abundance data. We further i) compare this metric with more classical indices (richness, diversity) ii) test its sensitivity to human pressures (fragmentation, urbanisation, agricultural intensification). iii) We also compare results for different taxonomic groups using atlases of distribution in Europe. We also repeat this analysis at European scale and for countries within Europe. Finally, iv) we examine the possibility to calculate CSI trends using GBIF data. Our results show the relevance of such mean species trait indicator. We found a consistent strong relationship between CSI and the increase of human pressures both spatially and temporally across countries in Europe. Overall, our results highlight the ongoing functional biotic homogenization process.

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Ptilochronology and Fluctuating Asymmetry as Phenotypic Biomarkers of Forest Fragmentation in the Eurasian Treecreeper (Certhia familiaris)

Measuring the Impact of Information Education Campaigns on the Calayan Rail Gallirallus calayanensis
After the discovery of the Calayan Rail Gallirallus calayanensis in 2004, a conservation project involving awareness on the species and the environment was undertaken in the remote island of Calayan, northern Philippines. From 2005, the team conducted information education campaigns (IEC) throughout the Island as part of our strategy to convey the uniqueness of and threats to this species. But how much of our effort has been well-targeted and how do we measure the success of our IEC work? We solicited the help of barangay (village) health workers in doing an objective, third-party survey through questionnaires to monitor and evaluate the impacts of IEC activities conducted between the years 2005 - 2008. 350 (3% of total population) took part in the survey. Questions were designed to know the respondents' knowledge on the rail's physical characteristics and habitat and the where these information were gathered from. We also included questions on resource use, perceptions on the environment and environmental responsibilities and policies. This will help us quantify the awareness our project has generated for the Calayan Rail. It will also help us identify gaps and strengths in our IEC campaigns so we could focus our strategies more effectively in our work ahead.

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Gathering local knowledge in quantifying local pressures on the Calayan Rail (Gallirallus calayanensis)
The coastal zone of Vietnam is under various adverse impacts of natural disasters such as storms, floods, high tide, and northeast monsoon. According to assessment of scientists (IPCC, 2007; Thuc at al., 2009), these impacts would be increased due to climate change and sea level rise. Local people in the Northern region of Vietnam have, for generations, known how to plant mangroves to protect dykes, rice fields, properties and people life. Ong and Tan (2008) asserted that mangroves have survived sea-level changes through geological time. Recognizing the role of mangrove, remarkable efforts of society, government and NGOs have been mobilized to reforest the mangroves along the coast of Vietnam. Our study indicated that mangrove forests (Kandelia obovata aged 5-6 years and Sonneratia caseolaris 9 years) can reduce 80-87% of wave height and over 90% of wave energy; and the carbon accumulation, e.g., of 9 year old forests is 15.090 ton/ha/year. The increased trend of mangrove reforestation in the last ten years would make a favourable base to develop and conserve mangroves in northern Vietnam. Some recommendations for utilizing mangrove as soft measure to respond to climate change and sea level rise in northern Vietnam will be discussed, to help the managers, policy-makers and local communities in their consideration to restore mangroves and related decision making process.

**Canada’s Boreal Intactness: Opportunities and Threats**

The Canadian Boreal Forest's level of ecological intactness represents an unprecedented global conservation opportunity, although there are imminent anthropogenic threats. Canada contains the majority of Earth's ecologically intact boreal forest (54%) and about one quarter of the entire world's remaining ecologically intact forest cover. It features large mountain ranges and expansive plains with bogs, peatlands, and permafrost; provides habitat for more than half of North America's birds; contains some of the largest caribou-wolf ecosystems in the world; contains more than 20 percent of Earth's freshwater rivers, lakes, and wetlands; and is home to over 600 Aboriginal communities. However there has been a rapid, unprecedented and accelerating increase of incursions into the forest to exploit its natural riches; primarily timber, hydrocarbon, hydroelectric and mineral extraction operations. Their cumulative impacts remain largely unstudied although they are evolving rapidly. Global warming is of particular significance in the boreal forest. Over the next century, average temperatures in northern regions will rise substantially more than the global average. Early conservation decisions are necessary to capitalize on the opportunities and ameliorate the threats.

**Deadwood is obviously important ecological resources of forests providing unique structural characteristics that can be useful habitats for various organisms. Nevertheless, there is a small number of specific information on saproxylic organisms (i.e. organisms that depend on dead or dying wood during some part of their life cycle), especially beetles, according to different stages of deadwood decomposition. We investigated saproxylic beetles in twenty four white spruce logs of 6 different classes on July, 2009 at the EMEND (Ecosystem Management Emulating Natural Disturbance) research site in NW Alberta, Canada. Bolts c. 60 cm in length were cut and moved to rearing cages near the research camp and saproxylic beetles were sampled twice until September. The abundance was the highest in the early decay class. The trophic guild structure was different according to the chage of deadwood decomposition, for example, wood-borer was the most diverse in the early decay class, and predator and fungivore were abundant in the late decay class.**
Remote cameras can be used to gather data for a variety of objectives including detecting key fur-bearers and wide-ranging carnivores, wildlife habitat use, seasonal movements of wildlife and wildlife interactions with industrial infrastructure. The use of remote camera technology for collecting data on wildlife species offers several advantages over traditional methods of data collection. They allow for collection of data during any season or time of day and in remote locations. As well, remote cameras are simple and reliable systems that can be easily moved among survey sites. In northeast Alberta, within the Oil Sands Region, remote cameras have been used effectively for conducting baseline inventories using baited and non-baited camera stations, monitoring wildlife species in reclaimed areas, assessing wildlife use of potential movement corridors, monitoring wildlife habitat use in relation to disturbances, monitoring for species of concern and monitoring the efficacy of mitigation measures. A minimum of fifteen camera programs have been conducted since 2005 in northeast Alberta. This presentation will outline the methods used for the various objectives and how the results from remote camera surveys can be integrated with other survey types to predict environmental impact assessments, focus long term monitoring and assess effectiveness of mitigation measures for wildlife species in the Oil Sands Region.

Conservation of the threatened northern spotted owl in the Pacific Northwest, USA, has been based on a reserve network since 1994. From the start, the persistence of reserves in the dry mixed-conifer forests of the eastern Cascade Range has been at issue. There, the loss of fire-tolerant vegetation and increasing wildfire severity and extent are key consequences of 20th century management. Loss of old forests from stand-replacement fires has increased 100 fold from 1972 through 2002. Current reserves occupy 77% of the landscape yet contain only half of the habitat-capable lands, and owl populations have declined by 4% annually since 1994, despite zero habitat loss due to harvest. Wildfire severity and extent are predicted to increase even under moderate climate change forecasts. The last 20 years of research and management in dry forest landscapes provides the scientific basis for a new whole-landscape conservation strategy that integrates forest restoration and owl conservation. This strategy was envisioned and adopted under the recently developed Northern Spotted Owl Recovery Plan. Under the strategy, the entire federal landscape east of the Cascade crest would be managed for ecological objectives, with emphasis on retaining current owl habitat and recruiting future habitat. Model tests of this strategy vs. the reserve strategy are under way. Field implementation and novel restoration treatments will be evaluated under adaptive management.

Patterns of decline for threatened and endangered species in the United States
Species are listed as threatened or endangered because they have experienced dramatic declines that place them at high risk for extinction. The ways in which species experience declines, however, may vary among taxa. Although precise estimates of the numbers of individuals, populations, and range sizes are often unknown for imperiled species, the qualitative nature of declines can be ascertained. For all listed species, subspecies, and distinct population segments in the United States with approved recovery plans, we recorded whether each one experienced a change in abundance, the number of populations, and/or range size compared to historic levels. Nearly all species experienced a decline in abundance and many experienced population losses or range contractions. However, taxonomy was associated with the pattern of decline. Vertebrates were just as likely to lose populations as they were to undergo range contractions. Vertebrates were more likely to experience range contractions than to lose populations, whereas plants were more likely to lose populations. These patterns may result from different threats. Narrowly distributed plants and invertebrates may be experiencing acute threats that extirpate populations, while vertebrates may suffer more from diffuse threats that reduce the extent and size of populations. A better understanding of the patterns of decline can help guide recovery objectives and help determine strategies to increase the likelihood of species recovery.
Management approaches to commonly held resources in the Canadian North such as polar bears, have tended to be organized under traditional disciplinary lines emphasizing either utilitarian or preservationist approaches. The effectiveness and appropriateness of such management approaches are being challenged on two fronts. First, climate change is affecting wildlife population parameters and environmental conditions so rapidly that traditional scientific research and monitoring may not be able to keep pace, and second, the co-management systems that are aimed at incorporating aboriginal perspectives, have not lived up to expectations. This presentation explores how the engagement of Cree communities would improve current governance structure, and promote co-management approaches of polar bears in the province of Ontario.

Variable retention as strategy to protect insect diversity in managed South Patagonian forests

Traditional silviculture affects original diversity of old-growth forests, and insect conservation was usually not included in ecosystem management planning. However, in last decade, variable retention was proposed as a strategy to mitigate species losses. The aim was to compare insect diversity in Nothofagus pumilio forests managed with variable retention and traditional forestry during the first four years after harvesting. Adult insects were sampled through a wide spectrum trap set (pit-fall, alcohol, lights and color trays) in managed (aggregated-AR, variable-VR and dispersed retention-DR) and control unmanaged stands-C. Richness and relative abundance were analyzed with multivariate tests (classification, NMS, PERMANOVA and PERMDISP), 282 morphospecies were identified, where Diptera, Coleoptera, Lepidoptera and Hymenoptera were the main orders. Studied variables trend to decrease in harvested forests compared to C, depending to habitat damage level and years after harvesting. Multivariate analyses showed similarities between C and aggregated retention areas, however, great dissimilarities were observed with time. Also, introduced species from other environments were higher in harvested than in retained areas. VR improved insect diversity conservation compared to AR or traditional forestry (DR or clear-cuts), maintaining old-growth forest diversity inside the aggregates and decreasing the impact of forestry in harvested areas.

Condition and context effects on birds in a large-scale corridor network

The intensively managed agricultural zone of south-eastern Australia is criss-crossed with an extensive network of linear corridors of remnant native vegetation that were originally established for the purpose of droving stock. This network represents a unique natural experiment for regional connectivity. We investigated how species use the network, and how the habitat value of the network interacts with the surrounding farm landscape. To address these objectives, we surveyed birds across a 14,000 km² area, both in the network and on adjacent farmland. Our design incorporated corridors of varying size and condition, as well as different adjacent land use types (cropping, exotic pastures, native pastures), located at distances of 100m, 200m, or 400m from a given corridor. Bird communities responded to a number of variables, in particular the density of trees within the corridors and the intensity of agriculture in the surrounding landscape. Woodland birds of conservation concern were found almost exclusively in the network of corridors or in native pastures adjacent to the network, as opposed to exotic pastures or crops. Our results demonstrate that networks of corridors for conservation will need to take into account not only the condition of a given corridor, but also its landscape context and adjacent land use.
SY22 Leong, Kirsten*; Emmerson, David; National Park Service, Department of the Interior; kirsten_leong@nps.gov

Collaborative Conservation and Adaptive Management in Department of the Interior Agencies

The U.S. Department of the Interior manages one-fifth of the land in the U.S., including the public lands administered by the National Park Service, U.S. Fish and Wildlife Service, and Bureau of Land Management. Federal agencies have included public input in decision-making since the Administrative Procedures Act in 1946, with varying degrees of effectiveness. In the past few decades, approaches to public involvement have broadened to encompass a philosophy of public engagement that includes possibilities for collaborative conservation. This philosophy is reflected in a number of policy and reporting directives, but has not yet diffused widely throughout the agencies in practice. In this paper, we present evidence for this philosophical shift in agency guidance; discuss some of the legal and policy considerations for adopting more dialogue-based collaborative approaches on federal lands; identify common barriers to adoption; and provide examples of cases in which practitioners successfully fulfilled legal procedural requirements while meeting the standards of participatory practice as outlined by organizations such as the International Association for Public Participation. As large scale societal changes continue to affect the way that people experience and value public lands, effectively incorporating collaborative conservation will be increasingly important in public land management.

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Incorporating natural disturbance in the design of protected areas for the boreal region of Canada

The boreal region of Canada is a dynamic ecosystem shaped by large-scale natural disturbances like forest fire. The boreal is unique as it is one of the only remaining regions in the world where we can proactively design protected areas that are big enough to maintain large-scale ecological processes. We present criteria based on characteristics of wildfires to determine the size, location, and efficacy of protected areas that have a high probability of maintaining internal recolonization sources and apply these criteria in 5 study areas in the Northwest boreal region of Canada. We used the estimated maximum extent of the largest fire and the extent and distribution of vegetation communities that are differentially affected by fire to estimate the size and location of candidate protected areas. Then, we use CONSERV, a spatially explicit dynamic simulation model, to determine the ability of candidate protected areas to maintain internal recolonization sources through time (i.e., efficacy). In 4 of 5 study areas, protected areas that were ~2.7-2.8 times the estimated maximum extent of the largest fire effectively maintained recolonization sources through time. Study areas with rare or patchily distributed vegetation communities required larger protected areas in order to maintain recolonization sources. We offer a quantitative method for incorporating large natural disturbance into protected areas design.

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When the Geographic Range is the Same as Critical Habitat: the Case of the Banff Springs Snail

Sometimes it’s easier to delineate Critical Habitat (CH) than to protect it. The diminutive and endemic Banff Springs Snail (Physella johnsoni) is the only species in Canada to have full protection under provisions of the Species-at-Risk Act (SARA). It was reassessed as endangered by COSEWIC in 2008 and continues to be listed as such under SARA. Both a Recovery Strategy and an Action Plan have been approved (2007) and CH has been delineated and gazetted (2008). Systematic population surveys once every three (Jan 1996-July 2000) or four weeks (thereafter) identified an occupied thermal spring habitat (595 sq. m.) slightly smaller than the penalty box area on a soccer field. Having this small area all within Banff National Park facilitated its delineation as CH. However, challenges continue between implementing policies for protection and for providing memorable visitor experiences as four of the seven snail subpopulations are in a high-visitor use area and birthplace of Canada’s national park system - the Cave and Basin National Historic Site (C&BNHS). These challenges may increase as annual visitation at the C&BNHS is targeted to increase from 100,000 to 300,000 visitors per year following the 2010-2012 redevelopment.

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Restoration from the Perspective of the US National Park Service

The bison is the icon of the Department of the Interior (DOI) and the National Park Service. Following the near extinction of bison during the 19th century, substantial numbers of bison currently exist as a result of the combined management efforts of State, tribal and Federal governments, conservation groups, and private ranchers and landowners. One of the iconic symbols of American frontier expansion is the image of vast herds of North American bison grazing on the western plains. While the days of millions of free-roaming bison are gone, it may be possible to develop partnership arrangements that will permit bison herds to recreate their natural role in areas where biologically suitable and socially acceptable. In appropriate areas, the presence of bison in adequate numbers may help support the restoration or maintenance of other native species and habitats. This in turn would provide inspiration or enjoyment to diverse elements of our society. As demonstrated convincingly at Yellowstone National Park, observing bison ranging freely over the landscape holds a major attraction for the American public. In 2008, the DOI announced an initiative for managing bison by bureaus and articulates a framework for improved management of the species while providing a foundation to strengthen existing and build new partnerships. This presentation will present a status update on the framework which establishes steps to address the health and genetic composition of DOI bison herds, and acknowledges the ecological and cultural role of bison on the American landscape.

3-7 July 2010, Edmonton, Alberta 139
Climate change induced range shifts of Galliformes in China

Climate change would cause range shifts of many species in the future. Galliformes may be particularly vulnerable to climate change, as they have low dispersal ability. Little is known about their possible responses to the future climate. We used three predictive habitat distribution models (i.e. generalized linear model, generalized additive model, and MaxEnt) to predict the current and future ranges of all 63 Galliformes in China, based on a comprehensive species occurrence database and a combination of climate variables. Other environmental variables, i.e. elevation and human footprint index were also included in the models. Principal component analysis was conducted to illustrate the association of environmental variables and each species. Using the SRES A2 and B2 climate change scenarios for 2071-2100, we projected that 26 species would have range shifts over 50%, including 10 endemic species. Galliformes at higher elevation face greater range shifts. Northward shifts are more than other directions. Some local range shift patterns are obvious, e.g. nine species in Yungui Plateau (at Southwest China) would have parallel eastwards moving. As to model selection, MaxEnt has the best performance. Incorporating more environmental variables did not significantly improve the model performance, because the variables are correlated. We suggest conservationists pay special concerns to the 26 Galliformes that face extensive range shifts, especially the 10 endemic species.
Safari hunting tourism comprises a major industry in parts of Africa, particularly in the SADC region. Approximately 26,750 hunting tourists visit Africa every year, generating annual revenues of at least USD229 million. Due to expanding human and livestock populations there is increasing competition for land and pressure on natural resources. Effective wildlife conservation outside of protected areas is increasingly dependent on wildlife-based land uses competing financially and economically with alternatives. In the more remote and less secure parts of Africa, safari hunting is currently the only practical means of generating significant returns from wildlife. Safari hunting is currently practised over ~1.55 million km² in sub-Saharan Africa, and provides incentives for both habitat protection and for the prevention of unregulated bushmeat hunting. Safari hunting justifies the retention of a massive wildlife-ranching industry on private land in southern Africa. However, there are a number of problems which undermine the conservation value of safari hunting and which threaten the future of the industry. The primary issue is structural and institutional: failure of governments to allocate full ownership or user-rights over wildlife to communities, preventing local people from benefiting adequately from safari hunting (or ecotourism). Other key problems include inappropriate systems for leasing hunting concessions, inadequate monitoring of hunted wildlife populations, and flawed processes for establishing quotas. Animal rights groups are vocally opposed to safari hunting, and some African governments appear uncertain over the acceptability of safari hunting as a conservation tool. Consequently, the long term future of safari hunting in Africa is by no means secure. Resolving problems associated with safari hunting is crucial to ensure that the key incentives for wildlife conservation stemming from the industry are perpetuated and enhanced.
The green & blue network initiative: planning for sustainable conservation beyond NATURA 2000

Often, project aiming at protecting land come from our governments or Europe (Natura 2000) and thus face resistance at the local level, because seen as a top-bottom non democratic process. The green and blue network is an old concept in French-speaking countries. It has recently been revisited during the Grenelle de l’Environnement to match the new challenges of biodiversity conservation within climate change. It provides a new adaptive frame for land use planning, in order to restore or maintain connectivity between ecosystems and populations, from the basis of existing protected and designated areas. We present a case-study based on the conservation of Hermann’s tortoises (Testudo hermanni hermanni) in Var, France, to illustrate how a concerted bottom-up approach could lead to increased protection of buffer zones and corridors on a short and long term adaptive process.

Overcoming Data Paucity in Two Tropical Fisheries: Queen Conch and Spiny Lobster in the Turks and Caicos Islands

The Turks and Caicos Islands (TCI) are home to two fisheries of critical importance for the local economy: the queen conch (Strombus gigas) fishery, which comparatively is relatively healthy, and the spiny lobster (Panulirus argus) fishery, which gives rise to rather more concern, though the exact status of the stock is difficult to assess. These two fisheries are managed completely differently, with a closed season, and national size and gear restrictions for the spiny lobster, but through a CITES quota for queen conch, along with national gear and size restrictions. In both instances, however, the same level of data collection has taken place, and some of the data collection started as early as the 1800’s. Stock assessments have been carried out for both fisheries, some visual surveys were carried out in 2001, marine protected areas were established to protect the stocks and local consumption has been monitored. This paper first evaluates the level of certainty that can be derived from this fragmentary approach, and then suggests alternative methods to best fill the gaps in knowledge and to improve the management of these two key fisheries in the absence of greater certainty.

Considerations in designing wildlife-friendly night lighting

Conservation lands with public access, including wildland parks, are places to be able to see and enjoy the solitude of unspoiled nature, where the natural rhythms of life are allowed to flourish with minimal disturbance from human interference. Managers of such lands therefore must balance the need to provide visitor infrastructure with its adverse effects on the environment. Although night lighting is considered an essential element for visitors in many circumstances, night lighting has a range of adverse ecological consequences for ecosystems and wildlife. With some planning, however, the effects of lighting on species and ecosystems can be reduced and in some instances avoided altogether. We provide an overview of the effects of artificial night lighting on wildlife and considerations for designing or retrofitting lighting that minimize impacts to wildlife and the nocturnal environment. These considerations are organized by habitat type: dunes, beaches, and shorelines; deserts and scrublands; wetlands; islands, oceans, and reefs; grasslands; deciduous and evergreen forests; alpine and tundra; and urban environments. Within the unique context of each of these environments, managers should consider five questions about lighting systems that address need, duration, intensity, direction, and spectrum as they relate to potential adverse effects.

At Least Half: Core protected areas as a cornerstone of the human endeavour in the 21st century

Global efforts to date have been seriously inadequate to protect the other life forms that share the world with us and to prevent human-caused climate change. The oceans are being depleted of fish, large carnivores are disappearing all over the terrestrial world, climate change is drastically changing habitats, freshwater scarcity is becoming acute on many continents, and humans continue to destroy wild ecosystems even though their value to agriculture is marginal. A galvanizing vision is needed. Humanity should protect at least half of Earth’s land and water in interconnected PAs because of their critical importance to biodiversity, ecosystem services, human well-being and climate change adaptation and mitigation. We need to renew our focus on core areas while advancing the critical connectivity agenda to avoid building “bridges to nowhere”. PAs are the best way to ensure that carbon stays in place and out of the atmosphere. PAs established could take a variety of forms and land tenures that include national parks and wilderness areas, aboriginal conservation areas, private land conservation (whether held by individuals, corporations, community held lands or NGOs), municipal watershed protection areas, and regional land use zone designations provided they meet IUCN’s 2008 standards for PAs.
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Improving land management plans for the conservation of an endangered Huemul deer (Hippocamelus bisulcus) in Southern Chile

Despite the understanding that wildlife conservation requires maintenance of population connectivity, there is lack of management tools that allows the incorporation of this concept to land use planning. The Aysen region has a large amount of protected lands but its abrupt geography and increasing human activities might reduce the connectivity of the remaining huemul populations. The later is significant due to previous research showing the existence of a threshold on population size and aggregation for population viability. We use spatially explicit population models based on individuals to assess the connectivity between huemul populations and potential corridors. We increase the size of urban areas to evaluate their impacts on connectivity and we explore population spatial configurations that minimize local extinctions. One-hundred individuals were located on each population. The number of individuals and their arriving time with respect to other populations was recorded. Colonization areas and use frequency was used to determine corridors. Results showed a deficient connectivity between the northern populations and the rest of the system and also the existence of isolated populations. Human activities enhance this naturally low connectivity. This methodological approach allows us to create practical tools (e.g. maps) to improve the actual land management plans and enhance the huemul conservation.

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An assessment of native plant species in removal of heavy metals from contaminated soil of a protected area in Iran

Heavy metals concentrations in mine waste are higher than of uncontaminated soil. These mine wastes are harmful to humans and other organisms and tend to bio-accumulate in the food chain. Hyperaccumulator plants can be potentially used to remEDIATE metal-contaminated soil and this process is called phyto remediation. We assessed the extent of metal accumulation by plants found in a mining area located in Lashgardar protected area in Iran. The ultimate goals of this study were to find suitable plants for phytoextraction and phytostabilization (two strategies of phytoremediation). Plants with a high bioconcentration factor (BCF) and low translocation factor (TF) have the potential for phyto-stabilization and plants with both BCFs and TFs greater than one have the potential to be used for phytoextraction. We collected 36 plants each from 12 species and extracted shoots and roots together with associated soil from the study area. All plant and soil samples were analyzed for total concentration of Pb, Zn, Mn and Fe using atomic absorption spectrophotometer and BCF and TF parameters were calculated for each element. Our results showed that Scrophularia scaparia is effective in phyto-stabilization of P b and Centauraea virgata, Echinophora platyloba and Scariola orientalis had a potential for phyto-stabilization of Zn. Furthermore Centauraea virgata and Cirsium congestum were effective in phyto-stabilization of Mn. However none of the plant species we assessed were suitable for phytoextraction of Pb, Zn, Mn and Fe, and phyto-stabilization of Fe. In summary, our finding suggest that native plant species growing on mine wastes can be used for restoration of mine waste contaminated sites due to potential for phytoremediation.

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Biodiversity facing direct and indirect human induced disturbances.

Human activities are expected to results in a diversity of directional or stochastic disturbances, affecting species either directly or through an effect on their resources. Yet there is no theoretical framework to predict the complex and various effects of these disturbances on communities. We developed a dynamic model that mimics the use of different types of resources by a community of interacting species. We investigated the effects of different types of environmental perturbations (affecting either the growth of species or the availability of resources) on several biodiversity indicators. Our results indicated that (i) in realistic community models (assuming uneven resource requirements among species) the effects of perturbations are strongly buffered as compared with neutral models; (ii) intermediate levels of disturbance are expected to improve community species richness, confirming previous theoretical findings. However, functional community characteristic may be strongly affected by directional or stochastic disturbances; (iii) an increase of the environmental (e.g., climatic) variance may have contrasting effects on community biomass and species richness. Overall, the model may help the interpretation of biodiversity metrics in communities facing disturbances and seriously questions the used of neutral models in biodiversity assessments.

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The National Ecological Observatory Network (NEON)
The US National Ecological Observatory Network (NEON) is a large facility project funded by the National Science Foundation. NEON’s goal is to contribute to ecological understanding and decision-making at the regional to national-scale through integrated observations and experiments. NEON will create a new national observatory network to collect ecological and climatic observations across the continental U.S., Alaska, Hawaii and Puerto Rico. The observatory will be the first of its kind designed to detect and enable forecasting of ecological change at national scales over multiple decades. NEON has partitioned the U. S. into 20 ecoclimatic domains, representing different regions of vegetation, landforms, climate, and ecosystem performance. Data will be collected from strategically selected sites within each domain and synthesized into information products that can be used to describe changes in the nation’s ecosystem through space and time. The data NEON collects will focus on how land use, climate change and invasive species affect biodiversity, disease ecology, and ecosystem services. Obtaining integrated data on these relationships over a long-term period is crucial to improving forecast models and resource management for environmental changes. These data and information products will be freely and openly available to scientists, educators, students, decision makers, and the public to enable them to understand and address ecological questions and issues.
SY42 Lovelock, B; University of Otago; brent.lovelock@otago.ac.nz
Perspectives from New Zealand: Hunting as Tourism and its Role in Conservation
This paper addresses the challenges facing the sustainability of touristic hunting, and its use as a game management tool. A niche tourism product, hunting-tourism fits into the broader category of wildlife tourism, which includes non-consumptive, ecotourism activities, e.g. wildlife viewing, photography, as well as consumptive (hunting/fishing) activities. Hunting-tourists and eco-tourists hold different social and environmental values, a source of conflict, impacting visitor patterns, behaviour and satisfaction for both groups. Ironically, in destinations such as New Zealand, where all game species are introduced pests, causing unacceptable modification to natural ecosystems, hunting could quite validly be considered to be ecotourism. However the grounds of this argument will always be contentious. One problem facing destination managers who wish to market hunting tourism, is how to do this in a sensitive manner that will not alienate large and lucrative segments of their tourist market. While some destinations have overtly promoted hunting tourism opportunities historically, this may no longer be an acceptable practice given the contemporary realities of the animal-rights/welfare movement and the power of the tourist eco-dollar. For hunting tourism to continue, will increasingly rely upon its proponents clearly defining the benefits of the activity and developing collaborative relationships with the broader tourism industry.

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Impacts of mountain bike trails on red squirrel populations (Sciurus vulgaris) in Northern England
The increase in tourism and recreational activities potentially add to the already increasing pressure on endangered and vulnerable wildlife. Impacts on wildlife caused by these increasing popular pursuits are however poorly understood. However it is thought to have damaging effects on species that can lead to a decline in local population numbers and even species richness. I tested the effect of two recently opened mountain bike trails on the abundance of the red squirrel (Sciurus vulgaris), whose numbers have rapidly declined throughout Britain. Surveys were undertaken using distance sampling methods. These followed transects carried out during 2007 prior to the construction of the mountain bike trails. Data gathered was used to compare squirrel abundance with trail usage, habitat typology and population abundances from previous years. Habitat typology was the principle determinant of red squirrel abundance. The presence of mountain bike trails had a strong negative impact on the abundance of red squirrels. The negative impacts created by mountain bike trails could be alleviated by careful selection of trail sites due to habitat types. Leaving areas that provide refugees for red squirrels such as Larch (Larix deciduas) and Sitka spruce (Picea sitchensis).

P2.179 Lu Zhang*; Jiazi Liu; Dajun Wang; Zhi Lu; George Schaller; Yonglin Wu; Li Zhang; Xin He; Peking University, Wildlife Conservation Society, Qinghai Lake National Nature Reserve, Qinghai Forestry Bureau, Shanshui Conservation Center; changlu726@gmail.com
Impact of Fencing and Livestock on the Survival of Przewalski's Gazelle
The highly-endangered Przewalski's gazelle (Procapra przewalskii) endured severe habitat loss and population decline over the last century. Since 2002, illegal hunting of gazelles has been largely stopped, making fencing of pastures and competition with livestock now the main threats (hunting was banned well before 2002 but not enforced much). We quantified fencing and livestock on gazelle's habitat using parallel transects and analysed spatial correlation among fence-density, livestock-density, and gazelle activity. We also compared reproduction performance of small gazelle populations on distribution areas with different fence densities. Our study indicated that highly-fenced areas in the gazelle's habitat were associated with less gazelle activity, but a higher Enhanced Vegetation Index (EVI) and more livestock. Higher fence density did not correlate with young gazelle mortality, but did correlate with fawning rate. Ten-year EVI trends showed that fencing did not help to improve the condition of grassland, especially in high livestock-density areas. We observed no significant spatial correlation between livestock and gazelle activity, but more work is needed to evaluate the impact of livestock, especially the potential for food competition.

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Large carnivores, their prey and humans in Europe - the ambitious task of making everyone happy
In spite of high human densities and virtual absence of wilderness areas, 29 out of 33 continental European countries host large carnivore (bears, lynx, wolves and wolverines) populations, most increasing in number and distribution areas, even in agricultural and peri-urban areas. However, predation on livestock affects farmers' economies, predation on wild prey affects hunters' activities, and fears of attacks on humans frighten part of the general public. To reconcile the needs to conserve viable populations of large carnivores with those of humans is a formidable task in the European human dominated landscapes. European protected areas are too small to host viable populations, and hence large carnivores need to co-exist with humans in multi-use landscapes to survive. In spite of their general legal protection, coexistence requires the implementation of locally adapted conservation rules and effective means to prevent and mitigate the conflicts, including culling and hunting within compensatory mortality. The goal of the Large Carnivore Initiative for Europe (LICE) is to have (more) large carnivores in wider ranges - maximizing distribution rather than density. Populations should be self-sustaining on wild prey but coexistence with human activities implies acceptance that the large carnivores may not be allowed to grow to the levels of pre-licence densities. Populations should be self-sustaining on wild prey but coexistence with human activities implies acceptance that the large carnivores may not be allowed to grow to the levels of pre-licence densities. Populations need to co-exist with humans in multi-use landscapes to survive.
Restoration in New Zealand Estuaries

Abstract: Estuaries in New Zealand are subject to a range of disturbances, including land-based sediment loading that increases turbidity and deposition of fine sediments, favoring mangrove expansion, and decreasing health of shellfish beds and seagrass meadows. Here we discuss three projects led by scientists, community groups, and management agencies that have resulted in successful restoration efforts, and the development of guidelines for restoration activities in New Zealand estuaries. In the first, we developed guidelines for translocating shellfish (cockles). Field experiments tested which methods maximized retention and later recruitment of shellfish (cages; density of shellfish; size of plots). A community group assisted with field work, increasing local knowledge of shellfish biology and restoration methods, and resulting in support for additional shellfish restoration projects. A second project successfully translocated seagrass. Long-term monitoring of translocated seagrass demonstrates that the meadows are increasing in extent. A final project is developing guidelines to maintain a balance of areas of mangrove forest and open sand-flat in the face of increased sediment loads that favour mangrove expansion. Here, the challenge is in identifying techniques to reduce mangrove expansion that minimize impacts on neighboring habitats, while managing community expectations and educating communities on mangrove contributions to estuarine health.

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The Allee effects in invasive ant species

The Allee Effects (AE) gather phenomena in which species’ population growth shows a positive relationship between a component of individual fitness and population size, as a direct consequence of individual aggregation and cooperation. Recently its importance in conservation has been shown for its potential role in extinctions of endangered species as well as in the dynamics of invasive species. Eusocial insects are strong candidates for many AE mechanisms, due to the nature of their social structure. We aim at determining the presence and the mechanisms that may cause AE in ants, including native and invasive species, through the study of the success of colony survivorship in relation to the number of queens and workers that cooperate to found a new colony. We set up lab colonies of Linepitema humile (Argentine ant), one of the most devastating of the invasive species worldwide and Tapinoma nigerinum, a non-invasive species with similar colony structure. We studied the relationship between reproductive colony fitness and the initial size of the colonies (number of queens). We measured colony survivorship (as a direct measure of reproductive fitness) and other components of fitness (such as reproductive output). Significant differences in the effect of colony size and some measures of fitness between the two species are useful to determine the existence of a critical population size for the colony of invasive species to survive, which is crucial for the management and control of invasive species.
The highly productive southern boreal forest in Canada and Eurasia is dominated by mixedwood forests in which the canopy is dominated by varying mixtures of broadleaf (e.g., aspen, poplar, birch) and coniferous (e.g., spruce, fir, pine, cedar) trees. Mixed forest stands, in which two or more tree species are prominent in the canopy, can have higher productivity and may also host higher levels of biodiversity than pure stands, because they provide a greater variety of habitats. We analyzed data available in the literature on vascular and non-vascular plants, soil microorganisms, arthropods, and songbirds for the Canadian boreal mixedwood forest to determine the relationships of species diversity and community composition to forest (canopy) composition (conifer-dominated vs mixed vs broadleaf-dominated). Four different relationships were observed, each support by different biotic groups. Many different studies of ground beetles demonstrated that all three forest types had similar richness and community composition with minor differences in relative abundance. This was also the case for spiders and moths in mixedwood forests of northwestern Alberta. For understory vascular plants, soil microbial communities, saproxylic beetles, and songbirds mixed forests had higher species richness than either broadleaf- or conifer-dominated forests because they hosted communities comprised of a combination of species found in those two extremes. For nonvascular plants and in a study of litter-dwelling and saproxylic beetles from mixedwood forest types in Quebec richness increased with an increasing conifer component. For rove beetles and understory vascular plant communities in heavily conifer-dominated forests of eastern Canada, richness declined with increasing conifer component. The different relationships between forest composition and richness and community composition for the different groups can be explained by differences in habitat requirements. We conclude that maintaining a diversity of mixedwood forest types at different scales will be important for conserving biodiversity in managed boreal mixedwood landscapes.
Effects of population management by immunocontraception on harem stability in feral horses (Equus caballus) on Shackleford Banks Island, NC

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Feral horses on Shackleford Banks Island, NC are managed by The National Park Service in order to reduce their impact on the fragile barrier island ecosystem. Management techniques include immunocontraception of most females. The immunocontraceptive reduces the number of horses that need to be physically removed, but there is concern that the immunocontraceptive is influencing the social behavior of the mares and reducing harem stability. I investigated the effect of immunocontraception on harem stability by tracking the number of harem changes of each adult mare through the breeding season for two seasons. In both seasons the mares that had been treated with the immunocontraceptive changed harems significantly more than mares never treated (one-tailed: 2007 p = .042 and 2008, p=.021). The number of years treated did not have a significant effect on the number of harem changes (2007 p=.199, 2008 p = .871), nor did the number of years a mare had been off contraceptive once the contraceptive is discontinued (2007 p = .310, 2008 p=.823). Additionally, there was no significant difference in harem changes between mares that were actively contracepted and mares that had been contracepted in the past but were not actively contracepted (2007 p=.196, 2008 p = .751). These results indicate that the immunocontraceptive has a significant effect on harem stability and that once a mare has been contracepted the behavioral effect of the contraceptive treatment may not be readily reversed.

Are Scientists Able to Make Consistent Judgments About Relative Endangerment of Species Based on Patterns of Extinction Probability?

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Determining whether a species warrants listing under the U.S. Endangered Species Act requires judgment about how large its chances of extinction must be, and how imminent, to qualify for listing. Developing clear, perhaps quantitative, listing standards requires information on how scientists decide what patterns of extinction probability indicate more or less endangerment. Using several value elicitation protocols, we presented 21 scientists knowledgeable about endangered species with graphs depicting different patterns of extinction probability and asked them to rate relative endangerment. We found that: (1) judgments of endangerment were often inconsistent within and between subjects; (2) the timeframes for concern about extinction varied among subjects from a hundred to thousands of years; (3) scientists working to develop quantitative listing criteria responded most consistently, although all subjects sometimes misinterpreted graphs of extinction probability over time; (4) judgments were less consistent when graphs of extinction probability rose slowly but steadily over time, or rose rapidly but not until several decades into the future; and (5) some subjects revealed changing perceptions of endangerment as they completed the tasks, suggesting that perhaps they did not have stable prior concepts of degree of endangerment. Better training in the kinds of judgmental tasks we presented will be needed both to develop clear standards for listing and to apply them consistently.

Making a comeback: A study of population genetic health of the Alberta peregrine falcon (F. peregrinus)

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Alberta peregrine falcons (Falco peregrinus anatum) are an endangered species recovering from catastrophic population declines during the mid-1900s. However, despite great interest in the conservation of this species, little is known about the genetic relationships within populations or the biological mechanisms that influence their population dynamics. As an initial step, we investigated genetic diversity among the bottlenecked Alberta peregrines and compared it to a wild population from Nunavut. We isolated DNA from 17 blood samples obtained from a captive population in Alberta, which contains progeny from the captive population bred for a reintroduction effort under the Canadian Wildlife Service from 1970-96. To provide a baseline for genetic diversity in wild peregrines, we also examined genetic diversity in a wild population from Nunavut that has not experienced a recent bottleneck. For this comparison, we isolated DNA from 64 F. p. tundrus specimens collected in 2006-09 near Rankin Inlet. For all samples, we determined genotypes at six microsatellite loci. Results show that the captive population exhibits lower genetic diversity than the wild population. Across both populations, allelic diversity ranged from 3-13 alleles/locus, and heterozygosity ranged from 59-89%. We speculate that the captive population is not representative of the wild Alberta population, if the diversity of the Nunavut population is indicative of that typically found among wild peregrines.
23.2 Mahoney, Shane P.; Lewis, Keith P.;*; Soulliere, C.E.; Weir, Jackie N.; Department of Environment & Conservation, Government of Newfoundland & Labrador, St. John’s, NL A1B 4J6, Canada; colleen@soulliere@gov.nl.ca

Newfoundland’s woodland caribou: Population dynamics through a century of ecological change

Woodland caribou (Rangifer tarandus) have persisted in Newfoundland, Canada since the last glaciation and are the only native ungulate to the island landscape. Population estimates are available from survey and census since the 1950s and have been reconstructed from historic reports and documents to the 1880s. The caribou population peaked in the late 1800s, followed by a rapid decline and a long period of low-density stasis. In the 1960s the population began to increase steadily to a second peak in the late 1990s followed again by a rapid decline which continues today. The influence of ecological change is evaluated including: the disappearance, introduction, and colonization of the island by other mammalian species, introduction of parasites, and the collapse of the cod stocks. In addition, we evaluated the technological advances which changed both the nature of anthropogenic influence and the nature of our understanding of caribou ecology. Despite similarities in the magnitude of the current population decline and that of the late 19th century, factors limiting population recovery have changed dramatically; coupled with prediction of climate change, there is a great deal of uncertainty regarding the future of Newfoundland caribou.

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Caribou in a Collapsing World: Rescuing Space Travelers on a Finite Planet

Caribou represent an iconic life form, not only in the recent history of circumpolar ecosystems and human cultures of the north temperate and arctic systems, but also from a human history perspective. The populations of both Neanderthal and Cro Magnon in Europe were heavily dependant on this species for their survival, as were the evolved cultures of many northern peoples around the globe who, like Rangifer, ranged northward with glacial retreat. Indeed, it may be argued that caribou absence from these northern ecosystems would have significantly altered the course of human development in these regions. Resilient in their significance, caribou remain today of inestimable importance within the ecological fabric of the systems they occupy, and within the subsistence and recreational human enterprises aligned with them. For many reasons these magnificent animals pose incredibly complex challenges to conservation leaders of every region and discipline. Their tendency to express long term population perturbations of great magnitude; their catholic diets and habitat occupancy traditions that have seen them established from frigid arctic islands to temperate rainforests; the great latitudinal and longitudinal metrics of their distribution globally; their unique and heavy reliance on the lethargic lichen pastures of tundra and forest; their tradition of flight over aggression and subsequent vulnerability to an extraordinary host of large and meso-predators; their unique place in the diverse cultures they have supported and fed; and their reluctance to generally adapt to broad scale human intrusions, all make caribou a species for which management solutions are synonyms for constant reevaluation. But more than all other factors, it is the inherent tendency of caribou to utilize space and to inevitably move between extremes of density over annual cycles and/or geographic planes that makes them so hard to evaluate and difficult to protect. They are bound to meet humanity along an almost amorphous front, and outside of leaving the land for them, a half century of science still struggles to define more realistic options. The patchwork quilt that is the reality of Rangifer ecotone expression means that the generalities science pursues may never possible and the specifics for their local conservation too many to invoke. Caribou may well be, like the bison before and perhaps the wildebeest to come, a species for whom only a shadow awaits. What is unquestionably true is that we will have no greater conservation challenge than to keep them with us over the vast areas that even today they roam. Losing them will be a tragedy beyond measure. Once more caribou are bleeding northward, but this time it is not the ice fields that are furing them on, but the front of humanity that is pushing them beyond.
**P2.30** Malcolm, CD*; Bruederlin, B; Sallows, T; Department of Geography, Brandon University, Brandon, Manitoba, Canada, Manitoba Water Stewardship, Fisheries Branch, Brandon, Manitoba, Canada, Riding Mountain National Park, Parks Canada, Wasagaming, Manitoba, Canada; malcolm@brandonu.ca

**Movement of northern pike in a human-altered river system in Manitoba, Canada**

Between the late 1800s and 1960 the Little Saskatchewan River, in southwestern Manitoba, was divided into five disjoint stretches, for upstream movement of fish, through construction of dams and a spillway; four reservoirs were created. Beginning in 1992, fish passways were constructed around three of the barriers. In April, 2007 and 2008, we tagged a total of 88 northern pike with external VHF transmitters at each of the four reservoirs, to examine movements and assess connectivity at the dams. During each year pike were tracked by foot, boat, and airplane throughout the summer, fall, winter, and following spring, until tags no longer functioned; maximum tag operation was 400 days. We used data from 66 of the tagged fish: 51.5% of the pike moved greater than 500 metres beyond their first data point following tagging, 21.2% moved downstream over a dam, 10.6% moved back and forth around a dam more than once within one year, and 19.7% over-wintered in a river portion of the system. Two pike moved approximately 120 km upriver, river channel distance, from point of tagging. The results support successful function of the fish passways (for northern pike), and indicate greater movement, particularly in a downstream direction and during the winter, as well as connectivity, than was expected. River over-wintering dictates that water levels must be maintained at current levels or higher, to restrict winterkill.

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**Participatory Conservation Of The Edible-Nest Swiftlets In Andaman And Nicobar Islands**

International trafficking affected wild population of the Edible-nest Swiftlet Aerodramus fuciphagus allofree its distribution including Andaman and Nicobar Islands. After loss of around 80.00% of breeding population in a decade, conservation of the species was commenced by involving the motivated nest collectors/poachers. To assess the efficacy of the protection system, data were collected from 29 protected and 168 unprotected caves using nest count method. Annual breeding populations in 28 protected caves at Chalis-ek and one cave at Interview Island were estimated between 2001 and 2008. Unprotected populations in 152 caves at Baratang Island and 16 caves at Interview Island were estimated between February and April 2008. Protected population showed significant growth of 38.98% with an average annual growth rate of 4.75±6.21%. Unprotected population showed significant decline of 73.68% with dissertation of 60.50% of caves between 1997 and 2008. These results demand urgency to expand existing protection system to the undefended caves throughout the island arc. Recent exclusion of the species from the Scheduled-I of Wildlife protection Act will help to develop and expand the protection system to assure survival of the species in wild and sustainable use of this natural resource towards economic development of local people.

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**Oil Sands Tailings Technology: Understanding the Impacts to Reclamation**

Managing tailings is a critical component in the development of oil sands mines; the choice of tailings technology impacts reclamation schedules and outcomes. When tailings are released to a pond, a layer forms called Mature Fine Tailings (MFT) which is made up of fine clay particles suspended in water. The challenge is that MFT does not settle within a reasonable timeframe. As a result, Suncor has needed more and larger oil sands tailings ponds over the years. In the 1990s, Suncor pioneered consolidated tailings technology to help speed up the consolidation of MFT. Tailings Reduction Operations is a new approach to tailings management. TRO is the process of mixing MFT with a polymer flocculent, then depositing it in thin layers and allowing it to dry. This new process has significant benefits such as: accelerating reclamation, reducing the need for more tailings ponds and reducing the existing inventory of MFT. Suncor began reclamation of tailings in 1971 with varied success. The development of Consolidated Tailings technology required new reclamation techniques which has resulted in significant research. Examples of existing tailings reclamation will be discussed. The impact of TRO on reclamation schedules and outcomes will also be discussed.

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**Current status, trends, threats and future of the Great Lakes ecozone**

The Great Lakes have a combined surface area of about 244,000 km2 and is the largest freshwater ecosystem on Earth. The Great Lakes have been an agricultural and industrial hub of northeastern North America for several hundred years. As a result, the ecosystem has undergone substantial changes. Although historically oligotrophic, large portions of the lower Great Lakes became increasingly eutrophied due to increasing nutrient inputs from urban and rural sources culminating in large dead zones by the 1950s. The large population of the basin (currently >35 million) has led to significant habitat modification and losses, most notably the loss of 35% of the coastal wetlands. Overfishing led to substantial declines in fisheries by the early 20th century, and remaining fishes contained increasing levels of toxic contaminants. There has also been a long history of invasive species introductions, deliberate and accidental, leading to significant changes in the ecosystem. Recently, nutrient and contaminant levels have declined, and remaining fisheries and habitat have been managed more effectively. Invasive species remain a major threat, and climate change is an emerging threat. Future management actions should focus on further monitoring and control of nutrients, contaminants and invasive species, and conservation and protection of native species and habitat.
Stakeholders’ perceptions of invasive alien plants: a case study from Galicia, Spain.

Social perceptions of the risks posed by deliberately introduced plants influence the development of effective public policies to manage and control invasive alien species (IAS). An understanding of the determinants of these public perceptions can improve the capacity to anticipate policy responses for two main reasons: 1) A high percentage of IAS were introduced deliberately for economic reasons such as horticultural and forestry species (Groves, 1998; Mack and Ernæberg, 2002; Pysek et al., 2002); 2) IAS generate economic benefits to their users that may offset the impacts. This paper investigates social perceptions, awareness and attitudes of the local population towards invasive plants (IAS) to evaluate the potential success and possible implications of different IAS policies. The analysis is being undertaken in Galicia (northwest of Spain). Particular emphasis is given to species introduced by ornamental or forestry uses and that are currently under more control in Galicia and Spain or represent a serious threat. We speculate that the results will highlight the current low level of risk awareness by stakeholders, local population and decision makers. This low level of awareness has resulted in a lack of regulation of market distribution of non-native plants in Spain.

Building social-ecological resilience: how climate change can help improve conservation management of Marine Protected Areas in Thailand

Marine Protected Areas (MPAs) in Thailand are well established but their success and effectiveness are largely unknown. Disparate government agencies and outdated legislation are inadequate to address the management challenges posed by cumulative local pressures such as pollution and over-fishing. Climate change will pose new challenges due to sea level rise, increasing sea surface temperature, ocean acidification and extreme climate events. Addressing climate change challenges will require a holistic approach that incorporates site-specific environmental vulnerability and social adaptive capacity into conservation planning. In post-tsunami efforts, a number of integrated ecosystem-based management programs have been developed to restore coastal ecosystems through community-focused and sustainable livelihood approaches. A newly proposed Andaman Protected Area Network comprised of 18 MPAs and recommended buffer zones and community management areas, over 3.5 million ha in total, will be country’s largest marine spatial planning initiative in which a new form of governance is expected. This paper describes and analyses these initiatives and their efficacy in reducing immediate threats to coral reef and associated coastal systems and enhancing ecological and social resiliency in the face of climate change. Developing a resilient MPA network is identified as an important next step and the paper concludes with some suggestions on how to achieve this objective.

Monitoring and reporting for environmental changes in northern latitudes presents a number of unique challenges related to the remoteness of the areas, the vast tracts of space, and in many cases, the lack of available basic information. To overcome these obstacles, we have pursued a number of innovative approaches that build on strong partnerships with local communities around Sirmilik, Auyuittuq and Ukkusiksalik National Park, Nunavut, Canada. Through a combination of interviewing and mapping techniques, regular experts meetings and on-the-land activities in key park areas, we identified indicators of sea ice and on-the-land activities in key park areas, we identified indicators of sea ice and environmental changes, gained expert advice from Elders and hunters on places of ecological importance and associated ecological processes, approaches to conservation, safety practices, and ecosystem management. The life-long experiences of Elders and hunters from their extensive travels across the Arctic, their dependence on the availability of animal species for survival and their ability to access these remote areas provided comprehensive and detailed information that will enhance the design of long-term monitoring programs. Although the knowledge provided was unparalleled, the most significant outcome of the work was in the development of solid relationships with the Inuit communities and knowledge holders - creating a place where meaningful discussions can happen about resource conservation and safety issues, environmental change and strategies for adaptation.

Native ecosystems are subject to a growing array and magnitude of anthropogenic stressors as human populations and associated resource demands increase over time. Declines in biological diversity are a predictable consequence of loss, fragmentation, and degradation of native ecosystems. In turn, biodiversity is a key factor in maintaining the resilience of native ecosystems in the face of changing environmental conditions, including those associated with climate change. The host of anthropogenic stressors acting in concert on native ecosystems today has uncertain and potentially unpredictable consequences for native species populations and communities and the ecosystem services that they provide. Large-scale status and change monitoring is an essential tool in the race to gain knowledge about vulnerabilities and thresholds of stability in population persistence, community cohesion, and ultimately ecosystem resilience. High levels of uncertainty about where, when, and what changes in biodiversity may occur in response to uncertain future environmental conditions dictate strategic sampling designs that provide a balance of focused and broad-scale data collection, short- and longer-term response information, and retrospective and prospective analyses. These uncertainties also limit the utility of coarse filter approaches to monitoring biodiversity, although wide-spread reluctance to commit resources to direct measures of biodiversity persists. The Multiple Species Inventory and Monitoring protocol developed by the US Forest Service is an approach that offers many of these features; its strengths and weaknesses are explored as a case study.
Education and sustainable development alternatives: tools for regional conservation model in Colombia

The Colombian Andes has the highest diversity of amphibian species reported for the country and the largest number of endemic species in other groups like mammals and butterflies. However, 80% of these ecosystems have been heavily tapped due to the indiscriminate expansion of agricultural and livestock frontiers, product of unmet needs and ignorance of the farmers in the Colombian Andes. For this reason, Falan is a pioneer municipality in research and environmental education, which through workshops, lectures, eco-hikes and videos made by young school students about environmental issues in the municipality, awareness has been generated largely from the farmers population. Also, to strengthen the research process, meetings have been held annually for young researchers from universities and regional research centers whose purpose is to seek sustainable development alternatives that allow positioning the municipality as a center for research and conservation in Colombia. Moreover, strategic alliances with government institutions, have resulted in encounters regional eco-tourism each year since 2004, representing an affordable alternative that encourage farmers to take care the environment and sustainable thinking in a harvesting natural resources.

Greenhouse Gas Emissions and Mitigation Options Associated With Grazing system Management in Alberta

A first approximation framework to assess net emissions/reductions of carbon dioxide (CO2), nitrous oxide (N2O) and methane (CH4) within beef cattle-grazing systems in Alberta was outlined in the form of a case study of typical “business as usual” or baseline management scenario as compared with improved pasture scenarios for the dry and moist agro-climatic zones of Alberta. Using the modified Intergovernmental Panel for Climate Change (IPCC) modified Tier 2 approach the carbon (C) sequestration rates, N2O emission and enteric plus grazing cattle manure CH4 emission rates were estimated for unimproved (i.e. baseline) and improved cattle-pasture systems in dry and moist zones in Alberta. The results indicated that improved pastures under light grazing represented increases in net greenhouse gas (GHG) sinks in the subregions considered, due to increased rates of C sequestration. In contrast, heavily grazed improved pastures represented net GHG sources due to increased N2O emissions caused by fertilizer application. Also increased CH4 emissions occurred under heavy grazing as a result of higher stocking rates that are beyond what can be counteracted by increased C sequestration. Accurate estimation of baseline emissions in various subregions will be critical for the development of a carbon offset system for beef livestock-pasture systems across Alberta.

Evaluation of conflicts between birds an powerlines in Mexico: Problems and solutions

Collision with wind turbines, transmission lines and electrocution on power lines are part of the celebration for the Bicentenary of Mexican Independence. 2) Adoption of power lines by different industries to retrofit them and prevent electrocution risk. 3) Surveys to identify critical areas and studies to evaluate different impacts of energy generation, transmission and distribution on ecosystems. 4) Update information on wind power regulations, on bats as collision victims in wind farms, and the removal of anemometric towers once wind farms are operating. 5) Suggestions on how to improve inter-institutional planning, coordination of information and guidelines and exchange of good practices relating the planning of environmental projects.
**P2.50** Marianne G. Camoying*; Coleen Espos; Jean Radelle Romo; University of the Philippines; mg.camoying@gmail.com


A taxonomic survey and zonation analysis of mangrove species was conducted in Bagonbanua Mangrove Forest during the Summer of 2005. The transect line plot method was applied for establishing sampling plots. Physico-chemical parameters such as temperature, salinity, and pH were noted. Five species belonging to three families were identified. The species were Rhizophora mucronata, Rhizophora apiculata, Bruguiera cylindrica, Sonneratia alba and Aegiceras corniculatum. The most dominant species and had the highest regenerative capacity was Rhizophora mucronata. The least in number was Aegiceras corniculatum having the lowest probability to sustain its existence. An evident zonation was observed perpendicular to the shore. The seaward zone which was dominated by Rhizophora sp. was the most expansive.

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A new technology to determine Burrowing Owl critical foraging habitat.

The purpose of this project is to identify the precise locations at which Burrowing Owls capture their prey. The Burrowing Owl (Athena cunicularia) was listed as endangered in Canada in 1995. The main reason for the decline of B. Owls is loss of native prairie habitat, with over 75% of their native range converted to non-native habitat. Non-native habitats (i.e., cropland, tame grass, tame hay and roadside ditches) tend to consist of tall, dense vegetation, which may restrict successful foraging by precluding small mammal detection and/or capture. Recovery strategies for the B.Owl have recognized the need to identify the types and configuration of critical feeding habitats required to effectively raise owlets. I use new dataloggers that acquire a location every second, accurate to

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A critique of ungulate management in the post-wolf recovery era

Wolf recovery is restoring one of the most important ecological processes shaping ungulate population dynamics after an absence of 70 years. Unfortunately, the modern foundation of ungulate population management is ill-equipped to this new reality for several reasons. First, management objectives for most ungulate populations are based on either the concept of nutritional carrying capacity or the long-term average ungulate population size for a wildlife management unit. For either of these approaches to work after wolf recolonization, wolf predation must be a weak limiting, but not regulating factor. If this is false, then it becomes a logical tautology to define the population objective as the number of elk based only on food in the post-wolf recovery era. A review of predator-prey theory suggests three alternate hypotheses to the food-only model, the predation-food hypothesis, the predator-pit hypothesis, and the predator regulation hypothesis. Posing here on wolf-elk dynamics because of the importance of elk management in the west, I review the theoretical and empirical support for these three broad alternate hypotheses. Similar to wolf-moose systems, empirical and theoretical evidence supports the predator regulation hypothesis, and rejects the predation-food and predator-pit hypotheses for wolf-elk dynamics. Rejection of the alternate hypotheses emphasizes that wolf control is unlikely to have long-term effects or that high ungulate densities will persist after wolf recovery. However, uncertainty as to the magnitude of the predation effect suggests a critical role for habitat quality to buffer the top-down effects of wolf regulation. Faced with this review of theory and empiricism, I outline several options available to ungulate managers for integrating wolf-ungulate management under different management paradigms including maximum sustained yields of ungulates, ecosystem process management, or national parks management.

**SY76** Martin, R.D.*; Oxbrough, A.; Kelly, T.C.; Irwin, S.; O’Halloran, J.; ZEPS Dept. and Environmental Research Institute, University College Cork, Ireland; r.martin@ucc.ie

The biodiversity of canopy invertebrates in a range of forest types in Ireland

The biodiversity of canopy invertebrates in a range of forest types in Ireland was assessed in monoculture Norway spruce plantations, polyculture Norway spruce plantations with native oak as the secondary tree species, and native oak woodlands. Thus, there is great potential for plantation forests to function as refugia for forest specialist species here. Our research aims to assess the hitherto unexplored canopy invertebrate component of Irish native and plantation forests, to identify suitable forest canopy biodiversity indicators and to provide detailed information on the basic ecology and species composition of forest canopy invertebrates in Ireland. Canopy invertebrate diversity was assessed in monoculture Norway spruce plantations, polyculture Norway spruce plantations with native oak as the secondary tree species, and native oak woodlands throughout Ireland using thermal fogging. Invertebrates from the orders Araneae, Opilionidae and Coleoptera were identified to species level. Significant differences (p
Use of Grit Supplements by Waterbirds: an Experimental Assessment of Strategies to Reduce Lead Poisoning

The ingestion of spent lead (Pb) shot due to confusion with grit particles causes Pb poisoning in a large number of waterbirds, being one of the main causes of mortality. Lead ammunition for hunting over wetlands is being progressively banned in more countries, while grit supplementation has been proposed as a management measure to avoid the ingestion of deposited Pb shot. However, few studies have been done on grit ingestion in waterfowl. Thus, studies of grit selection with waterfowl in semi-captivity and in the wild were undertaken to evaluate preferences in the colour (red or grey), and geochemical composition (silicious or calcareous) of grit, whether it was available dry or in water, its position within the wetland (the shore, open water or artificial platforms). Grit ingestion in waterfowl was intimately associated with feeding behaviour; it was consistently higher when food was included in the treatments. In the absence of food, red grit was taken in higher amounts than grey grit in semi-captivity but not in the wild. Silicious grit was taken in a higher amount than calcareous grit when offered dry, but not in water. No differences in the amount of ingested grit were found between different positions within the wetland. In order to optimize the effectiveness of grit supplementation to reduce the risk of Pb poisoning in waterfowl, calcareous and silicious grit may be combined and applied in feeding sites or else mixed with bait to attract birds.

Methods for identifying policy-relevant conservation research questions in the United States and Canada

To identify priorities for policy-relevant conservation research in the United States and Canada, we employed a parallel set of participatory methods. To identify U.S. research priorities, we opportunistically engaged diverse senior conservation decision makers (n=8) to determine scientific issues of near-term (up to 10 years) policy relevance. We then invited thought leaders from public, private, and non-profit organizations (including academia) to a workshop to identify “America’s Top 40” policy-relevant research questions in conservation science. Workshop organizers (n=7) and participants (n=35) solicited questions within their organizations, from other colleagues, and in public forums (e.g., email listservs). We received questions (n=531) through an online portal (www.40q.org). Prior to the workshop, participants screened questions to eliminate obvious redundancies, value statements, and questions that could not be addressed through scientific inquiry. In the workshop, participants reviewed and refined the remaining research questions to identify 40 of particular importance to U.S. conservation policy and practice. Workshop participants subsequently refined these questions via email dialogue. To explore variation in priorities across sectors and levels of government, we then presented these 40 research questions to staff of federal and state agencies and NGOs and to academics in a survey. We used parallel methods to identify Canadian research priorities.

Payments for Ecosystem Services and Poverty Reduction in Rwanda

Two of the biggest challenges facing Rwanda today are reducing poverty, especially among rural households, and protecting the ecosystems which provide essential services that support activities such as subsistence agriculture, collection of safe drinking water and the harvesting of forest products. Combining these two objectives is not easy and there are numerous pitfalls to effective policy design. This presentation will explore the possibilities of linking the growing interest in payments for ecosystem services (PES) mechanisms with alleviating poverty of smallholder farmers of Rwanda. Specifically the potential of PES programs for carbon offsets, water quality enhancement and biodiversity are analyzed to identify key challenges and opportunities for successful implementation. To have a positive impact on rural farmers, a main recommendation is the integration of PES programs with other rural development initiatives in order to avoid contradictory policies and actions in rural development and land use planning. PES programs also need to be tailored to the specific economic challenges faced by smallholder farmers.
Usefulness of coarse grain data on forest management to improve habitat suitability models for interior forest birds

We tested the use of coarse grain data on forest management systems to improve habitat suitability models for five broadleaf forest birds: the long-tailed tit Aegithalos caudatus, marsh tit Poecile palustris, blue tit Cyanistes caeruleus, wood nuthatch Sitta europaea and short-toed tree-creeper Certhia brachydactyla. All species except the long-tailed tit are cavity nesters. Bird data were extracted from a database of 4552 point counts performed between 1992 and 2002 in Lombardy (Italy). We used Generalized Linear Models to assess habitat suitability for each species. Environmental predictors were land-use fractional covers, elevation, slope, aspect, forest isolation, and coarse grain data on forest management systems aggregated for administrative provinces. They were selected by a stepwise procedure using the Bayesian Information Criterion. Variables describing the forest management system at provincial scale resulted important for the cavity-nesting species, while they were discarded from the model of the long-tailed tit. This supports the hypothesis that data on forest management, although coarse grained, are useful to improve habitat models for structure-sensitive species, whose abundance is strongly affected by silvicultural practices. The results should be taken into account by forest managers, considering that Europe is still losing ecologically high-quality forests, although the overall forested area has increased in the last decades.

Conservation consequences of rarity: lessons from Juniperus blancoi phylogeography

The phylogeographic study of a rare species has relevant consequences to our understanding of its habitat evolution and for conservation. Juniperus blancoi MartÃ­nez is an endangered rare conifer with three recognized varieties, which has a wide yet restricted distribution. In this study the trnC-trnF cpDNA region was used to assess population genetics parameters and to perform phylogeographic analyses using the eight known populations of the species. The phylogeographic structure indicates a series of expansion, fragmentation and isolation processes. The Ne = 3.3x106 males and a tmrca= 3.5 MYA suggest that there existed bigger populations that were drastically reduced and fragmented. This resulted in high haplotypic diversity (h = 0.86266), geographic structure (5 SHAVOA groups) and high differentiation values (FST = 0.79469 and FST > 0.25 in most of the pairwise comparisons). We conclude that rarity can be a natural condition characterized by historically large effective population sizes, and as a consequence high genetic diversity and differentiation levels. Fragmented and isolated populations are more inclined to differentiation and speciation processes, thus each one has high evolutionary potential, which makes its conservation more challenging. Also, we state that the geographic distribution of species like this should be more closely related to historical processes, so its presence must be considered as a factor increasing the biological relevance of a region.

A successful methodology to establish Payment for Environmental Services in a tropical rainforest area: a case study in the Selva Lacandona

Conservation of the rainforest remnants in the southern part of Selva Lacandona region (MarquÃ­os de Comillas), has been furthered by a payment for environmental services (PES) program issued by the government. A proper method was needed for the acceptance of the program by the communities and for it to have good results. More than 30% of the original ecosystem in the study area has been lost due to land use change, with most of it happening between 2000 and 2007. Since 2007, the PES program has helped ejidos to avoid deforestation. This has been achieved by designing and applying a method according to the ecosystem, land tenure and geographic information available. The method consists on: explaining the program in the ejido assembly and registering interested people; finding the geographic information available for the site; field assessment of the area; geopositioning it and evaluating its vegetation and conservation status; integrating the results in a GIS; discussing and verifying the results with the landholders in a participatory process; drafting a technical report that presents the results and includes resource management practices for the area's conservation. The use of this method has benefited 369 families and is protecting 9921 Ha, which is the 27% of these ejidos. This method was essential to the success of the PES program in the region and triggered local management and long-term conservation programs.

Forest vegetation remnant in Mato Grosso state in Brazilian Amazonia - measuring the impact of landcover fragmentation

For several years conversion of native vegetation into pasture and cropland was conducted at high rate in the Mato Grosso state in the Brazilian Amazonia. More recently, due to several reasons the deforestation rate has been reduced in that state, however one of most important effects of deforestation remain, which is the landscape fragmentation. Currently, there is 314,504 km² natural forest vegetation left in the Mato Grosso state, compounding a diverse landscape structure, from a continuous natural forest to mosaic of forest patches surrounded by pasture/cropland. In order to evaluate the effect of land fragmentation, we applied Landcover Fragmentation tool to measure the level of impact due to natural vegetation conversion from 1997 to 2007 in the Mato Grosso state. The result shows that 75,964 km² of natural forest were converted during 1997 to 2007, while the landscape fragmentation analysis revealed that only 258,265 km² corresponds to a core area of vegetation remnant, which is about 82% of current natural forest left. Based on this preliminary result, there is evidence that the real impact of landscape fragmentation is greater than the total area of vegetation remnant mapped in the Mato Grosso state.
Association Mapping of Genetic Risk Factors for Chronic Wasting Disease in Wild Deer

Chronic wasting disease (CWD) is a fatal prion disease of North American cervids, affecting elk, deer, and moose. CWD is the only prion disease known to infect free-ranging animals, and its management in the wild presents great challenges. Identification of genetic risk factors would increase our understanding of prion pathobiology and potentially lead to CWD mitigation. Our study aims to assess the feasibility of identifying novel genetic risk factors for CWD using a population genetic approach called association mapping. We used the bovine microsatellite map as a reference and developed a marker panel for three predicted deer linkage groups containing several candidate genes. Amplification rate in Wisconsin white-tailed deer (Odocoileus virginianus) was relatively inefficient (31.62%), and a low level of linkage disequilibrium (<1-2cM predicted distance) was found in the population sample (N=184), indicating that current marker density is insufficient for chromosome-wide coverage. Currently two matched case-control samples of Wisconsin white-tailed deer and Saskatchewan mule deer (Odocoileus hemionus) are being genotyped for association analysis. Our results illuminate the challenges of using comparative, microsatellite-based association mapping in wild species. At present, it may be more effective to target candidate genes or small genomic regions in association studies of wild populations until more substantial genomic resources become available.

Cumulative human impacts on regional scale boreal vascular plant biodiversity and community structure

In northern Alberta, expansion of energy sector, forestry, agriculture, and urban land uses are rapidly altering the boreal ecoregion at an unprecedented scale and intensity. How are ecological communities responding to these landscape changes? We conducted large scale (1 ha) timed field surveys of vascular plant occupancy and abundance throughout Alberta’s boreal ecoregion (380 000 km²). Human impacts were investigated at three scales (1 ha, 18 km², 400 km²) on a continuum of 0 - 100% land alteration. We analyzed species diversity (Hs), turnover (Pt), occupancy-rank relationships, species-abundance distributions, species-area relationships, and community specialization in concert to assess community structure. At intermediate disturbances, diversity was higher than in intact landscapes, but specialists were rarer and the community was dominated by fewer species. At heavy disturbances, communities were more homogeneous, harboured fewer species with more varied abundances, occupied by more common and generalist species while specialists and rare species were rarer. These differences suggest a broad, fundamental shift in community organization with anthropogenic disturbance concealed by richness alone. The scales at which disturbance influenced biodiversity revealed the mechanisms behind community change: extensive regional scale disturbance altered local diversity patterns by increasing isolation, while extensive local disturbance altered diversity by environmental filtering.

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Indigenous Perception of Environmental Impact of Domestic Activities in The Amazonia

The University of MÃ¡laga has been working in concurrence with different Venezuelan indigenous communities in the Amazonas State since 2001 in order to know which their main problems concerning biodiversity conservation are. In June 2009 we started another research line with them, i.e., how they (mainly females) perceive the impacts that different daily activities could have on the environment. We visited six indigenous communities and asked them to work in partnership with us. We obtained a positive answer, so they were questioned about the state of affairs of: i) the energy they use, ii) the waste they produce, iii) their hygiene habits, and iv) the sanitation systems they have. As an example, all the communities obtained electricity through gasoil plants which operate some hours a day. A majority (83.3%) of them thought the gasoil plant does not produce any problem for people or the environment. However, when they were asked to classify the above mentioned activities in relation to the impacts they produce, 50% of the communities identified gasoil spill as the principal problem. The second environmental problem was considered to be the rubbish they generate, followed by faeces deposition, and the soap they use to wash in the river. We will present in detail their perceptions for the different activities. In our next visit, we aim to show them the conclusions reached by the neighbouring communities, as well as some eco-friendly alternatives to the identified problems.
SY60 McCarney, G.R.; Armstrong, G.*; Adamowicz, W.L.; University of Alberta; glen.armstrong@ualberta.ca

Joint Production of Timber, Carbon, and Wildlife Habitat in the Canadian Boreal Plains
This study investigates the relationships and trade-offs between forest carbon management, sustained timber yield, and the production of wildlife habitat in order to provide a more complete picture of the costs and challenges faced by forest managers for a particular case study in Canadian’s boreal mixedwood region. The work presented is an extension of previous efforts by Armstrong et al. (2003), who model the joint production of timber supply and wildlife habitat using a natural disturbance model approach to ecosystem management. The primary contribution of the present study is the detailed incorporation of a carbon budget model into the framework developed by Armstrong et al. (2003). Using the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3), dynamics specific to separate biomass and dead organic matter carbon pools are represented for individual forest cover types. Results indicate the potential for cost thresholds in the joint production of timber supply and carbon sequestration. These thresholds are linked to switch points in the decision types. Results indicate the potential for cost thresholds in the joint production of timber supply and carbon sequestration. These thresholds are linked to switch points in the decision types.

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Policy Approaches to Connectivity Requirements in Marine and Coastal Systems
The oceans continue to provide far superior connectivity of protected resources than terrestrial systems, but the lack of roads, other infrastructure and property boundaries require broad policy interventions across large seascapes of even oceans between critical life stages or habitat of marine wildlife. A number of new policy tools are emerging to conserve marine biodiversity and their supporting ecosystems both in the domestic and international context. In developed countries, the increasing privatization of fishery resources through ‘catch shares’ and a significant effort to plan for future ocean development via “Marine Spatial Planning” are providing both obstacles and useful mechanisms for adaptation of both marine wildlife and human use of marine resources. World-wide, large scale efforts to increase networks of Marine Protected Areas (MPAs) and larger “Seascape” scale conservation in open-access systems are challenged by limited scientific understanding, such complex larval transport mechanisms, but are increasingly considering connectivity needs. The experience of the Wildlife Conservation Society’s efforts to conserve marine biodiversity in several different eco-regions will be presented to explore policy solutions across both socio-economic and environmental gradients. Vertical connectivity across land and sea in the Fijiian islands, resilient networks of protected coral reefs in Madagascar, consideration of the needs of highly migratory wildlife in large ocean systems of the Southwest Atlantic, and the opportunities of domestic Marine Spatial Planning of the US Mid-Atlantic will all be considered for their various policy approaches to addressing connectivity requirements in the Marine Environment.

P1.144 McCreless, E*; Visconti, P; Carwardine, J; Smith, RJ; University of California, Santa Cruz, James Cook University, CSIRO Sustainable Ecosystems, DICE, University of Kent; mccreless@biology.ucsc.edu

Cheap and nasty? Global conservation prioritisation schemes based on cost data must consider governance and human rights
The financial cost of different conservation projects varies widely and it is vital to consider costs when prioritising projects. Recent work has modelled protected area management costs for a large number of countries, and these data have been used to identify where conservation funds would be best spent to maximise the return on investment. However, low management costs in some countries may correlate with other factors that influence conservation effectiveness and broader impacts. We found that membership of conservation NGOs tends to be lower in countries with low management costs, indicating a lack of civil society involvement. Therefore, conservation projects in these countries are likely driven by outside organisations and implemented by state agencies. This can have perverse outcomes in countries with poor governance or human rights records, which we found to be correlated with management cost at the country level. Poor governance and corruption can increase the financial cost and risk of failure for conservation projects, and disenfranchised citizens in some countries are less likely to be involved in conservation and thus less likely to support it. Our results suggest that decision-makers should take these socio-political factors into consideration when choosing where to work. It is important to account for the side effects of conservation policies on human well being, and to estimate the extra costs involved in ensuring that projects have strong local support.

SP11.7 McCue, AJ*; Wiersma, YF; McGrath, MJ; Memorial University of Newfoundland, NL Dept. of Environment and Conservation; ajmccue@mun.ca

Seasonal Habitat Associations of Recently Colonized Coyotes in the Maritime Barrens Ecoregion of Newfoundland
Coyotes (Canis latrans) recently colonized the island of Newfoundland. Their range expansion has generated public calls for predator control, since it is believed (not verified) that the concurrent decline of the largest remaining woodland caribou (Rangifer tarandus) population in Canada is due to the new predator. Here, we determine habitat associations of coyotes in a novel environment, the Maritime Barrens Ecoregion (MBE). The MBE is characterized by dwarf-shrub heath, sparsely populated with high density patches of stunted conifers. The region is interspersed with bogs, fens and ponds associated with high precipitation and high fog frequency. The depauperate mammalian fauna of the region results in high variability of available food biomass for coyotes. Migratory woodland caribou represent a seasonally abundant food source throughout the winter. Seventeen (9M, 8F) coyotes were monitored with GPS collars collecting data points every 4 hours for periods ranging from 6 months to 2 years. Location acquisition rates ranged from 70-97%. We delineated seasons for modelling based on abundant (winter) and limited (summer) woodland caribou. We used both statistical modelling and machine learning to develop individual-based models of habitat association to better assess coyote relationships to a range of environment and habitat attributes. The models can be used to assess spatial interactions between caribou and coyotes to better assess the potential impacts of the new predator.
One of the most important issues in conservation biology is human influence on habitat-selection patterns. This affects microevolutionary processes (evolution at fine spatial and temporal scales) and can be associated with the factors that cause extirpation, including habitat degradation and over-harvesting. Our project evaluates human effects on microevolution through changes in habitat selection, using elk (Cervus elaphus) as a model species. Based on previous findings, we predicted that (a) animals born in a certain habitat remain or disperse to similar habitats, supporting natal-habitat based dispersal and that (b) humans influence habitat selection. Therefore, human activity could lead to reproductive isolation of demes. We are implementing a combined genetics and spatial analysis of elk and their habitat use in southwest Alberta, Canada in a region heavily impacted by human use through industry and recreation. We examined relatedness and fine-scale genetic structure using 30 microsatellite loci on 140 GPS-collared elk to test how relatedness and genetic structure are correlated with preference for similar habitats. We combined this with extensive GIS and human-activity data to show how natural and anthropogenic factors drive microevolution.
The application of an ecosystem model to the planning and assessment of a fisheries restoration project in a freshwater system.

In the last 100 years Lac La Biche, a 22,000 ha lake located in northeastern Alberta, Canada, has changed from a system with walleye (Sander vitreus) as the top fish-eating predator to one where a bird, the Double-Crested Cormorant (Phalacrocorax auritus), is at the top of the aquatic food chain. In 2005, the fisheries management branch of the provincial government initiated a fisheries restoration program with the goal of restoring walleye as the top predator in the system. A mass-balance modeling system called Ecopath with Ecosim (EwE) was used to examine the influence of foraging by Double-crested Cormorants on the local fish community. This model is being used to examine the different structuring roles of bird versus fish predators in aquatic food webs, and the potential for different management activities (i.e. bird control and walleye stocking) to restore piscivore dominance within the system.

Potential Impacts of Shipping Noise on Mother-Calf Acoustic Contact in Belugas (Delphinapterus leucas)

In coming decades, decreases in annual ice cover in the Arctic resulting from climate change will likely increase the exposure of marine mammals such as belugas- highly vocal whales that winter in the vicinity of ice and calf near ice-free estuaries in late spring -to noise from fishing, shipping and other vessels. Here we investigated the potential for this noise to acoustically mask calls used by beluga mothers and offspring to maintain or regain contact. We compared the frequency distributions of calls produced by two mother-calf pairs over 10-12 months in a captive setting with sounds from natural and anthropogenic sources. Mothers used characteristic contact calls (Vergara and Barrett-Lennard 2008 Aquatic Mammals 34:123) with typical peak energy frequencies from 6-15 kHz from the time of birth. The peak energies of most contact calls were well above most of the energy of noise produced by shipping, sea ice, wind, and precipitation. In contrast, the vocalizations of newborn calves had lower peak frequencies (2-3.4 kHz) and narrower energy distributions with significant potential for masking by shipping noise and ice. By 4-5 months, a time when calves in the wild would begin to encounter ice, their peak frequencies increased to 5 kHz. We conclude that shipping noise is most likely to affect the ability of mothers to hear calves during the first few months of life, and may increase the risk of mother-calf separation.

Status and conservation of grizzly bears in British Columbia

Shortly following the westward movement of European trappers, gold miners, and settlers, grizzly bear abundance and distribution contract; plummeting in the lower 48 states and the prairies Provinces. Perhaps due to a combination of more northern latitudes, much more rugged topography, and often higher precipitation, grizzly bears remain across more than 80% of their historic range in British Columbia (BC). Because grizzly bears are difficult to census in heavily forested areas, we in BC developed the DNA based mark-recapture methods in 1995 and have used it in 22 areas in the province to estimate grizzly bear densities. Across most of BC, grizzly bear populations are healthy and are managed as a big-game animal and hunted mostly in the spring but also the fall in some areas using a lottery system for a limited number of permits for residents and a quota for guides. The number of permits varies to attain the acceptable annual harvest that is averaged over a 5 year allocation period. Females with attendant offspring are protected and where bears are only hunted in the spring, this regulation essentially protects the most productive females from hunting. In some southern areas, however, the populations are small and fragmented. The level of fragmentation has been highlighted in the southeastern corner of the province but populations in the southwestern corner appear even smaller and more fragmented. In the southwest, populations are not only small, but have been isolated for many decades and have the lowest levels of heterozygosity of any grizzly populations except on Kodiak Island. Until recently, grizzly bears in this corner of BC have largely been ignored by scientists and they continue to have a low profile by conservation groups.
Matrix management and large mammal conservation in British Columbia.

The large mammal predator prey system (LMPPS) in British Columbia involves 6 species of predators and 9 ungulates. Although the movements of individual animals reflect the large spatial scales that the system functions across, this is dwarfed by the scale covered by their shifting distribution’s over temporal scales relevant to conservation. Over the past few decades, people have suggested that BC adopt a “core and linkage” conservation model for the LMPPS. This expanded into a broader strategy called the Y2Y that has been expanding in size over time. These conservation strategies, however, are more restrictive than where the LMPPS currently function. The management strategy in BC is to not only maintain the LMPPS across this much larger area but recover it where needed. Given the historic shifts in members of the LMPPS due to climate change in the 1800’s and early 1900’s, more shifting due to climate change is expected. Limiting conservation efforts to relatively restricted areas is unwise compared to maintaining its current distribution or expanding it. Clearly, managing the “matrix” and the few “fractures” in the distribution for some species will continue to be a significant challenge.


Terrestrial ecosystems in NYC are in the midst of a significant restoration effort which includes the addition of two thousand acres of forest to the city with the goal of increasing canopy cover, reducing invasive species, and mitigating climate change effects while increasing other ecological functions and services. This effort constitutes a large natural experiment in the most densely populated urban center in the nation. The NYC Urban Forest Restoration Study was established in 2008 in order to comprehensively understand the effect of MillionTreesNYC forest restoration efforts on urban ecosystem structure and function. This is a long-term study that focuses on the abiotic and biotic drivers that may impact vegetation structure, biodiversity, invasive species dynamics, soil nutrients, and carbon sequestration and storage in urban forests. This research links multiple plot-scale investigations across all five boroughs of New York City together to create a regional scale analysis of the changing urban forest ecosystem. Analyses make use of annually sampled vegetation and soil data, and documentation of forest management activity. Study design and preliminary soil heterogeneity, plant diversity, and invasive species results of the first full study year will be presented.

Monitoring trends in vertebrate abundance from the global to the regional scale

Biodiversity monitoring is an essential component of conservation practice with uses ranging from assessing the global status of biodiversity to addressing local management effectiveness. Tracking trends in vertebrate population abundance can be a straightforward and cost-effective approach to monitoring biodiversity. Such data can be fed into an indicator of biodiversity such as the Living Planet Index (a global indicator of vertebrate population trends) which has been adopted by the Convention on Biological Diversity. This is used to measure progress towards international biodiversity targets such as the target to reduce the rate of biodiversity loss by 2010, and is considered a robust measure at a global scale. At smaller scales, this method could be applied to produce indicators at the national level, for regions of interest or specific habitat types. To investigate this, the average trends of 2500 vertebrate species populations were modelled at different spatial scales from the global to regional level to elicit how patterns of abundance differ and to assess the utility of using such an approach. Results from averaging the population trends globally show that on average, vertebrate abundance has been in decline since 1970. When applying the method at smaller scales, robust results can be produced but in some cases caveats such as data availability and representation also need to be considered. One strategy to pursue in the future would be to scale up from representative monitoring schemes at a local level to give accurate indicators of vertebrate trends all the way up to the global level.

Managing Arctic Biodiversity in a Changing World - A Model for Proactive Adaptive Management in Canada's Arctic National Parks

This presentation uses work completed under the CiCAT Tundra IPY Project to demonstrate the development, key components (inventory, monitoring, research, and management modelling), and applications of a management knowledge system aimed at providing park managers with critical information on park ecological change, intended to facilitate adaptation to ongoing and future ecological change. It is now well documented that arctic landscapes have been changing and are continuing to change more rapidly than any other terrestrial landscapes on the planet. Canada’s arctic national parks have been established to maintain or restore the ecological integrity of 10 protected areas over about 160,000 km2 of the Canadian arctic, and ongoing ecological change presents a complex challenge for park managers and scientists. The presentation focuses principally on two key elements of proactive adaptive management systems - the development of a cost effective method to develop dynamic ecological inventories in large remote parks, and the establishment of effective park monitoring programs.
P1.36 MD. ABDULLAH ABRAHAM HOSSAIN*, Mazlin Bin Mokhtar; Mohd Ekhwan Hj. Toriman; Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia; nobu_fd@yahoo.com
Institutions and Organizations for Conservation: A Case of Langat River Basin, Malaysia
According to contemporary policy paradigm, a river basin is an acquiescent interface for conservation interventions under integrated approach. But challenges of complexities and uncertainties in river basin management faced by institutions and organizations are causing mismatch between policy intentions and policy outcomes. Therefore, using institutional analysis and development (IAD) framework, we explored challenges in terms of learning environment and policy outcomes in terms of conservation in Langat River Basin. This analysis revealed that absence of learning environment for individual stakeholders is the major challenge to achieve policy objective. However, polycentric institutional arrangements partners.

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NOAA Fisheries Species of Concern Proactive Conservation Program
Species of Concern are those species about which NOAA’s National Marine Fisheries Service has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA). ‘Species of concern’ status does not carry any procedural or substantive protections under the ESA. There are currently 42 Species of Concern. The Species of Concern Program: 1) Identifies species potentially at risk; 2) Identifies data deficiencies and uncertainties in species’ status and threats; 3) Increases public awareness about those species; 4) Stimulates cooperative research efforts to obtain the information necessary to evaluate species status and threats; and, 5) Fosters voluntary efforts to conserve the species before listing becomes warranted. Funding for projects is available through our Proactive Species Conservation Grant Program. We wish to draw proactive attention and conservation action to these species through research, conservation, capacity building, and education and outreach partnerships.

P2.206 Meer van der, E*; Fritz, H; Painted Dog Conservation project Zimbabwe, Lyon University, CNRS, France; ester@painteddog.org
Why African wild dogs (Lycaon pictus) move outside the safety of a protected area; testing the ecological trap hypothesis
African wild dogs in Hwange National Park, Zimbabwe, show a tendency to make maladaptive habitat choices by actively establishing new home ranges outside the national park. Leaving the safety of the protected area inevitably means this endangered species regularly becomes the victim of snares and cars. When an animal shows a preferential choice for a habitat in which its reproductive success or adult survival is less than in other available habitat it is said to have been caught in an ecological trap. Ecological traps can lead to rapid extinction of a species especially when population sizes are low. African wild dogs coexist with other carnivores such as lions and spotted hyenas. Lions and/or hyenas can affect wild dogs indirectly by excluding them from preferred habitat or directly by killing and through kleptoparasitism. In order to test whether interspecific competition with lions and hyenas could led the African wild dogs to make a maladaptive habitat choice a call up experiment with dog sounds was designed. Preliminary results show that the potential risk of kleptoparasitism could indeed create an ecological trap for the African wild dogs in Hwange National Park.

P1.41 Mendel, J*; HalaÅ¡ ka, K; VeteÅ¡nÃ−k, L; PapouÅ¡ek, I; BartoÅ¡ ovÅ¡, E; Å anda, R; KonÅ¡ovÅ¡, M; UrbÅ¡kovÅ¡, S; Institute of Vertebrate Biology, v.v.i., National Museum; jmendel@seznam.cz
Molecular biodiversity inventory of the ichthyofauna in the Czech Republic
Our current knowledge of the genetic diversity in fish species from the Czech Republic is still insufficient. This project is based on international collaboration and has contributed significantly to the recognition and description of species diversity in all Czech fishes by using a comprehensive approach (literary data search, morphology, DNA barcoding, nDNA analysis). Indigenous and non-indigenous species of fish and lampreys living in the natural waters of the Czech Republic are the subject of recent inventory-taking and subsequent cataloguing. The acquired results are used for intercontinental comparison using DNA barcode within the BoLD platform. The study has contributed to the updating of information for Natura 2000 monitoring and has provided information and recommendations to the Agency for Nature Conservation and Landscape Protection of the Czech Republic. New designs for species collection of type specimens and the development of detailed vouchers are an important contribution to national museums. This study was carried out within the framework of research project no. M200930901 supported by the Program of internal support for international collaborative projects of the Academy of Sciences of CR.
Green Turtles (Chelonia mydas) of the Fernando de Noronha and Atol das Rocos World Heritage Sites: Insights from mitochondrial DNA sequencing

The protected Brazilian islands Rocos Atoll and Fernando de Noronha are important feeding grounds for green turtles. Although turtles at these sites are protected, they may face threats when migrating, underscoring the importance of understanding population connections. To investigate their population distribution, we sequenced a segment of the mitochondrial control region (162 bp; n = 119 for Fernando Noronha, n = 81 for Rocos Atoll). At Rocos Atoll, seven mtDNA haplotypes were revealed, and average haplotype diversity (h) was 0.609 + 0.037, while nucleotide diversity (I) was 0.010 + 0.005. In Fernando de Noronha eleven mtDNA haplotypes were found, and average haplotype diversity (h) was 0.641 + 0.027, while nucleotide diversity (I) was 0.008 + 0.005. At both sites the most common haplotypes were CMA-08 and CMA-05. To identify the natal origins of these foraging turtles, we used two kinds of "many-to-many" mixed stock analyses, either including or disregarding nesting population sizes. Results of these analyses varied depending on whether all feeding grounds from the Atlantic were included. For comparison, we performed traditional "one-to-many" MSAs, with results more consistent with expectations. The study will provide data necessary for conservation prioritization and management of endangered green turtles foraging at these World Heritage Sites.
Clayton's copper (Lycaena dorcas claytoni) is a wetland butterfly found almost exclusively within the state of Maine, where it was listed as state-endangered in 1997. It occurs only in rare circumneutral fen habitat, in conjunction with its host plant, shrubby cinquefoil (Dasiphora fruticosa). Recent population surveys estimated population sizes of less than 3000 butterflies at 6 of 8 extant sites, supporting the need for continued protection of this rare butterfly. Microsatellite markers have been used to assay the diversity within and among populations of Clayton's copper in Maine. Specimens for genetic analyses were collected from each of 7 sites in Maine during flight seasons in 2008 and 2009. Patterns of genetic diversity are compared with respect to spatial trends within sites and also across generations. Dispersal rates among sites have been estimated from genetic data to elucidate the metapopulation structure, and these data are being linked to analysis of a gene that affects the propensity of individuals to disperse or remain sedentary. A landscape genetic approach is being used to determine the effect of geographic features on the partitioning of genetic diversity among populations. Results of these experiments will help to understand population dynamics and genetic diversity of Clayton's copper - information that is crucial for effective conservation planning for the species.

Metapopulation structure and genetic diversity of the endangered Clayton’s copper butterfly.

Clayton’s copper (Lycaena dorcas claytoni) is a wetland butterfly found almost exclusively within the state of Maine, where it was listed as state-endangered in 1997. It occurs only in rare circumneutral fen habitat, in conjunction with its host plant, shrubby cinquefoil (Dasiphora fruticosa). Recent population surveys estimated population sizes of less than 3000 butterflies at 6 of 8 extant sites, supporting the need for continued protection of this rare butterfly. Microsatellite markers have been used to assay the diversity within and among populations of Clayton’s copper in Maine. Specimens for genetic analyses were collected from each of 7 sites in Maine during flight seasons in 2008 and 2009. Patterns of genetic diversity are compared with respect to spatial trends within sites and also across generations. Dispersal rates among sites have been estimated from genetic data to elucidate the metapopulation structure, and these data are being linked to analysis of a gene that affects the propensity of individuals to disperse or remain sedentary. A landscape genetic approach is being used to determine the effect of geographic features on the partitioning of genetic diversity among populations. Results of these experiments will help to understand population dynamics and genetic diversity of Clayton’s copper - information that is crucial for effective conservation planning for the species.

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BeadChip can be more efficient and cost effective than other SNP discovery methods. SNP discovery in wild sheep through application of the OvineSNP50 BeadChip
Conservation genomics, where a multitude of genetic markers distributed throughout a genome can be used to study adaptive variation, holds the prospect of dramatically informing and enhancing current management strategies that rely on demographies and population structure estimates inferred from a few neutral markers. Single nucleotide polymorphisms (SNPs) are fast becoming the genetic marker of choice for such endeavors as they provide several advantages over other markers including: abundance in the genome, distribution in both expressed and intronic sequences, and ease of genotyping through automation. However, the development of genomic resources for wild species is still in its infancy. Cross-species utilization of technologies developed for their domestic counterparts has the potential to unlock the genomes of species that currently lack genomic resources. Here we apply the OvineSNP50 BeadChip, developed for domestic sheep, to two related wild ungulate species: the bighorn sheep (Ovis canadensis) and the thinhorn sheep (Ovis dalli). Over 95% of the domestic sheep markers were successfully amplified in bighorn sheep while over 90% were amplified in thinhorn sheep. Pooling both species we found 868 SNPs distributed on all autosomes and the X-chromosome. This panel of SNPs was able to discriminate between the two species, assign individuals to their population of origin, and detect substructure within a population corresponding to known family groups. In taxa where no genomic resources are available typing individuals on a platform such as the OvineSNP50 BeadChip can be more efficient and cost effective than other SNP discovery methods.

Abundance and ecological significance of structure-forming taxa in the Bering Sea: implications for conservation
Marine benthic ecosystems harbor diverse communities of organisms that may depend on large sessile taxa like corals for habitat structure. Benthic trawl fisheries may severely impact this habitat, potentially adversely affecting populations of commercially valuable species. In the Bering Sea, trawl-based fisheries operate in a region rich with cold-water coral fauna that has been sparsely explored. Here we report results from video surveys of benthic communities in two virtually unexplored canyons, Zhembchug and Pribilof. Abundance of biogenic structure-forming taxa (corals) and associations between commercially valuable species, e.g. Pacific ocean perch (Sebastes alutus) and corals are evaluated.
Park's currently depleted wildlife populations. The Hindu Kush Mountains of Central Afghanistan contain some of Afghanistan's most intact ecosystems. Since 2006, the Wildlife Conservation Society (WCS) has been working in the Hindu Kush assisting the Islamic Republic of Afghanistan in conservation planning, wildlife and range surveys, environmental legislation and community involvement resulting in Afghanistan establishing Band-e-Amir as the country's first national Park in May 2009. Reconnaissance surveys done in the area larger area in and around Band-e-Amir suggests the 7000 km² high altitude plateau to the north of the National Park is inhabited only seasonally by graziers and continues to harbour significant populations of urial (Ovis orientalis) and Siberian ibex (Capra siberica). This unanticipated pocket of rich biodiversity is proposed for a diverse, community-based, landscape scale conservation program using the established National Park as the administrative focus and well known example of the locally new concept of protected area. Current plans, dependent on funding, entail assisting in developing and training Community Conservation Councils (CCCs) and hiring the community game guards from the 4 community clusters distributed geographically throughout the plateau. Based on advice from the CCCs, a spectrum of protection measures will be employed to protect natural values while enhancing the livelihoods of local people. Managing the entire plateau will act as a buffer zone and will provide a source for repopulating the National Park's currently depleted wildlife populations.

**P2.180** Mohammad Ayub Alavi; Wildlife Conservation Society, conservation specialist; ayubalavi83@yahoo.com

**The First Nation's National Park: an Anchor for Landscape Scale Conservation in Central Afghanistan**

The Hindu Kush Mountains of Central Afghanistan contain some of Afghanistan's most intact ecosystems. Since 2006, the Wildlife Conservation Society (WCS) has been working in the Hindu Kush assisting the Islamic Republic of Afghanistan in conservation planning, wildlife and range surveys, environmental legislation and community involvement resulting in Afghanistan establishing Band-e-Amir as the country's first national Park in May 2009. Reconnaissance surveys done in the area larger area in and around Band-e-Amir suggests the 7000 km² high altitude plateau to the north of the National Park is inhabited only seasonally by graziers and continues to harbour significant populations of urial (Ovis orientalis) and Siberian ibex (Capra siberica). This unanticipated pocket of rich biodiversity is proposed for a diverse, community-based, landscape scale conservation program using the established National Park as the administrative focus and well known example of the locally new concept of protected area. Current plans, dependent on funding, entail assisting in developing and training Community Conservation Councils (CCCs) and hiring the community game guards from the 4 community clusters distributed geographically throughout the plateau. Based on advice from the CCCs, a spectrum of protection measures will be employed to protect natural values while enhancing the livelihoods of local people. Managing the entire plateau will act as a buffer zone and will provide a source for repopulating the National Park's currently depleted wildlife populations.

**P1.77** Mollik, M.A.H. *, McField, R.; Hossain, A.B.M.A.; Hossain, M.F.; Sen, D.; Zahid. M.I.; Hassan, A.I.; Chowdhury, M.O.F.; Peoples Integrated Alliance, Bangladesh, SHACO-Health & Education Society, Bangladesh, State College of Health Sciences, Bangladesh, North South University, Bangladesh, Biogene Life Care, Bangladesh, Mohona Environment Development Society, Bangladesh; mollik_bge@live.com

**Status of Ethnobotanical Skills in Bangladesh: A Survey on Tippra Ethnic Group of Rema-Kelenga Wildlife Sanctuary**

Indigenous peoples are often considered potential allies in the conservation of biological diversity. Here we assess whether ethnobotanical skills of indigenous people contribute to a reduction in the clearance of Rema-Kelenga Wildlife Sanctuary. We measured ethnobotanical skills of male household heads and area of Rema-Kelenga Wildlife Sanctuary cleared for agriculture among 108 households of Tippra, one important ethnic group can be found living within the boundaries of the forest. We used multivariate regressions to estimate the relation between ethnobotanical skills and area of Rema-Kelenga Wildlife Sanctuary cleared while controlling for schooling, health status, number of plots cleared, adults in household, and village of residency. We found that when the ethnobotanical skills of the male household head were doubled, the amount of Rema-Kelenga Wildlife Sanctuary cleared per household was reduced by 024%. The association was stronger when the area of old-growth forest cleared was used as the dependent variable than when the area cleared from fallow forest was used as the dependent variable. People who use the forest for subsistence might place a higher value on standing forest than people who do not use it, and thus they may be more reluctant to cut down the forest.

**24.2 MOLLOY, PP*; Anticamara, JA; Vincent, ACJ; Project Sealhorse, UBC Fisheries Centre, Institute for Resources, Environment and Sustainability, University of British Columbia; philip.p.molloy@gmail.com**

**Frugal conservation: what does it take to detect changes in fish populations?**

Many conservation projects have to develop practical and feasible ways to detect changes in populations. We compare the ecological information obtained using intensive monitoring of fish populations with that which would be procured from less exhaustive sampling. At each of four sites in the Philippines, we surveyed all fish in eight monthly transects for up to three years. We first tested for changes in fish density, size and species richness; we then compared these results obtained by using all data to those obtained in simulated protocols that restricted effort in ways that were relevant to marine conservation practitioners. Bimonthly surveys retained high power to detect overall trends. Similarly, statistical power remained high when at least four monthly transects were carried out. However, power and accuracy fell and if fewer transects or surveys were considered. Most trends were also detected when all possible easily-identified species or at least 75% of fished species were considered. Indeed, power to detect overall trends remained high even when only fished species were considered in four transects monthly. We conclude that sampling protocols can be powerfully streamlined using strategic and inventive approaches and that the choice of protocol will depend on the objective of the research or management.
Monitoring is an investment many governmental and non-governmental organizations make while managing natural resources. Monitoring can demonstrate the success of management interventions, or guide a change in course when desired outcomes are not achieved. However, monitoring is often the last component in a project to receive funding and among the first to get eliminated when budgets tighten. Historically, The Nature Conservancy focused most monitoring efforts on population trends of species of concern on nature preserves. Today, our monitoring questions have evolved to focus on assessing under what conditions and to what extent our conservation management interventions accomplish desired outcomes and why. Investment in this monitoring must be balanced against what else might be done with these resources. We provide guiding principles for making these investment decisions based on two key factors: a) potential for risk to an organization (ecological, reputational, legal, and the risk of uncertainty) and b) leverage (potential for multiplying the influence of a demonstration site or approach). We use a sampling of Conservancy projects to illustrate the interplay between these factors with monitoring costs ranging from minimal (<US$500/year) to significant (>US$100,000/year). We also provide a simple framework to help managers balance the level of scientific rigor (inference) with the need for rapid and inexpensive results to inform management decisions.

Improving Conservation Practice by Investing in Monitoring Strategy Effectiveness
Montambault, JR; Groves, CR*; The Nature Conservancy; jmontambault@tnc.org

The use of science in the Canadian Species at Risk Act
Mooers, A; Whitton, J*; Simon Fraser University, University of British Columbia; amoers@sfu.ca

The Eastern Canadian gill-net removal experiment: Tracking the population responses of seabirds to the ground-fishery closure
Montevecchi WA*; Bureen AD; Burke CM; Fifield DA; Hedd A; McFarlane-Tranquila L; Regular PM; Wilson EE; Memorial University of Newfoundland; mont@mun.ca

Subtropical montane beetle assemblages in transformed anthropogenic landscapes
Montes de Oca, Enrique*; Spence, John R.; Ball, George E.; Instituto de Ecologia A.C., University of Alberta; enrique.montesdeoca@inecol.edu.mx

I will outline how science is currently used to inform decision-making in Canada's Species at Risk Act (SARA, 2002). The act was designed to separate the independent science necessary when publically proposing wildlife species for legal protection from the political decision whether to legally list and so protect those species. Independent science input at this listing stage and subsequently (particularly the identification and protection of critical habitat, decisions on feasibility of recovery, attendant population and distribution objectives, even the general definitions of survival and recovery) require close scrutiny in this young piece of legislation. Relatively minor adjustments to the legislation and attendant policy could help better identify the necessary tradeoffs required when managing imperiled natural heritage.
Waiting for the Ark: the biodiversity crisis in British Columbia, Canada and the need for a Species and Ecosystem Protection Act

British Columbia (BC) is atypically rich in biodiversity for a northern temperate region. It is home to 76 per cent of Canada's bird species, 70 per cent of its freshwater fish species and 60 per cent of its evergreen trees. Well over 1600 known taxa are now ranked at risk by the province's Conservation Data Center and levels of endangerment are extremely high in some wildlife groups, such as reptiles and amphibians. However, the existing fragmented policy landscape for BC's species at risk provides little legal mandate for protection and is ineffective to actually protect and recover wildlife at risk or their habitat. For example, we found that eighty-nine per cent of known threatened and endangered species in British Columbia are not protected under BC's laws or policies for species at risk (e.g., the IWMS policy of the Forest Range and Practices Act and the Wildlife Act) or under federal endangered species legislation (Species at Risk Act). Furthermore, existing provincial laws do not require habitat protection and do not require recovery planning and action. Given the magnitude of the biodiversity crisis in BC and the inadequacy of the current policy response, we argue in favor of new legislation to protect the province's species and ecosystem at risk (a Species and Ecosystem Protection Act; SEPA). We outline the principles of an effective SEPA, based on a review of other provincial and international species protection laws and best practices.

Landscape Effects on Gene Flow and Connectivity of a Widespread Amphibian at the Northern Range Margin

Natural and anthropogenic landscape features can have profound effects on gene flow and connectivity, ultimately affecting population dynamics and the evolutionary trajectory of a species. Amphibians are particularly susceptible to changes in the landscape due to their sensitivity to microclimatic regimes and their generally low dispersal capabilities. Boreal toads are widespread across western North America, yet local extinctions are occurring. We examined the effects of the landscape on gene flow and connectivity of boreal toad populations in Southeast Alaska, which encompass an impressive array of landscape features and are at the extreme northern edge of their geographic range. Using GIS and circuit theory, we analyzed neutral genetic variation in relation to physiographic and microclimatic landscape features, and compared populations from pristine wilderness and urban areas to further investigate the influence of anthropogenic environmental changes. The landscape has dramatically shaped the genetic structure of all populations (wilderness and urban), with low connectivity even at short geographic distances and at low elevations. Alteration of climate regimes and landscape features in this region will affect amphibians in ways that differ from more southern latitudes. Our results will enable conservation planners to mitigate the effects of anthropogenic landscape changes in light of decreased connectivity of toad populations.

Using resource selection functions to map livestock depredations by wolves

The sharp interface between mountains and parries in southwest Alberta means wildlife habitats overlap prime cattle grazing lands. Consequently, a number of stakeholder groups are concerned over wolf (Canis lupus) depredation on livestock. Producers are compensated for confirmed losses to predators, but missing cattle remain a persistent problem. Such conflicts often result in the removal of these predators. A lack of information about wolf diets and activity in this multi-use landscape makes management decisions more difficult. To assess the impact of wolves on cattle we collared wolves with GPS radiocollars programmed on a 1-hr duty cycle and analyzed these data for clusters of activity. Year-round field visits of 698 cluster sites revealed 213 kill or scavenge sites. Wolf diets shifted dramatically from livestock during the grazing season to wild prey in the winter months, but cattle depredation remained a year-round problem. We used kill-site locations and spatial layers in a GIS framework to estimate resource selection functions (RSF) and maps of these RSFs highlighted areas of highest relative risk of wolf depredation. These "hotspot" maps represent an important management tool in narrowing the areas of focus for wolf-livestock mitigation efforts, especially in the grazing areas of the public forest reserve.

The social dimensions of conservation program design for privately-managed land

Biodiversity conservation programs are increasingly employed by governments and natural resource management agencies to encourage landholders (freeholders and leaseholders) to deliver environmental policy objectives on their property. However, failure of program designers to consider adequately the social dimension of landholders, such as their personal and financial circumstances, environmental attitudes, and land use aspirations, can limit participation rates and compromise policy outcomes. To examine how well conservation programs account for landholders' willingness and ability to participate in biodiversity conservation, interviews were conducted with 45 participants in three conservation programs in Queensland, Australia, which used different policy instruments (voluntary, direct-payment, and market-based) and were administered by different agencies (state and local government and non-government). The results revealed that: 1) the locally-based non-government program best responded to the social dimensions of participants; 2) the government programs did not offer landholders their preferred incentives (money and on-ground advice); and 3) the programs did not remove the barriers that landholders perceive to limit environmental sustainability on privately managed land. There is much scope for improvement of conservation programs designed for privately-managed land, specifically incorporation of landholders' social dimensions and removal of barriers to conservation.
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**Planning for action: Tackling the mismatch of scales between regional planning and local implementation in Fiji**

The mismatch of scale between regional conservation planning and local-scale implementation can prevent the translation of conservation plans into conservation actions. While systematic conservation plans might provide theoretically optimal solutions for meeting national goals, community-based approaches can be more effective at a local scale. This study aims to understand the relative roles and potentials for systematic conservation planning and community-based actions to achieve an effective and functional network of no-take areas (NTAs) in Fiji. We address three questions: (1) How well are current national conservation goals in Fiji being achieved through community-based conservation actions? (2) What is the potential for community-based conservation action to achieve national scale goals in the future? (3) Is there a role for regional-scale systematic conservation planning to complement local conservation action in achieving national goals in Fiji? We use time-series and geographic mapping of established NTAs and expert interviews to inform a model of the expansion of community-based NTAs. Our model allows us to examine the potential for community-based NTAs to meet national goals and to be scaled up with systematic conservation planning to form functional networks. Our study shows that conservation planning and local-scale community-based action can be complementary.

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**Can density-dependent habitat selection predict evolutionary adjustments to habitat change?**

The long-term success of conservation planning depends on its success at anticipating ecological and evolutionary adjustments to habitat change. Both types of adjustments emerge from underlying theories of density-dependent habitat selection. The densities of individuals living in alternative habitats represent current strategies of habitat selection. The existing strategies can be converted into the underlying adaptive landscape of habitat selection under different scenarios of habitat change. We tested these ideas on three species of small mammals living on a small Arctic island undergoing rapid climate-induced habitat change. The adaptive landscapes yield unique insights into each species’ habitat selection and predict evolutionary trajectories under habitat change. It is thus possible to use rather simple assessments of population density to model habitat selection and to inform the long-term success of conservation programs.

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**P1.194** Morris, J; Semmens, BX; Akins, L; Green, SJ; Cote, IM*; NOAA, Reef Environmental Education Foundation, Simon Fraser University; incote@sfu.ca

**The Lionfish Tissue Repository: unique record of an on-going marine invasion**

The invasion of the northwest Atlantic by Indo-Pacific lionfish (Pterois spp.) began in the mid-1980s off the coast of Florida, USA. By 2000, individuals had been sighted as far north as North Carolina and Bermuda. Since then, the range of the invader has steadily increased southward, now encompassing much of the Caribbean. This invasion by a predatory fish that is largely immune to predation is generating grave concerns about its impacts on native reef fish population and fisheries in the region. Key questions regarding lionfish dispersal and plausible control strategies remain unanswered. It is to address these questions that the Lionfish Tissue Repository (LTR) project has recently been launched. The LTR is a large, multi-national collaborative program intended to maintain tissue samples for research into the ecological and evolutionary processes driving the ongoing invasion of lionfish in the Caribbean and western Atlantic. The repository is jointly managed by NOAA (Beaufort Lab) and the Reef Environmental Education Foundation (REEF). There are currently more than 2,000 tissue samples from lionfish throughout the Caribbean and representing a decade-long series from the eastern coast of the US. As samples continue to accumulate, we expect that this tissue repository will yield a unique, detailed genetic history of a major invasion. Our intent is to carry out collaborative research that will help understand the invasion, identify mechanisms for mitigating its impacts, and prevent future marine invasions. The aim of this poster is to raise awareness of the existence of the LTR and to encourage scientists working in the Caribbean region to contribute to this important effort.

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**Monitoring Black-Tailed Prairie Dog Population Dynamics at Scotts Bluff National Monument, Nebraska: A 26-Year Record**

Black-tailed prairie dogs, Cynomys ludovicianus, are keystone grassland species, although they have been excluded from all but a small fraction of their native range in the Great Plains. We monitored a population of black-tailed prairie dogs at Scotts Bluff National Monument, Nebraska, for 28 years, from colonization in 1981 through 2009. Visual counts and mark-recapture techniques were employed to estimate population densities. Colony boundaries were mapped with a GPS by delineating clip lines and active burrows. Estimates of total population size of the main colony revealed four distinct periods of changing dynamics: (1) a linear increase, (2) a decline and prolonged depression, (3) an exponential increase, and (4) a period of high variability. Area occupied revealed similar, although less-defined trends, whereas densities fluctuated greatly (8-80 individuals/ha). Two new colonies were founded, although one disappeared, apparently due to illegal poisoning. Decreases in the main colony were correlated with predation by badgers, although sylvatic plague cannot be ruled out. Even after almost 30 years, this population remains relatively small. Attempts are underway to reintroduce prairie dogs to areas of their native range, and introductions or natural dispersal events have the potential to result in large, established colonies; incipient colonies, however, are susceptible to predators, disease, and illegal shooting/poisoning, and should be closely monitored.
any North American bird: the island scrub-jay (Aphelocoma insularis). Its global range is the smallest of any North American bird species—North America has over 50,000 islands and nearly 1000 bird species but only one insular species.

Multiple co-benefits of proactive management of North America’s lone insular bird species

North America has over 50,000 islands and nearly 1000 bird species but only one insular species—the island scrub-jay (Aphelocoma insularis). Its global range is the smallest of any North American bird.

Multiple co-benefits of proactive management of North America’s lone insular bird species

Cascading effects of humans, through wolves, on a terrestrial ecosystem

Predators play integral roles in shaping ecosystems through cascading effects to prey and vegetation. Such effects can occur when prey species alter their behaviour to avoid predators, a phenomenon called the risk effects of predators. Risk effects of predators such as wolves have been documented for wild prey, but not for free ranging domestic animals such as cattle. We compared risk effects of satellite-collared wolves (n=16) on habitat selection by global-positioning-system-collared elk (n=10) and cattle (n=31). We calculated Resource Selection Functions (RSFs) in periods before, during and after wolf visits in elk home ranges or cattle pastures to test for changes in prey habitat selection. When wolves were present, elk stayed closer to forest cover and selected less for high-quality-food habitat. Cattle responded to wolf presence by avoiding high-quality-food habitat and selecting areas closer to roads and trails, but these effects manifested only after wolves had left. Artificial selection in cattle may have attenuated natural anti-predator behaviours. The effects of predators on ecosystems are likely different when mediated through risk effects on domestic compared to wild animals. Furthermore, predator control in response to livestock predation may produce broad ecosystem effects triggered by decrease of an important predator species. Conservation planners should consider these effects where domestic herbivores are dominant species in the ecosystem.

Academic Training for a Nonacademic Workplace: a case study and recommendations for graduate education in conservation

Graduate education in conservation biology has been criticized as ineffective and inadequate to train the professionals needed to solve conservation problems. To identify how graduate education might better fit the needs of the conservation workplace, we surveyed practitioners and academics about the importance of particular skills on the job and the perceived importance of teaching those same skills in graduate school. All survey participants (n=189) were alumni from the University of California Davis Graduate Group in Ecology and received thesis-based degrees. Academic and practitioner respondents clearly differed in workplace skills, although there was considerably more agreement on what should be taught. Skill sets particularly at risk of under-emphasis in graduate programs are decision making and policy implementation, whereas research skills may be overemphasized. Because practitioners vary widely in types of jobs and necessary skill sets, we suggest that ever-increasing calls to broaden training to fit this range of careers will lead to a trade-off in the teaching of other important skills. We recommend a community approach to improving graduate education in conservation, including roles for conservation employers, academic programs, and students; and present initial findings from a May 2010 meeting that will bring these three groups together.

Emerging trends of biotechnology and their application in wildlife conservation

Biotechnology has become the most fascinating field for wildlife conservation. Recently, there has been a complete shift in the study of traditional wildlife biology. Molecular methods have been applied in various fields of wildlife biology including Medical and Veterinary Science. This paper reviews the importance and putative function of molecular markers for wildlife conservation. Wildlife diversity including flora and fauna is shrinking rapidly because of poaching, habitat degradation and majorly by human encroachment. There is an urgent need to define strategies to prioritize the species conservation. A large number of genetic markers that show different Mendelian pattern of inheritances (maternal, paternal, bi-parental) are now available for most of the wild species. Today, number of wild species is under endangered category or on the edge of extinction while there is no concrete data for their origin and distribution. Along with ecology, there is a strong need to study the species genetically. Today, various molecular tools are being used for species identification, molecular taxonomy, phylogeny, sex determination, assigning & estimating population, admixture analysis, inbreeding depression, gene flow, distribution and also molecular tracking of the wild animals. Such information can guide the choice of species and geographic areas for conservation actions.
P1.193 Mukherjee, N; Feagin, RA; Shanker, K; Baird, AH; Cinner, J; Kerr, AM; Koedam, N; Sridhar, A; Vrije Universiteit Brussel-VUB, Texas A&M University, Dakshin Foundation, James Cook University, University of Guam, Dakshin Foundation; nibedita41282@gmail.com

SHELTER FROM THE STORM? USE AND MISUSE OF COASTAL VEGETATION BIOSHIELDS FOR MANAGING NATURAL DISASTERS

Vegetated coastal ecosystems are known to provide myriad ecosystem services to billions of people globally. However, in the aftermath of a series of recent natural disasters, including the Indian Ocean Tsunami, Hurricane Katrina and Cyclone Nargis, coastal vegetation has been singularly promoted as a protection measure against large storm surges and tsunami. In this paper, we review the use of coastal vegetation as a “bioshield” against these extreme events. Our objective is to investigate the long-term consequences of rapid plantation of bioshields on local biodiversity and human capital. We begin with an overview of the scientific literature, in particular focusing on studies published since the Indian Ocean Tsunami in 2004 and discuss the science of wave attenuation by vegetation. We then explore case studies from the Indian subcontinent and evaluate the detrimental impacts bioshield plantations can have upon native ecosystems. We draw a clear distinction between coastal restoration and the introduction of exotic species in inappropriate locations in the name of coastal protection. We conclude by placing existing bioshield policies into a larger socio-political context and outline a new direction for coastal vegetation policy and research.

P2.202 Murray, M*; Cembrowski, A; St. Clair, CC; Department of Biological Sciences, University of Alberta; mhmurray@ualberta.ca

The movement patterns, home range sizes, temporal activity patterns, and diet of urban coyotes (Canis latrans) in Edmonton, Alberta

Urban coyote populations and rates of human-coyote conflict are increasing in cities across North America. In Edmonton, Alberta coyotes were once considered rare, but city officials now receive several reports per week describing human-coyote interactions. Managers need information on urban coyote habitat use, movement, and diet to create an effective public education campaign and reduce coyote attractants. To monitor these attributes, we collared six adult coyotes in Edmonton with GPS collars set for three hour fix rates. We calculated home range sizes using the local convex hull method and modeled habitat selection with individual resource selection functions. To determine diet composition, we collected scats in urban parks and microscopically analyzed prey hairs. Coyotes mainly preyed on small rodents and consumed relatively little anthropogenic food. Individual collared coyotes appeared to have different home range sizes and habitat preferences. Four coyotes preferred natural habitat, one coyote selected for both natural and residential areas, and one coyote selected for residential and commercial areas. Interestingly, range sizes were larger for older coyotes, but did not vary with habitat type. One coyote with severe mange made the most extensive use of anthropogenic habitat. Our results suggest that older coyotes may be more habituated to humans and coyotes in poor physical condition may accept higher risks of encountering humans to exploit anthropogenic food sources.

P2.118 Mullen, Maureen; Monfort, Steven*; Stolk, Ruth Anna; Renick-Mayer, Lindsay; Christen, Catherine; Smithsonian Conservation Biology Institute, Smithsonian National Zoological Park; christenc@si.edu

Strategic Alignments for Conservation: The Smithsonian Conservation Biology Institute (SCBI)

"Understanding and sustaining a biodiverse planet" is one of the Smithsonian's new strategic goals. So it is timely that Smithsonian leaders in January 2010 established the Smithsonian Conservation Biology Institute (SCBI), encompassing the Zoo's Conservation and Research Center (established in 1973) and its Rock Creek Park research complex, to facilitate Smithsonian's ongoing global efforts to conserve species and train future generations of conservation scientists. SCBI researchers specialize in genetics, reproductive science, ecology, and wildlife health and husbandry sciences, while education and training programs are expanding at the Front Royal and global partner sites. We aim to increase our cutting-edge conservation science programs, and expand our convening role through symposia and more collaborations with like-minded organizations. This includes developing and sharing new strategies for conservation practice as they emerge from dialogue among students, global trainees, and conservation science practitioners and partners at field locations worldwide. National Zoo/SCBI scientists have long been closely involved with SCB and we look forward to more opportunities for SCB-SCBI synergies. This poster explores the new benefits SCBI seeks to build for conservation biology.

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9.9 Musiani, M*; Boitani, L; Paquet, P; University of Calgary, University of Rome; mmusiani@ucalgary.ca

Ecological Functions of Wolves and Wary Interpretations for Conservation Planning

Wolves and other carnivores are species of choice for conservation planning due to their ecological importance and charisma, and are used to address broader issues of coexistence between wildlife and human interests. Due to wolf's importance for conservation planning, new syntheses are needed regularly that venture beyond describing local adaptations of wolves. In collaboration with sixteen groups of wolf researchers and managers from Europe and North America, we compiled data and literature on (a) wolf community ecology, (b) attitudes towards wolves, and (c) the incorporation of both points (a) and (b) in conservation planning. Our analysis indicates that important ecosystem effects are initiated by wolves or mediated by wolves in natural and also in human-dominated areas. Wolf’s well-known ecological plasticity, which is likely correlated to genetic diversity of several interbreeding canids, has been key to recovery. Human attitudes toward wolves are improving despite depredation of livestock, which explains recovery in densely populated areas. Ironically, findings about wolves seem to be revisited in 5-year cycles. Some scientists and conservation groups claim that wolf recovery may represent a management action to lower prey densities and improve abundance and diversity of plants. However, new data demonstrate that wolves often do not control ecosystems from the top, and this will likely influence conservation planning in an opposite direction than in the recent past.
Angola headwaters: the white spot on the Serranochromis biogeographic map

Although the African cichlids can be considered as enormously studied group of fishes, there is no record of this group from central Angola since 1975 due to lack of any field work in the area. Up to now our project comprises first molecular study on cichlids from Bié Plateau. This Angolan headwater region includes five important river basins in relatively small area and we have collected samples from three of them, i.e. Kumbango (Okavango), Kwanza (Cuanza) and Kunene (Cunene). In the presented work we focused on biogeographic and phylogeographic study of serranochromine cichlids, based on four genes, three mitochondrial (16S rRNA, cytochrome b, NADH 2) and one nuclear marker (S7 intron). We included additional sequences from GeneBank, especially from specimens originated from two other river systems missing in our sampling, i.e. Congo and Zambezi. 1) We found separate lineage of upper Cuanza and upper Okavango serranochromine fishes. 2) Further we included additional sequences from GeneBank, especially from specimens originated from two other river systems missing in our sampling, i.e. Congo and Zambezi. In the presented work we focused on biogeographic and phylogeographic study of serranochromine cichlids, based on four genes, three mitochondrial (16S rRNA, cytochrome b, NADH 2) and one nuclear marker (S7 intron). We included additional sequences from GeneBank, especially from specimens originated from two other river systems missing in our sampling, i.e. Congo and Zambezi. 1) We found separate lineage of upper Cuanza and upper Okavango serranochromine fishes. 2) Further we formulated hypotheses about the river history in Angola: our results show the possibility of fish colonisation from Okavango River system to the Cuanza River system. 3) Finally, we combined our data with previous analyses in haplochromine cichlids and we thus significantly enlarged sampling area of this fish group in Africa. The work was supported by P1.189 Musilova, Z*; Kalous, L; Petrytl, M; Chaloupkova, P; Laboratory of Fish Genetics, Institute of Animal Physiology and Genetics AV ČR, v.v.i., 277 21 Liba, Czech Republic, Department of Zoology and Fisheries, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, 165 21 Praha 6 - Suchdol, Czech Republic, Institute of Tropics and Subtropics, Czech University of Life Sciences Prague, 165 21 Praha 6 - Suchdol, Czech Republic; zcimus@email.cz

P1.106 Nabe-Nielsen, J*; Sibly, RM; Forchhammer, MC; Forbes, VE; NERI, Aarhus University, University of Reading, Roskilde University; nabe@dmu.dk

The Importance of Landscape Structure for the Long-Term Conservation of Species

The presence of corridors and the way patches are arranged in a landscape are thought to be important for the long-term conservation of many species, and may determine whether species are able to recover from large-scale disturbances. Here we used individual-based models to investigate how population recovery was affected by landscape structure for four species in an agricultural landscape: skylark (Alauda arvensis), vole (Microtus agrestis), a ground beetle (Bembidion lampros) and a linyphiid spider (Erigone atra). We characterized population persistence based on equilibrium population sizes (K) and the time it took populations to recover from perturbations. We separated the effects of corridors and patch arrangement by comparing results from a real landscape with results from two virtual landscapes: One where linear corridors were removed by homogenizing patch shapes, while leaving the spatial arrangement of the patches unaltered, and one where patches were shuffled around, while still leaving the landscape composition unaltered. Patch arrangement and the presence of corridors had a large effect on population dynamics for species whose local success depended on the identity of the neighbouring patches. The short-dispersing beetle and vole recovered slowly from perturbations in landscapes where they had low K. Our study demonstrates that it is necessary to consider the dynamics of populations in a spatially explicit context when designing landscapes for conservation of species.

SY67 Myers, O. E.; Western Washington University; Gene.Myers@wwu.edu

Psychology for conservation institutions: Synthesizing and looking forward

What are the implications of recent descriptions of human cognitive, motivation and social functioning, such as those presented by contributors to this symposium, for the design of conservation institutions and interventions? This talk will seek to synthesize trends in the field of psychology that offer promise for conservation application, as well as concrete suggestions for how they might be used. Among the themes to be discussed are: - what psychological factors composing an autonomy supportive environment in which conservation goals can be pursued without undermining by over-controlling actions; - using insights from the psychology of risk to ensure conservation is not perceived as a threat, and to help communities employ effective coping skills as an outgrowth of conservation interventions to help with problems they already face; - understanding and anticipating reliable cognitive biases in conservation choice architectures; - getting smart about emotion and motivation: using positive psychology and anticipating motivational pitfalls in conservation programming and economic tools; - activating central, peripheral and meta-level information processing routes to increase mental adaptability and resilience. The aims of this discussion will be to summarize symposium contributions, and to prompt a more articulated dialog and new research agendas between conservation biology and conservation social sciences, and particularly among psychology, political science and economics.
There exist few quantitative assessments of the relationship between biodiversity and human welfare at scales that are relevant for conservation. Similarly, the merits of Community-Based Natural Resource Management (CBNRM) programs for both wildlife and people are contested. Here, we harness two databases, on wildlife surveys and financial benefits (mostly from nature-based tourism and trophy hunting), to address these issues for communal conservancies in northwest Namibia. We use ordination methods to characterize wildlife composition on conservancies, and demonstrate that after controlling for confounding factors, the structure of wildlife assemblages is an important predictor of conservancy financial benefits. Our results indicate that for this area of Namibia, biodiversity, as represented by diverse wildlife assemblages, has an important, positive effect on the tangible financial benefits that people derive from conservation programs.

**Genetic analysis of feces reveals minimum number, sex, and diet of mountain lions on Kofa National Wildlife Refuge, Arizona**

Recent records of mountain lions (Puma concolor) and concurrent declines in desert bighorn sheep (Ovis canadensis mexicana) numbers on Kofa National Wildlife Refuge have prompted investigation into estimating the number of mountain lions and their diet on the refuge. We used genetic techniques and identified 53 mountain lion fecal samples from a total of 105 fecal samples collected from the Kofa and Castle Dome mountains in the refuge from 2007 through 2009. We genotyped the mountain lion samples and identified 11 individual mountain lions. These individuals consisted of six males, two females, and three of unknown sex. Three of the 11 mountain lion individuals were identified multiple times over the study period. We also identified species of prey from bone and connective tissue remains inside the feces. A majority of mountain lion diet (62 %) was composed of desert mule deer (Odocoileus hemionus crooki). These estimates supplement previously recorded information on mountain lions in areas where mountain lions were historically considered transient. We demonstrate the efficacy of non-invasive genetic techniques and their potential use by wildlife managers to obtain reliable information on elusive species.

**Phylogeography and conservation genetics of the smallest felid in the American continent, the guigna (Leopardus guigna, Mammalia, Felidae)**

The guigna (L. guigna) is the smallest felid in the American continent, and also one of the smallest in the world. It also has the most restricted geographic range of all the New World cat species, inhabiting only around 160,000 km². It is currently threatened by habitat loss, fragmentation and human persecution. In order to devise adequate conservation and management strategies for this endangered species, we characterized for the first time the distribution of its genetic diversity, investigated its population structure and the existence of demographic partitions across its geographical range by analysing 2,000 base pairs of the mitochondrial DNA (mtDNA) (ND5, 16S, HVSI, ATP8 and Cyb-b genes) and 20 microsatellite loci in 80 individuals sampled from 32°S to 47°S in Chile and Argentina. Guignas display moderate to high levels of mtDNA diversity and moderate to low levels of microsatellite size variation. Both mtDNA and microsatellite variation show evidence of geographical structure within populations in Chile, while the lack of genetic structure between chilean and argentian guigna populations suggests that the Andes mountain range is not a complete barrier for effective guigna migration. Our results have implications for the conservation of guignas, contributing to come closer to defining, for the first time, the situation of guigna populations over their restricted distribution range, facilitating future research and conservation efforts on this largely unknown small cat.
Non timber wetland products and their sustainable use: case of Rugezi wetland, Rwanda

Rugezi wetland plays an important role in different ways by acting as water catchments. It is also a refuge of endemic species i.e. the endangered Grauer's swamp Warbler Bradypterus graueri. The unsustainable utilization of Rugezi resources has affected the existence and health of the wetland and caused locals suffering, but also has affected the ecosystem as a whole and has contributed to national and even regional environmental problems. The study conducted in this swamp has showed that the unsustainable use of non timber wetland products has led to the extirpation of some species i.e. Sitatunga, papyrus Gonolek and papyrus Canary. Large areas of the swamp have been altered to other forms of land use namely settlement and agriculture. Alternative sustainable development options have been studied to be of significant help in improving the livelihood of adjacent communities. Some of which include improved agriculture and animal husbandry, small scale industries (improved oven), eco-tourism, etc. The swamp can be utilized sustainably by adding value of non timber wetland based products i.e. mats and baskets. This report shows the way wetlands can get conserved while providing goods and services to adjacent communities in particular, to the whole nation or region and even globally.

Markets and Politics: Confronting Conservation Paradoxes in Africa

During the past several decades, biodiversity conservation efforts in sub-Saharan Africa have increasingly focused on developing strategies that integrates conservation into economic development efforts. In seeking to make 'conservation pay its way', practitioners have developed paradigms that include 'integrated conservation and development projects', 'community-based conservation', and now 'payments for ecosystem services'. Even as conservation efforts have widely promoted the twin planks of market-based benefits and localized rights to use and manage resources such as forests and wildlife, natural resource governance arrangements in African countries have become increasingly contested and subject to conflict. As the economic value of natural resources has risen, it has encouraged greater investments in conservation- such as in the case of wildlife-based land uses in East Africa- but also more intense struggles amongst different groups and individuals over resource rights and control. This paper will examine these political struggles over resource rights and tenure in east and southern Africa, drawing on recent case studies, and discussing the underlying institutional challenges facing efforts to promote market-based conservation strategies across the region.
Can we effectively conserve the tuatara in the face of climate change?

Climate change poses a particular threat to species with disjunct distributions and little or no capacity to migrate. Increasing the range of species distributions through management actions may help in establishing populations where they are expected to survive as temperatures increase. We present the potential for assisted colonization to counter effects of climate change in tuatara (Sphenodon), a taxon that was once widely distributed, but where anthropogenic habitat change and the introduction of predators caused the extinction of many populations. Assisted colonization per se is not controversial in this example, because the proposed introductions are to areas where the same or very closely related species occurred in the recent past. However, remnant populations of tuatara cover only a small portion of their pre-human latitudinal range, presenting issues related to local adaptation to ecological conditions. We include the following considerations in our experimental design aimed at securing the demographic and genetic potential of tuatara: potential source populations (acknowledging molecular diversity); affiliation of sources with local Maori communities; and the potential region for convergence of northern and southern sourced tuatara.

Measuring Success: A Comparative Study of Wolf Reintroductions in the US

Wolf reintroduction programs in the US have been called both successful and unsuccessful. One population has been delisted amidst great controversy. What constitutes success with regard to endangered species reintroductions? Are there proven management protocols that can be applied to all such programs? This presentation compares three wolf reintroductions—the species recovery plans, current scientific findings, and management protocols, examining the disconnect among the three. I conclude that appropriate management protocols do exist, but that determination of “success” has been arbitrary.

Behavioural side effects of human harvest in ungulates?

Understanding the indirect predator effects on wildlife behaviour becomes increasingly important when human harvest dominates mortality in the absence of natural top-predators as in many ungulate systems. Modification in prey anti-predator behaviour towards human predation may result in predator facilitation when natural top predators re-colonize, and thus are particularly of interest for wildlife management and conservation. In a controlled field experiment in Northern Sweden devoid of wolves, we exposed GPS-marked adult female moose to hunting activity using a moose baying dog. Scandinavian moose are excellent to study individual decision-making under hunting impact, because of their experience of long-term predominance in human predation, heavy hunting pressure and expansive absence of natural predators. Moose response was distinct, but short-lived. Instead of fronting, which is the natural defense behavior for adult moose charged by wolves, moose most commonly fled when confronted with the hunting dog. Distance at the initial encounter, dog tracking time and reproductive status influenced moose escape pattern. We suggest the observed moose response to reflect an alteration of moose anti-predator behavior produced by human hunting using moose baying dogs as moose were more prone to escape when confronted. This may explain the high predation success of wolves on Scandinavian moose where human and wolf predation co-exists, and needs to be considered in future management.

A Whale of a Dilemma: Analyzing the Contemporary Intersection of Capitalism and Nature Conservation

This presentation provides an overview of Marx’s notion of “metabolic rift” and its relevance for the analysis of core elements in the historical relation between capital and nature, and their role in the emergence of our current global environmental predicament. It examines the recent greening of capitalism and the coconterminous emergence of a “conservationist mode of capitalist production” (Katz 1998). It shows moreover, that as capitalism and nature conservation become increasingly intertwined, purported “causes” and “solutions” to our environmental crises are at times difficult to discern. These issues are illustrated via consideration of data from two empirical studies (organic agricultural production in Quebec - Canada, and whale watching in the Azores - Portugal). Together they reveal the extent to which “nature conservation’ tends to be co-opted by capitalist interests, as well as the production of a new “post-industrial” type of “metabolic rift” in nature conservation. Alas alternatives do exist at the margins, and these will also be considered in this presentation. This will entail revising Marx’s notion of “metabolic rift” through the lenses of contemporary ecological sciences which bring forth a qualitative understanding of the role of connection and communication in ecosystems, rather than emphasizing nutrient and material exchanges.
14.5 Nevin, OT; University of Cumbria; owen.nevin@cumbria.ac.uk

Importing carnivore encounters: conservation and ecotourism in a new carbon economy

For several decades eco-tourism has been presented as a viable income source to local communities when considering the protection of species and ecosystems and in the declaration of national parks and protected areas. Whether in East Africa, India, even North America it is carnivores which are the key species in many of these systems. Large numbers of well educated, relatively high income with an interest in wildlife and the environment have been travelling to remote regions around the world assigning real economic value to the sites and species they travel to encounter. In many regions this income stream has assured local and regional support for protection and in some cases funded protection and restoration efforts; however, with increasing awareness of the climate impacts of long-haul travel will this continue in the new carbon economy? The typical carnivore ecotourist fits a similar demographic profile to those most likely to monitor and reduce their personal “carbon footprint” and while nature tourism has been is the fastest growing sector in the $3 trillion global annual tourism market this is unlikely to continue. What impacts will this have on the conservation of these areas and the species which are found there?

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Habitat security and diets for recovery of Alberta grizzlies: lessons from coastal BC, Alaska and Yellowstone

Brown bears (Ursus arctos) in North America vary widely in their densities from a maximum of 550 bears /1000 km2 in coastal Alaska to less than 5 bears /1000 km2 for mountain bears in the north; this variation has been attributed to differences in food base. The impacts of security and perceived risk on the exploitation of energy rich environments also have significant impacts on demographic rates within populations. Increasing the energy density of habitat has been identified as an important step in the restoration and maintenance of small brown bear populations in Europe and this is equally applicable to bear populations at risk in North America. Where bears persist at high densities they are in productive ecosystems, where protection has been of low productivity land populations which survive are marginal. Drawing on examples from Yellowstone, coastal British Columbia and Alaska we will present the case for using areas of enhanced habit security and energy density as source populations within a source-sink model of conservation of a species at the edge of its current range to halt the retreat of bears in Alberta.

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Shelterwood harvests provide suitable habitat for canopy-nesting songbirds

Forest management efforts such as shelterwood harvesting aim to replicate historical disturbance regimes and promote oak regeneration. We evaluated the short-term response of canopy songbirds to opening of the forest canopy through removal of fifty percent of the overstory trees. From 2007-2009 we studied settlement, abundance, and reproductive success for a guild of five sensitive canopy songbirds in shelterwood stands 1-4 years post-harvesting and mature second-growth forest in Ohio, USA. Although densities of canopy songbirds were slightly higher in shelterwood stands, similar patterns in settlement suggested that there were no strong preferences for stand type. Daily nest survival rates (>700 nests) varied among species but did not differ between harvested and unharvested stands. Our data suggest that shelterwood harvests containing abundant overstory trees can provide suitable nesting habitat for canopy songbirds. We caution that the long-term responses of birds to partial harvesting may differ from those documented here while management for oak regeneration will typically remove all overstory trees later in the cutting cycle.

20.8 NEWMARK, WILLIAM*; Rickart, Eric; Utah Museum of Natural History; bnewmark@umnh.utah.edu

High-Use Movement Pathways and Habitat Selection by Ungulates

The cumulative movements of large mammals are expressed in many areas as semi-permanent wildlife trails. The mapping of semi-permanent trail networks offers a direct approach to assess habitat selection of high-use movement routes at relatively fine spatial scales across a landscape. Here we examine an ungulate trail network in north-central Utah created and maintained by the repeated movements of mule deer (Odocoileus hemionus) and elk (Cervus elaphus). In a resource selection analysis using multivariable spatial regression analysis, we show that at a spatial scale of 70 m open and low cover and distance to water are important predictors of movement pathway density. We also demonstrate at a scale of 10 m that elk and deer movement pathways are less steep than adjacent terrain. The mapping of trail networks should be a particularly useful technique for examining functional connectivity among resource patches across a landscape and identifying important high-use movement routes.
Matching Monitoring to Program Needs: The Key to Successful Monitoring

Biodiversity monitoring is most useful when viewed as a component of a larger program of either science or management. In both cases, the design, conduct and analysis of the monitoring are inherited from the objectives of the larger program. Structured decision making (SDM) provides a logical framework for addressing problems in biodiversity conservation. The basic components of SDM are: (1) objectives, (2) set of available actions, (3) models predicting system response to management actions, (4) monitoring program, and (5) an approach (e.g., optimization algorithm) for deciding on the appropriate action. Dynamics and responses of natural systems are typically characterized by substantial uncertainty. Adaptive resource management (ARM) is a SDM process developed for use with recurrent decision problems characterized by uncertainty, and is thus a natural choice for use in biodiversity conservation. In ARM programs directed at biodiversity conservation, monitoring programs provide estimates of state variables and vital rates that are used for: (1) making state-dependent decisions, (2) assessing the degree to which conservation objectives are being met, (3) discriminating among different hypotheses about system response to management actions, and (4) populating new models of system dynamics and response to management. An example illustrates the importance of tailoring monitoring to those specific uses within a conservation program.

Conservation Planning for Recovery of Grizzly Bears in Alberta

High rates of human-caused mortality threaten the long-term persistence of grizzly bears in Alberta. One management action that has proved successful for recovery of grizzly bears elsewhere is to limit motorized access. When enforced, such actions reduce the frequency of encounters between humans and bears and thus vulnerability towards poaching. Since the eastern limit of grizzly bears in Alberta occurs within a multi-use landscape dominated by forestry and energy extractions, a major challenge to implementing access restrictions is the delineation (prioritization) of areas where this would most benefit bears. We used a simulated annealing optimization method for identifying conservation areas where motorized access should be limited for six of seven population units in Alberta. Road density was used to define a cost or penalty for selection of conservation sites, while habitat selection models for 81 radiocollared grizzly bears were used to define grizzly bear habitat. We illustrate patterns in conservation areas for the six population units and evaluate the effectiveness of these sites as source-like habitats for grizzlies using DNA hair-snag detections. Finally, we discuss the need for further conservation strategies, including clear targets for monitoring of population recovery and the need for implementing a long-term habitat banking strategy where conservation offsets are used to decommission roads within core habitats in a planned and coordinated manner.

Conservation of white-headed duck in Barabinskay lowland

2006-2007: the number and distribution of WHD in Western Siberia were estimated, the reduction of WHD number in Siberia up to 10 times was shown. 2007-2009: the data on success of the species reproduction in Western Siberia was obtained, the educational campaign among local population (more than 10,000 people) was conducted, the recognizability of WHD among hunters increased from 3 to 13%. The partner relations were established practically with all stakeholders of conservation WHD in Russia. Became the initiators for establishment of the National working group of conservation WHD in Russia. The results were shown at 3 international conferences and 3 articles

Inuit participation in wildlife management in Nunavut

Inuit participation in wildlife management has been identified by the Government of Canada as critical to any conservation efforts in Nunavut. One major objective of Article 5 of the Nunavut Land Claims Agreement is the creation of a system of wildlife management that respects and secures Inuit harvesting rights and involvement. While Inuit participation in wildlife management has progressed, there are still areas that require significant improvement. One area that requires attention is the inclusion of Inuit Qaujimajatuqangit (IQ) and traditional ecological knowledge into the decision making process. Nunavut Tunngavik Inc. is working to elucidate a process that effects the inclusion of IQ into wildlife management decision policy. Three specific case studies will be used to highlight current challenges and potential solutions to advance Inuit and IQ involvement. These include the establishment and participation of Inuit with the Nunavut Wildlife Management Board, consultation and accommodation by agencies with affected parties, and the development and support of community based management programs in Nunavut.
Modeling Deer Movement: Implications for Chronic Wasting Disease Spread in East Central Alberta

Chronic wasting disease (CWD) was first detected in free-ranging deer in Alberta in 2005 and is continuing to spread despite management efforts to contain the disease. To help direct surveillance and management in Alberta, we developed an individually based movement model based on a correlated random walk of deer to identify movement corridors that can potentially facilitate disease spread. Movement data, including step lengths and turning angles, were collected from 58 GPS-collared mule deer (Odocoileus hemionus) and white-tailed deer (Odocoileus virginianus) relocated every 2 hours from 2006 to 2008 in a CWD-infected area near Chauvin, AB. We used a step selection function (SSF) approach to describe the selection bias of deer dispersing across a heterogeneous landscape. The best SSF among a set of a priori competing SSFs was chosen for both mule and white-tailed deer as a final movement model based on Akaike's information criterion and parsimony. Our results indicated during movement deer responded to vegetation cover type, topography, hydrology, roads and human dwelling density. To evaluate disease spread, we simulated deer movement from known clusters of CWD to determine movement corridors and connectivity among deer populations.

Clarifying the critical habitat concept: insight from conservation planning for Spotted Owls

Critical habitat can generally be defined as the set of locations on the landscape needed for a listed species to reach an appropriate population size and geographic distribution so that its risk of extinction meets some predetermined recovery criterion (e.g., a 5% chance of extinction over the next 50 years). Implicit in this definition is a set of scale-dependent biological criteria that must be addressed in critical habitat designations: 1) habitat provides the resources and physical conditions necessary for individual organisms to survive and reproduce (individual organism scale); 2) habitat is sufficiently extensive and connected so that it has a high probability of supporting local populations of sufficient size to be resilient to natural and human disturbance events and not experience local extinction (local population scale); and 3) habitat is sufficiently extensive at the scale of the target geographic distribution that it is highly unlikely that all local populations will simultaneously experience catastrophic events (geographic range scale). I will discuss how these spatial scales of critical habitat were addressed in the Northwest Forest Plan for the Northern spotted owl (Strix occidentalis caurina). In addition, I will discuss how these insights can be used to improve the recovery planning process for threatened and endangered species.

Negative impacts of land use changes on endangered salmonid, Sakhalin taimen abundance in eastern Hokkaido, Japan; Management implications for conservation

Sakhalin taimen, (Parahucho perryi), is one of the biggest salmonid species in the world. They have been rapidly diminished in the last few decades, and listed under “Critically Endangered species” in the IUCN red list. Our field surveys revealed that as many as >75% of local populations have become extinct in the past five decades in eastern Hokkaido, Japan. We investigated the factors of the local extinction in the same region, by correlating number of reds and environmental variables in 32 tributaries (subbasins) of two neighboring river basins. An information theoretic model suggested that the percentage of the subbasin grazed, suitable spawning area, and the interaction of the two were important for Sakhalin taimen’s persistence. This model also suggested that the cumulative level of livestock grazing in the past five decades has resulted in as many as 52.8% reduction of Sakhalin taimen reds. To develop management strategies that minimize cumulative negative effects of live stock grazing on the endangered population, we forecasted the number of Sakhalin taimen’s reds in response to simulated changes of percent grazing land based on the same model. The important point was the effects of habitat changes (both in positive and negative) were remarkably different depending on the individual basin. Response to habitat change was more dramatic in the basins less grazed. This suggests that conservation efforts should be directed toward less impacted basins.
Land use change poses serious threats to biodiversity, especially at and beyond the urban-rural fringe on privately owned lands, where natural and rural landscape values still predominate and the impacts from ongoing exurban development are greatest. The generation of scientific knowledge on ecosystems and nature-human dynamics is necessary to effectively address biodiversity decline in these settings, but it is not by itself sufficient. It is also necessary to understand and engage in the generation of practical knowledge. From a research perspective, it is especially important to understand the ways in which scientific knowledge is perceived, interpreted, and transformed into practical knowledge, and then how it is actually used within decision-making processes. Failing to account for these distinctions and relationships between scientific knowledge and practical knowledge, and attempting to use scientific knowledge as practical knowledge without critical reflection or engagement with decision-makers, can yield incomplete scholarship on nature-human dynamics in research, as well as a range of perverse policy outcomes in practice. This paper builds upon contemporary efforts to integrate natural and social science scholarship, offers a meta-framework for reconceptualizing such integration, and concludes by discussing several overarching issues and challenges.

Land-use planning usually is poorly linked to conservation planning. Biodiversity is seldom a consideration in land-use planning; regulations requiring conservation actions are uncommon; and planners seldom make use of scientific methods, information, or modern conservation planning tools. The link between conservation science and land-use planning must be strengthened in order to maintain and restore biodiversity and ecological processes in landscapes inhabited by humans. Conservation biologists interested in land-use planning commonly assume that high-density (clustered) development with reserved open space is preferable to low-density (dispersed) development with large lot sizes. This assumption is not necessarily valid. Conservation outcomes depend on habitat content and habitat context for particular species and on the influence of landscape patterns on ecological processes - and vice versa. The few studies that compared clustered development and dispersed development found little or no difference in biodiversity outcomes. These results are not surprising, given what is known about the importance of habitat quantity (e.g., patch size and total available habitat in the landscape), habitat quality in patches and matrix for species of interest, and the spatial configuration of the landscape. Although comparisons to date might suggest that each planning exercise is idiosyncratic and case-specific, some empirical generalizations have emerged, which can guide land-use planning toward better ecological outcomes. I offer suggestions for making land-use planning more ecologically and biologically responsible, which mainly derive from well-established principles of conservation planning.

Conservation in North America began with utilitarian watershed and forest protection, on the one hand, and protection of special places for scenic and recreational purposes on the other. This dual emphasis resulted in large, multiple-use landscapes and large scenic parks. By the mid 20th century reserves were established to protect biological features; these reserves were usually small and poorly buffered from surrounding land uses. The idea of buffering reserves emerged in the early 20th century but has been poorly implemented, even within Biosphere Reserves. The idea of maintaining connectivity among reserves, for example via habitat corridors, also has a long history, but usually has been implemented on fine scales and for single species. The concept of core reserves surrounded by multiple-use zones and connected via broad habitat corridors on regional scales emerged as a primary model of conservation planning in the late 20th century. This model has been challenged by studies demonstrating the value of the landscape matrix for its inherent biodiversity and as movement habitat. Some studies questioned the value of reserves. Others questioned the “binary” model of protected and useful vs. unprotected and useless, which led to a more integrated model where the areas of highest value are protected as core reserves, but are surrounded by managed lands that provide suitable habitat for many species. Corridors remain a key component of this new model, but are often envisioned as permeable landscape units rather than distinct linear swaths. Nevertheless, especially in regions where the landscape matrix has been heavily altered, clearly defined and strictly protected cores and corridors remain essential elements of conservation planning.

The effectiveness of the pan-European system of protected areas Natura 2000 is strongly debated. We report a promising case of eight Natura 2000 sites devoted to endangered wet meadow butterflies, established in the Kraków region, southern Poland, in late 2009. The best known of the sites, monitored since 2003, contains the largest metapopulations of Maculinea teleius (ca. 55,000 adults), M. naustitohus (30,000), Lycaena helle, and L. dispar (each 4000), so far described in Europe. Butterfly numbers at four other sites are comparable, while the three remaining sites include smaller, but still viable metapopulations. All eight sites comprise a network with the inter-site distances of 1-17 km; the resulting exchange of individuals estimated at tens (in Lycaena) to hundreds (in Maculinea) per generation should allow maintaining high genetic variability. The metapopulations are relatively stable, and their main threats, i.e. habitat destruction due to urban development and its deterioration through natural succession on abandoned meadows, should be easy to eliminate under new management plans. It appears that Natura 2000 may be a highly successful tool in insect conservation, which stems from the following reasons: (i) its focus on less charismatic species and semi-natural habitats, (ii) spatial scale more appropriate for small animals, and (iii) enhancing the survival of species living in dynamic metapopulations through networking of protected areas.
Identifying and Evaluating High-integrity Conservation Linkages for Climate Change in the Western U.S.

In the past, as climates changed, many species moved great distances to track suitable climates. However, today’s fragmented landscapes will make it far more difficult for species to track projected climate changes for the coming centuries. We propose and demonstrate a coarse-filter approach to prioritizing areas for climate-change connectivity based on ecological integrity and simple rules of thumb for promoting species’ range shifts. We begin by indentifying areas of high ecological integrity (low human impacts) that provide connectivity between larger relatively intact areas. We then highlight the subset of linkages that tend to cross climatic, elevational, ecological or latitudinal gradients. To evaluate the potential utility of these linkages, we examine the overlap between prioritized linkages and areas of high projected change in vertebrate species composition derived from bioclimatic envelope models. We provide results from analyses conducted at two scales, that of the Pacific Northwest and across the Western U.S.

Measuring illegal bushmeat hunting in the Serengeti: application of novel approaches

The unsustainable use of wildlife resources poses a threat to biodiversity and to the livelihoods of those who depend upon it. To devise effective strategies for sustainable use, information is required on activities which are often illegal. Bushmeat has been identified as an important ecosystem service in Tanzania but, due to its mainly illegal nature in this area, information may lack accuracy. Previous studies have estimated the prevalence of illegal bushmeat hunters within the Serengeti ecosystem but conventional survey techniques intended to provide data on non-compliance may be inappropriate. Attempts to estimate its rate through direct survey techniques are expected to generate misleading and evasive responses. Using rule breaking among Serengeti households as a case study, this study aims to test a range of novel approaches to better understand illegal behaviour. The application of these indirect questioning techniques allows inferences to be drawn concerning the prevalence of hunting in communities surrounding a protected area. It also enables us to analyse the probability of hunting in different social groups and areas, and hence to target conservation interventions more effectively.

Connectivity of a scattered resource in a continuous seasonal tropical forest

The maintenance of landscape connectivity is important for species and ecosystems especially given the current rates of land use transformation and climate change. Little attention has been given to the connectivity of critical resources, such as water, within threatened habitats. Our study area, the Greater Calakmul Region of the Yucatan Peninsula is undergoing climate change. From 1950 to 2009 the mean decrease in precipitation was approximately 16%; this decrease in precipitation influences water availability in the area, as water is only present in seasonal waterholes. We performed a graph analysis of the connectivity of the waterhole network for 4 endangered species: Baird’s tapir (Tapirus bairdii), spider monkey (Ateles geoffroyi), jaguar (Panthera onca) and white-lipped peccary (Tayassu pecari). We treated waterholes as nodes and linked those pairs that fell within the range of each species maximum known dispersal distance. We deleted waterholes from the network based on their size to mimic the natural drying-up process. We found that the waterhole network is very sensitive to the loss of waterholes; the landscape fragments easily when small waterholes disappear. Our scenario analysis revealed that our study species experience fragmentation of the network at different rates and scales. The results indicate that resource connectivity analyses are necessary to improve our understanding of reserve functioning and functional habitat connectivity in seasonal landscapes.
A Tale of Two Horses: Examining the Ecological Exchangeability of Island Feral Horse Populations

Domestic horses (Equus caballus) have been living feral on islands along the eastern seaboard for generations; their presence on Assateague Island, a 37-mile barrier island off the coast of Virginia and Maryland, has been documented since the 1600's (Zimmerman et al., 2006). Other populations are found on Shackleford Banks off the coast of North Carolina. All three of these populations are managed by the National Park Service and are considered "desirable exotics" (US Dept of Interior, 2008). Managers must have plans to maintain the integrity of the herds, both socially and genetically, while also maintaining the integrity of their habitat. Should genetic diversity become compromised, current management plans assume total exchangeability between these island horse populations. Genetic divergence, as well as differences in habitat and potential local adaptations, may affect the ease of exchangeability between these populations. As the world's climate changes, the issue of exchange and/or relocation will become more and more relevant in conservation biology. I am performing a comparative study of the three populations to assess their genetic and ecological exchangeability. Genetic characteristics, diet composition analysis and differences in parasite communities are presented as a measure of ecological exchangeability.

Aquatic Tourism Promotion As An Arsenal In Conservation Of Nigerian Protected Areas: A Case Study Of Old Oyo National Park

The study aimed at determining composition, abundance and distribution of some aquatic resources for sustainable ecotourism development and management. The study was based on typical wet and dry seasons and river stratification. Fish sampling of Ogun River in the park done with monofilament gillnets of 38mm to 127mm and graded hooks. Physico-chemical properties of the river also determined. 12 fish families and 30 species were identified, 5 families classified as fishes of ecotourism importance. Optimal fish catches achieved with mesh sizes 51mm and 76mm. Highest species diversity found in upstream and decreased downward with Sex ratio 6.48 female: 3.52male. Effect of seasons and mesh sizes were significant for total catches, however significant difference observed in number and weight of fishes among mesh sizes (P < 0.05).
Applications of spatial tools in conservation of fragile ecosystems; a case study of Dakatcha and Marafa forests in Malindi District, Kenya

A combination of human induced and natural changes have led to drastic reduction in biodiversity of major ecosystems including forests. A study to investigate land cover changes and its impacts on forest biodiversity as well as the status of Warburgia stuhlmannii was carried out in two forests in Marafa and Dakatcha forests in Coast province in 2007. LANDSAT satellite imageries were processed using (IDRISI, GEOVIS and Arc View 3.3). Relationships between socio-economic processes and environmental factors influencing the conservation of forest biodiversity were obtained by use of questionnaires. The status and recent developments in forest cover were also examined. Results from analysis of satellite imageries indicate reduction in land cover. There was evidence that different forms of human pressures exerted varying degrees of impacts. Warburgia stuhlmannii was found to be vulnerable to extinction based on the 2007 IUCN summary criteria. The study recommends the need to alter land use practices to address losses in forest ecosystem biodiversity. The findings are expected to be useful to forest managers and policy makers in the conservation of forest resources. Key words: Spatial tools forest biodiversity, degradation, land cover, conservation.
Application of DNA Bushmeat Barcoding in Prosecution of Wildlife Crimes in East Africa

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APPLICATION OF DNA BUSHMEAT BARCODING IN PROSECUTION OF WILDLIFE CRIMES IN EAST AFRICA OPYENE V 1. Uganda Wildlife Authority, Kampala , Uganda 2. Bushmeat Free Eastern Africa Network, Kampala, Uganda Uganda, Kenya and Tanzania apply common wealth legal system. The three countries have the same legal system with the legal precedents (judgments) pronounced in one state binding on others. This paper assessed the application of DNA barcoding of bushmeat in prosecution of wildlife crimes in Kenya, Uganda and Tanzania. The study shows that in courts in the study areas, application of scientific technology or opinion to prove cases are inadequate. The study also examines the laws in the three countries to ascertain the legal readiness to embrace bushmeat barcoding as a scientific tool in the prosecution of wildlife crimes in the region. The study shows that in Uganda and Kenya the Evidence Act has placed the burden of proof in criminal cases, wildlife crimes inclusive on the state/prosecution to prove that the species poached is wildlife under section 104 of the Uganda Evidence Act. The burden of proving any fact necessary to be proved in order to enable anyone to give evidence of any other fact is on the person who wishes to give that evidence. And the required standard of proof is proof beyond reasonable doubt. Under section 105(b) of the Uganda Evidence Act the person accused shall be entitled to be acquitted of the offence with which he or she is charged if the court is satisfied that the evidence given by either the prosecution or the defense creates a reasonable doubt as to the guilt of the accused person in respect of that offence. This provision for this was further illustrated in the case of Uganda vs Dick Ojong [1992-93] HCIB 54. Where court held that in all criminal cases the duty of proving the guilt of an offence this provided for this was further illustrated in the case of Uganda Vs Dick Ojong [1992-93] HCIB 54. Where court held that in all criminal cases the duty of proving the guilt of the accused always lies on the prosecution and that duty does not shift to the accused person and the standard by which the prosecution must prove the guilt of the accused is proof beyond reasonable doubt except in a few statutory cases. Any legally acceptable doubt raised in court is always resolved to the benefit of the accused. This impacts on the prosecution of wildlife crime because in the absence of visible morphological features such as trophies, hair, hooves, smoked or sundried, bushmeat from antelopes are impossible to differentiate from goats meat, buffaloes from beef, warthogs and wild pigs from pork. In the absence of scientific proof courts in east Africa have always ruled that prosecution did not prove their case beyond reasonable doubt. The absence of Bushmeat DNA barcoding in prosecution has motivated the habitual wildlife criminals, commercial wildlife poachers in east Africa to poach while knowing that in the absence of visible morphological features the prosecution will miserably fail to prove their case beyond reasonable doubt. The provision of the law has frustrated the efforts of the wildlife crime law enforcement rangers who usually take their time going through a costly investigation processes. Whereas in Tanzania in an attempt to improve on the prosecution of wildlife crime, the state has shifted the legal burden of proof on the accused to prove that the species found in his or her possession is not wildlife or that it was acquired legally. The study also examined the professional capacity of magistrates, prosecutors and law enforcement rangers in the use of DNA bushmeat barcoding in wildlife crime prosecution. The study finally recommended training of magistrates, prosecutors and police on use of DNA bushmeat barcoding in wildlife law enforcement, and development of wildlife crime prosecutors manual.

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Integrating the concept of well-being into harbor seal (Phoca vitulina) conservation and captive care

Historically, conservation focuses on the scale of populations and species. However, there has been a growing awareness of the social and ecological key roles that individuals play. Further, concerns for animal welfare bring ethical attention. It is therefore no longer ethically nor practically cogent to ignore factors such as individual well-being in conservation design and monitoring. Drawing from a literature review and interviews with seal researchers, rehabilitation care-givers, and a veterinarian, we introduce and discuss well-being as a core concept for the conservation of harbor seals. We use a working definition of well-being as “integrity of form, function, the ability to strive and utilize one’s abilities” as a backdrop to this synthesis of the natural behavioral repertoire and characteristics of harbor seals. This definition can aid in decisions that concern coastal and oceanic environmental policy, laws that govern how humans treat marine mammals in captivity, rehabilitation, and in the wild, and in any actions that impact harbor seal individuals and colonies.
Sacred Forests of India: Ecological and Cultural Conservation

India contains thousands of community-protected forests, called sacred groves. Sacred forests or groves are sites that have cultural or spiritual significance to the people who live around them. These areas may also be key reservoirs of biodiversity. The sacred groves of India are shrinking or disappearing due to cultural change and pressure to use natural resources. Sacred forests often have associated taboos on the use of specific plants and hunting of animals within the area. These traditions can serve a conservation role. The size of groves varies greatly from very small plots (less than one hectare) to larger tracts of land. These fragments may represent the sole remaining forests in certain regions. Ethnographic research focused on the sacred groves of the Meghalaya region in northeastern India and the Western Ghats region of southern India, both biodiversity hotspots. Interviews were conducted with community residents to assess the status of groves and strength of cultural traditions in continued protection of the groves. Changing religious traditions and high demands for resource use have resulted in the reduction or loss of many groves, yet culturally protected sacred sites can still play a role as key biodiversity conservation areas if community conservation traditions are supported.

Payments for Ecosystem Services (PES) and the Implication for Poverty Reduction Among Pastoral Communities In East Africa

Payments for ecosystem services (PES) are designed as a tool for natural resource management and not for poverty reduction. However, given the high poverty levels in the developing world, it has been argued that PES can also contribute towards poverty reduction through the provision of cash flow, and as a means of household income diversification. Yet, little has been documented on the actual impact of PES on the poor, and empirical studies of PES targeting wildlife conservation in Africa’s rangelands are few. We used an integrated qualitative and quantitative research approach to evaluate the poverty impacts of PES schemes around a wildlife protected area in Kenya whose surrounding land is inhabited by predominantly poor pastoral communities, and to develop alternative plausible future scenarios for both wildlife resources and household poverty conditions. Preliminary analysis shows that PES payments account for 7% of total household income and 26% of the total off-farm income for participating households, and is particularly critical during periods of drought when livestock losses are large.
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A Paradigm Shift in Forest Management in Kenya: Enabling Local Communities to take their Place in a Narrow Window of Opportunity

Kenya's ever declining forest resources have been managed for about a century by the state in a top-down approach aimed specifically at excluding local communities. But a new law in the form of the Kenya Forest Act 2005 promises to completely overhaul existing stakeholder relationships. Through the mechanism of the newly introduced Community Forest Associations (CFAs), it is envisaged that forest adjacent communities will, for the first time, be engaged in legally-recognized forest management partnerships with the state. The new law is to be implemented within an implicit adaptive policy framework. Its lack of rigid implementation mechanisms means it is open to varied interpretation in a highly complex and contested environment. With reference to complex adaptive systems, an innovative analysis of CFAs using political ecology was undertaken to analyze their introduction and functioning. It was concluded that it is critical that boundaries of participation at all levels of governance are initially agreed upon by all the stakeholders given the narrow window of opportunity before conflicting beliefs become entrenched once more. Specific boundaries include questions of tenure, description of a forest-adjacent dweller, specific implementation periods and deadlines. Furthermore, conflict resolution mechanisms, the important role of women and literacy levels and capacity-building for negotiation were found to be vital for the success of the CFAs.

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Use of Principal Components Analysis to Assess Cultural Models of Land Conservation

The goal of this mixed-mode study was a deeper understanding of the diverse ways that stakeholders use cultural knowledge to understand approaches to protect working landscapes that are a mosaic of private and public properties. We applied principal components analysis to data from a survey instrument designed to measure validity of cultural schemas associated with the construct of “land conservation.” Survey questions were informed by in-depth qualitative interviews structured to identify the range of cultural beliefs and values that stakeholders express about diverse topics, such as land conservation, development, rural livelihoods, rural heritage, nature and community. We show how disparities between the two complementary analyses can help sharpen the cultural model approach, by stimulating a closer look at survey items that do not load as expected on principal components.

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Conservation of Grizzly Bears in a High Human Use Landscape

The persistence of grizzly bears in Alberta’s Kananaskis Country, represents a unique and successful model for maintaining grizzly bears in an area of increasing and diverse human activity. Research has informed managers and the public about the behavioural and biological requirements of bears in the region. Despite high levels of human activities, grizzly bears continue to persist and successfully reproduce in this landscape. The current management approach in Kananaskis Country comes from an evolving relationship between biologists, managers and the public, resulting in a genuine shift in values towards a grizzly bear conservation ethic. Guided by changing values and available science, land managers endeavour to maintain effective grizzly bear movement corridors at various scales around human transportation corridors, communities and facilities. These initiatives are increasingly supported by the public despite personal impacts and increased potential for interactions with bears. In an effort to mitigate human-bear conflicts, provincial agencies employ bear conflict specialists, attractants management, aversive conditioning programs, natural vegetation management and systematic area closures, as well as, public education and involvement. Increasingly, multiple interest stakeholders are becoming involved in the implementation and facilitation of monitoring, management and education initiatives. Regionally, interagency cooperation and coordination is also improving, resulting in more consistency in grizzly bear management actions.

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Estimating suitable habitat for Western Atlantic seahorses using ensemble niche models

Being exploited for international trade, and occurring in some of the ocean’s most threatened habitats, the life history of seahorses makes them particularly vulnerable to population decline. In order to manage a species effectively, knowledge of the target species’ geographical distribution and its habitat use is needed, but the survey data to describe species presence at every location in a landscape is rarely available. Therefore, ecological niche models are used to extrapolate, by relating species to environmental variables, beyond the locations where species presence is known. Here we address predictive distribution modeling for two seahorse species with largely sympatric distributions in the Caribbean: Hippocampus reidi and Hippocampus erectus. We obtained presence only data from the Ocean Bigrographic Information System and the Global Biodiversity Information Facility databases and 8 marine environmental (temperature, salinity, bathymetry, etc) layers. We then use an ensemble modeling approach to predict habitat suitability based on 4 different method/algorithms (Maxent, GARP, Aquamaps and a simple environmental envelope). The results address fundamental questions in seahorse conservation, such as, the location of suitable habitat for these Western Atlantic seahorse species, the identification of the environmental variables responsible for niche differentiation, and the extent to which existing protecting areas encompass suitable habitat for West Atlantic seahorses.
Optimizing Methods for Wildlife Monitoring Programs in Logistically Challenging Mountainous Areas

We designed a large-scale, long-term monitoring program for Olympic marmot (Marmota olympus), a species of conservation concern throughout its range across a logistically challenging, mountainous park. Our multiple-stage process of survey design accounts for the difficulty imposed by funding constraints and access to remote habitats. The Olympic marmot is endemic to the Olympic Mountains, Washington State. Although nearly all of its range is enclosed within Olympic National Park, declines and local extirpations of the species have been documented. We considered several possible alternative survey approaches, and proposed a monitoring program designed to reflect extinction-recolonization dynamics using presence-absence data. The sampling design is based on annual surveys of a set of at least 25 randomly selected clusters (closely located groups of sites) which constitute 1/3 of all known locations with records of current or historical occupancy by marmots. To detect potential new colonizations, the sampling is supplemented by sampling 15 never-occupied sites in appropriate habitat. The monitoring plan will be implemented in 2010. It provides a framework that park managers can use for assessing changes over time in Olympic marmot distribution across the range of the species. Our sampling design may serve as a useful case study for establishing monitoring programs for other species with clumped distributions in logistically challenging areas.

Intensive Exploitation of Amphibians by European Otter (Lutra lutra) and the Implications for Otter Conservation

Oppers, top predators of freshwater ecosystems, are food limited; thus, local species conservation plans should consider local food resources. We used scat analysis to assess seasonal changes in the diet of European otters inhabiting a mountain river in the Polish Carpathians (Bieszczady National Park). Although elsewhere in their range, otters feed mainly on fish, in our study area amphibians were equally important prey. Furthermore, in winter and spring, the frequency of occurrence of amphibians in scats (86% and 93% respectively) was significantly higher than that of fish (51% and 34%). In the fall, both prey groups were equally frequent (72%). Only in the summer were fish the staple diet of otters (90%), with amphibians present in 10% of scats. Three factors could explain seasonally high consumption of amphibians: i) fish availability might be temporally limited; ii) low water temperatures might increase the energetic cost of fishing in cold seasons, causing otters to minimize time in this activity; and iii) amphibians gathered in streams to spawn and hibernate constitute a readily accessible prey. This study raises the possibility that amphibian declines could negatively affect otters in cold, mountainous regions. The phenomenon of intensive otter predation on amphibians warrants further study.
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Conservation status of the Cuban population of Magnolia virginiana

Magnolia virginiana, a North American endemic was recently discovered in Majaguillar swamp, Matanzas, Cuba. This locality constitutes the southern record for this species. In this work, we make a census of M. virginiana in Majaguillar swamp, map the population, characterize their demographic structure, and identify main threats for this species in the locality. In Majaguillar, this species grows like shrubby trees forming large clusters. The mean diameter of the clusters is 3.06 m and the maximum diameter of is 18.83 m wide. The mean high of the clusters is 2.51 m but some single trunks may reach 9 m high and 52 cm of radio. During the survey, 245 clusters of plants were censed, 84 of them contain mature plants and 68 were constituted by sprouting of old plants damaged by fires. Only 57 plants show flowers and/or fruits during the sampling. The development of forestry plantations in the locality is leading to the invasion of species that are not native of this ecosystem changing the dynamics of this community.

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Using population biology to develop cost-effective translocations of Leucojum aestivum (Amaryllidaceae) in the valley of the river Po (NW Italy).

Plant translocations are a vital component in conservation biology of threatened species. However, successfully reintroducing a species needs preliminary long-term studies (PVA), and the lack of time or money could be a limitation in planning such efforts. The aim of this study is to develop a cost-effective study for translocation activities, using Leucojum aestivum L. (a threatened wetland species in Europe, due to the intensification of agriculture) as a case study. Our method aimed at inferring the typical population traits for the species, analysing natural populations spatially instead of temporally. In 2007, twenty-six populations of L. aestivum were identified in northern Italy. In each population, environmental conditions, the performance of plants (size and reproduction), the population size and density were determined. Germination features were studied in the laboratory. Population biology studies showed the following structure: seedling (50%), sub-adults (35%) adults (15 %), population size (at least 1000 individuals), density (2.6 plants/sqm). From this data we inferred the mortality of each stage: ca. 87 % between seedling and flowering plant and the typical size and density of the L. aestivum populations. Using these data, we are planning a translocation activity (restocking) in farmed areas that have recently been made available to experiment plant conservation activities (Corinat project funded by Lombardy Region, Agriculture Department).

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Acoustic communication in urban noise: the benefits of vocal adjustment for frogs and birds.

Urban areas continue to encroach upon the habitats of non-human species around the world. While urbanisation causes obvious changes to the physical structure of habitats, it also brings a marked change to the acoustic environment. Urban noise interferes with acoustic communication in species such as frogs and birds by dramatically reducing the distance over which their calls and songs can be heard (the active space). This may disrupt communication in diverse social settings from mate attraction to territory defence and predator warning, with wide-ranging consequences for individual fitness. Some urban songbirds can adjust the pitch, amplitude (loudness) and/or timing of their songs to make them more audible in urban noise, while one species of frog is known to call at a higher pitch in traffic noise. However, the benefits of these vocal adjustments are uncertain. Using mathematical models of the active space of frog calls and bird song in urban noise, I will demonstrate that calling/singing more loudly confers a greater increase in active space than calling at a higher pitch. Given the moderate metabolic cost of singing louder in birds, this may be the more adaptive strategy in this taxon. But the high metabolic cost of calling louder in frogs could limit chorus tenure and ultimately reduce breeding success. I conclude that vocal adjustments by frogs and birds in urban noise can only compensate partially for lost communication distance, and may come at a substantial cost.
Both science and conservation are often relegated to the margins of societal priorities and political agendas. For decades the Society for Conservation Biology has espoused the need to engage broader disciplines in conservation science, and large landscape scale conservation demands engagement of broad and diverse constituencies if core areas are to be protected and connected. The corporate sector is one such constituency that, from a biological conservation perspective, has yet to be fully engaged as an agent of positive change – in fact, most corporate social responsibility programs fail to include conservation in their sustainability conversations. How can we better inspire businesses to make biodiversity conservation part of their corporate bottom line? Two years ago, Patagonia Company, a private outdoor clothing entity, developed a new corporate conservation campaign known as Freedom to Roam to inspire far more and more diverse sectors of society - particularly influential businesses - to support wildlife conservation with their practices and resources. Freedom to Roam seeks to increase awareness and conservation of wildlife corridors and ecological connectivity conservation in response to continuing habitat fragmentation and as a climate adaptation solution. Today, the Freedom to Roam coalition includes a diverse array of partners from Walmart, and BP America to the Wildlife Conservation Society and Theodore Roosevelt Conservation Partnership. This presentation will not only convey the Freedom to Roam story to date but also describe core initiatives efforts to connect conservation science and stories with audiences of societal and political influence – thus making conservation a topic that matters.

Among marine mammals, odontocete cetaceans provide some extreme examples of highly stable matrilineal social structuring. The natal philopatry of both males and females exhibited by fish-eating killer whales in the eastern North Pacific is often cited as a unique example of such sociality in mammals. These whales are characterized as comprising closed maternal lineages from which effective dispersal has never been documented. However, even such apparently stable social systems may experience changes over time in response to critical changes in their ecosystem. The so-called southern resident killer whale (SRKW) population, consisting of less than 100 whales, has become the focus of much conservation and management concern in recent years. This population, typically described as consisting of three matrilineally-based social units (‘pods’), has been photographically censused on an annual basis for nearly three decades, providing a unique opportunity to examine temporal changes in the social dynamics of this long-lived highly social cetacean. Here we use this longitudinal dataset to assess changes in the social structure of the SRKW population at the level of both the individual and the matriline. Using both coefficients of association and novel Bayesian clustering methods, we quantify the stability of social affiliations within this killer whale population based on data from more than 1360 encounters, and 118000 high quality individual killer whale identifications. Inter-annual comparisons of social patterns from these photographic data demonstrate dramatic changes in the social affiliations of these killer whales within the last decade, coinciding with the most recent period of population decline. Moreover, pod-specific changes suggest differences in the social stability within pods. Understanding these social dynamics may provide insight into the influence of social structure on population demographics, and help identify critical changes in key anthropogenic and ecological forces driving such social changes.
The reefs of the Nicobar Islands in the Bay of Bengal were in the path of the tsunami of 2004. This provided a natural experiment to study damage to the reefs at varying distances from the epicentre. In 2008, we carried out a broad-scale benthic survey of coral communities by quantifying percentage cover of different benthic substrate categories and size-class structure of corals to understand (1) tsunami-related damage and subsequent reef recovery; (2) whether the damage to reefs varied between the islands; (3) response of corals to catastrophic destruction. We found that though the tsunami was most severe in the Nicobar Islands, damage to the reefs was minimal. Damage was greater in islands closer to the origin of the tsunami than those farther away. There were strong geographical trends in the benthic community structures between islands that are in proximity. An overall high percentage of live coral cover and high number of smaller individuals of corals highlight the inherent resilience of coral reefs to a natural catastrophic disturbance in the region sampled. The study forms a baseline for future studies and we outline the potential of reef recovery on a longer timescale.

The conservation of ungulate migration routes has received increased attention throughout the world, largely because the landscapes necessary to maintain migrations are becoming increasingly fragmented. Migration is a behavioral tactic that enables ungulates to circumvent resource shortages and perhaps ease predation risk. In southwestern Alberta's Crown of the Continent ecosystem elk herds are migrating from low elevation winter ranges to high elevation summer ranges seeking nutrient rich forage necessary for survival and successful reproduction. These traditional migratory routes of elk are being impacted by ever-increasing levels of resource extraction and recreational activity. For each collared elk (n = 114), location fixes are acquired every 2 hours, 24 hours a day, typically for 2 years if the elk is not harvested by hunters or a predator. Using this wealth of data, the migration linkage zones of elk are modeled to investigate the possible effects of human disturbance to the permeability of these zones. Identification of migration linkage zones provides managers with spatial data necessary to conserve landscape connectivity by using strategies such as restricting development, controlling human activity, or in the case of major highways, to provide safe crossing areas. The impetus for modeling and delineating elk migration and linkage zones is to promote towards management of landscape connectivity.

Unsustainable harvesting for the pet trade is a principal cause of declines in reptile populations. We assessed sustainability of harvesting chameleons in the East Usambara Mountains of Tanzania. Unsustainable harvesting for the pet trade is a principal cause of declines in reptile populations. We assessed sustainability of harvesting chameleons in the East Usambara Mountains of Tanzania. Although these species are protected under CITES Appendix II, insufficient demographic and socio-economic data are available to assess the effects of harvesting on population viabilities. Transects were established in or adjacent to forest, with the goal of spanning both ecological and socio-economic gradients including proximity to forest edge and human traffic. We observed 124 chameleons representing seven species with a clear separation of species depending on the habitat type surrounding each trail. The sex ratio of one species, Chameleo deremensis, differed greatly between juveniles and adults, with 60% of juveniles and only 9% of adults being male. Our results indicate that current harvesting levels of chameleons from the East Usambara Mountains may not be sustainable. Of particular concern were the low number of captures of Kinyongia matschei, an endemic species that has been recently identified, and the skewed sex-ratio seen in C. deremensis, a highly prized species in the international pet trade. We recommend continued monitoring of chameleons with possible revision of collection permits based on our data.
Conservation, captivity and whaling: a survey of Belize whale-watching tourist attitudes to cetacean conservation issues

With whale watching activities and associated expenditures increasing annually, governments in coastal countries have a vested interest in the growth and protection of cetacean populations and associated tourism. In 2007 and 2008, a survey investigating whale watchers’ attitudes towards cetacean conservation issues (e.g., whaling, captivity) was administered to volunteers at Blackbird Caye, Belize (n=166). The majority considered dolphins and whales to be under protected (37.1%) or only slightly protected (45.3%) and marine mammal conservation laws and policies to be very important (83.1%). Additionally, 94.4% opposed the hunting of whales and the majority of participants were against keeping dolphins in captivity (75.4% and 66.0% respectively). Furthermore, 91.9% of participants stated that they preferred to observe dolphins in the wild rather than in captivity. Almost three-quarters (70.2%) of participants felt that it was very important that Belize maintain a strong commitment to dolphin conservation. Additionally, 69.3% would actively boycott pro-whaling countries. More specifically, 83.8% stated that they would boycott Belize if the country supported whaling, which has implications for Belize’s policies at the International Whaling Commission. Basing future policies and decisions on the environmental attitudes of visitors can further secure the country’s tourism potential and the viability of species populations.

Climate change impacts on past and future ecosystems: Using Paleoeclimatology and Bioclimatic Envelope Modeling to Guide Protected Area Planning and Management

Understanding how species respond to past and future environmental change and what drivers dictate the structure and function of ecosystems are crucial questions for protected area managers. Paleoecological studies can help discern between natural and anthropogenic drivers of ecosystem change, and are the only empirical information available to examine ecosystem responses to climate change at the rate and magnitude projected using general circulation models (GCMs). When coupled with bioclimatic envelope modeling and GIS, a better understanding of how well species species in a protected area can be inferred at both the individual protected area and systems level. This paper discusses research using paleoecology and bioclimatic envelope models to understand the ecology and distribution of the endangered Garry oak ecosystems of western Canada. A multi-proxy approach using paleoecology and bioclimatic envelope modeling is used to assess the extent of Garry oak ecosystem change and to determine if the level of protection under future climate scenarios is sufficient for Garry oak to persist. The results of this study are being used in the evolving management plans for the Gulf Island National Park Reserve of Canada and Garry oak ecosystem management as a whole.

Boreal Forest Logging Affects the Bumble Bee-Flower Relationships in Adjacent Unlogged Stands

Boreal forests face mounting logging pressures, yet we know little about impacts of logging on the pollination community. This study extends research done one year before and after logging, to consider its longer-term effects. We censused bumble bee and flower communities 8-9 years after experimental logging. Harvest treatments left 0%, 10-20%, 50-75%, or 100% of the original trees after logging. Bee abundance, flower visitation rates, and floral resources were quantified as flower abundance, but deviated from an IFD when resources were quantified as nectar production rate. Bees in unlogged forests adjacent to logged forest deviated from an IFD by “undermatching” (i.e., too few bees in the best patches, too many in the poorest ones) when resources were quantified as nectar production rate. Bees in unlogged forests adjacent to logged forest deviated from an IFD by undermatching. Unlogged forest appears to be negatively affected by the presence of logging in adjacent forests, in that numerical responses of bees to flowers are altered, with implications for bee foraging success and plant pollination service. Forest reserves should therefore incorporate buffer zones when adjacent to logged forest, to preserve the bee-influenced pollination community inter-relationships.
Small scale fisheries by-catch and the marine aquarium trade: a case study of seahorses in Sri Lanka

Currently very little attention has been paid to understanding the importance of by-catch fisheries as a source of species for the marine aquarium trade. While this is a relatively minor component of the overall trade it can be locally important and may also have significant local conservation implications. In Sri Lanka, small-scale push net fishers have been a major source of live seahorses for the aquarium trade. Information on catch rates, historical trends, fisher perceptions and trade data was collected through interviews, catch inspections, and a logbook system. The number of seahorses caught fluctuated seasonally, with importance to fishers varying by location, season, and abundance and price of both seahorses and target species. Since the listing of seahorses as CITES there has been a sharp decline in the demand for wild caught seahorses among middlemen and exporters in Sri Lanka, primarily due to difficulties in obtaining export permits. However, despite the decline in demand, significant numbers continue to be caught in push nets and the lack of an economic incentive has reduced interest among fishermen in keeping them alive. In the future, increasing value of small scale fisheries by-catch through a sustainably managed trade of live seahorses may increase conservation interest among fishers and allow better monitoring and management of seahorses in Sri Lanka.

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Approaches To Conservation Of Biodiversity And Northern Ecosystems In Oil And Gas Projects: Lessons From Sakhalin II Project, Russia

The Sakhalin II Project (Sakhalin Island, NW Pacific) is one of the largest integrated oil & gas projects in the world. Construction occurred during 1998-2009. Activities for conserving biodiversity and Northern ecosystems within the footprint of the Project included: (1) baseline surveys (with an emphasis on biodiversity, protected areas and sensitive habitats) before construction; (2) development of EIA and mitigation measures for key biodiversity interests (including (a) re-routing of offshore and onshore pipelines to avoid impact on Western Gray Whale feeding areas and onshore colonies of protected dunlin and Kamchatka tern, and (b) postponing construction activities during the nesting period of endangered Steller’s Sea-Eagle and other bird species); (3) regular monitoring of biodiversity and sensitive areas (wetlands, protected areas) during construction phase; (4) monitoring of critically endangered Sakhalin taimen; (5) implementation of Biodiversity Action Plan and Environmental Monitoring Project during operational phase; and (6) stakeholder engagement through (a) regional Biodiversity Working Group, and (b) Sakhalin Salmon Initiative for conservation of wild salmon spawning areas. These approaches allowed successful mitigation of impacts on important biodiversity interests associated with the Project.

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Uncoupling of seed availability and regeneration processes in endangered limber pine populations of Alberta

Limber pine (Pinus flexilis) is endangered at the northern limits of its range, primarily due to white pine blister rust that kills both adult and juvenile trees. Recovery plans in Alberta will require rapidly identifying populations where the capacity for natural population growth exists, and mitigation measures in declining populations. We tested the effects of infection level, seed production, and pre-dispersal seed predation on regeneration density in a heavily infected and a lightly infected metapopulation of limber pine. Differences in cone predation relative to blister rust levels were minor compared to the much greater production of cones in the heavily infected metapopulation. Greater seed availability did not result in better regeneration success, as the lightly infected metapopulation had 24 times more seedlings than the heavily infected population. Differences in cone predation and infection level, seed production, and pre-dispersal seed predation on regeneration density in a heavily infected and a lightly infected metapopulation of limber pine. Differences in cone predation relative to blister rust levels were minor compared to the much greater production of cones in the heavily infected metapopulation. Greater seed availability did not result in better regeneration success, as the lightly infected metapopulation had 24 times more seedlings than the heavily infected population. Differences in cone predation and infection level, seed production, and pre-dispersal seed predation on regeneration density in a heavily infected and a lightly infected metapopulation of limber pine. Differences in cone predation relative to blister rust levels were minor compared to the much greater production of cones in the heavily infected metapopulation. Greater seed availability did not result in better regeneration success, as the lightly infected metapopulation had 24 times more seedlings than the heavily infected population. Differences in cone predation relative to blister rust levels were minor compared to the much greater production of cones in the heavily infected metapopulation. Greater seed availability did not result in better regeneration success, as the lightly infected metapopulation had 24 times more seedlings than the heavily infected population.
Spatial and temporal dynamics of seed predation in the endangered limber pine

Red squirrels are a major cause of pre-dispersal seed loss in many species of masting conifers. Stands with varying combinations of conifers that have a 2-year (firs, spruce) versus 3-year cone maturation periods (limber pine), may produce large numbers of cones in different years (i.e. masting), and experience different amounts of cone predation by squirrels. We compared 17 populations that ranged from pure limber pine, to even mixtures of limber pine with either douglas fir, white spruce, or lodgepole pine. All non-serotinous species masted in 2007, and had low cone production in 2008 and 2009. Cone predation of limber pine averaged 80% in non-mast years, but was highly variable between populations, ranging from 0 - 100%. Preliminary analyses suggest cone predation, and squirrel midden proximity were not significant predictors. These findings suggest that limber pine may frequently escape seed predation by squirrels, by virtue of it preference for open and exposed habitats. This research will assist provincial recovery efforts in Alberta by identifying forest stand types that are most subject to seed limitation, and in need of mitigation.

Evaluation of small stream restoration over two decades: strategies for success in wild trout conservation

In the past century, anthropogenic habitat degradation has led to range-wide salmonid declines. We examined the response of wild trout to reach-scale restoration projects from 1989-2009 on private ranchlands in Blackfoot River Basin, Montana. We used a single-pass electrofishing catch statistic to examine population response of age 1+ native and nonnative trout to restoration on 16 streams. Four years post-treatment, total trout abundance across all streams had increased 56% from pre-treatment (p

A conservation agenda for the persistence of the world's mammals

2010, the international year of biodiversity, is the time of a global biodiversity balance-sheet. While the 2009 IUCN Red List of Threatened Species yields a negative balance, the world leaders, in signing the Convention on Biodiversity, have committed to stop this trend and obtain "a significant reduction of the current rate of biodiversity loss". Achieving this objective is impossible without a prior evaluation of the effectiveness of different conservation policies and the cost involved. Using the most recent and fine-scaled suitability models for all world’s terrestrial mammals, a land-use change model, and data on the opportunity cost of conservation actions globally, we simulate the likely consequences of different scenarios of land-use change and reservation policies on the persistence of all terrestrial mammal species until 2050. Our analyses allow us to answer four important questions: 1) What will be the status of the terrestrial mammalian fauna in the future with different scenarios of land-use and climate change assuming that no further conservation takes place? 2) Which prioritization method performs best in minimizing species extinction under which scenarios of climate change, land-use change and budgets? 3) For each conservation policy, what total budget would be necessary to meet a given conservation objective for reducing species loss under plausible conditions? 4) How does this budget change with different assumptions regarding climate and land-use change?
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**Using GIS to model Cook Inlet beluga whale critical habitat parameters at the Anchorage, AK land-sea interface**

The Cook Inlet beluga whale (Delphinapterus leucas), one of five discrete US beluga whale populations, was listed as Endangered under the US Endangered Species Act in October 2008. The proposed critical habitat designation for this genetically distinct population is currently being assessed. The goal of this project is to define preferred habitat parameters using Geographical Information Systems (GIS) for the area of Cook Inlet in closest proximity to the city of Anchorage (Knik Arm). Cook Inlet is a hotspot for both near shore development and offshore natural resource exploration and extraction. Modeling preferential habitat use patterns in this area can provide valuable insights into habitat features and environmental conditions most likely to coincide with beluga whale presence. The habitat parameters modeled are sea ice cover, bathymetry, and proximity to anadromous streams and other food sources. Beluga whale presence data were collected from shore via theodolite tracking. Understanding habitat preferences is vital to inform marine spatial planning efforts that simultaneously optimize shoreline and offshore development as well as facilitating the recovery and conservation of this iconic species.

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**Mechanisms of faunal recovery during forest regeneration and the conservation value of secondary forests: Atlantic forest small mammals as a model**

Despite the regeneration of part of deforested areas in the tropics, old-growth forests are still being lost, leading to the secondarization of remaining forests. The impacts of such process are poorly known, and, as well as the value of secondary forests for conservation, remain the focus of much controversy. Regeneration apparently favors forest specialist animals while negatively affecting habitat generalists, but no conceptual model has been proposed to explain this pattern of faunal recovery. By sampling 27 sites in a continuous Atlantic forest area, we assessed the effects of regeneration, and of the structure of the forest floor and food availability, on the distribution of forest specialist and habitat generalist terrestrial small mammals. We found a decrease in generalist species accompanied by a more subtle increase in specialist species in old-growth areas, mainly explained by changes in food availability. These results are congruent with the successional niche mechanism, a trade-off between competitive ability and ability to use abundant resources: while habitat generalists benefit from increased productivity in younger forests, forest specialists are able to occupy old-growth areas where food is scarce. The less pronounced negative effect on specialist species compared to the proliferation of generalist species indicates the potential value of secondary forests for conservation, especially for the restoration of highly fragmented biomes as the Atlantic forest.

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**Melanesian Geo: A Grassroots Publication Dedicated to Regional Biological and Cultural Diversity**

Melanesia, a globally significant region with incredibly rich biological and cultural diversity, is both one of the most threatened and yet intact tropical regions on Earth. Until recently, there has not been a platform devoted to discussions of regional biological and cultural diversity (e.g., Australian Geographic, Canadian Geographic, etc.) where Melanesians could share their experiences and research with others facing similar situations across the region. Melanesian Geo now fills this gap; it is a grassroots publication that focuses on the people and environment of Melanesia. Based in the Solomon Islands, by combining a mixture of journalism, creative writing, and local storytelling, Melanesian Geo raises the awareness of environmental and social issues affecting the people and ecosystems of Melanesia. With a focus on local researchers and writers, it provides a unique forum for regional dialogue that is fostered by, and accessible to, Melanesian decision-makers. Online availability focuses on local researchers and writers, it provides a unique forum for regional dialogue that is fostered by, and accessible to, Melanesian decision-makers. Online availability provides access to an international audience, and with 7 issues published to date, Melanesian Geo exemplifies a successful grassroots initiative. By bringing together a variety of voices related to biological and cultural issues, the journal has both empowered local actors and raised regional awareness of issues with clear global significance.

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**Why endangered species are essential to proper ecosystem management**

The Cape Sable seaside sparrow is a Federally-listed Endangered Species that lives entirely within the Everglades ecosystem of southern Florida. The Everglades are the southern end of a watershed that flows out of Lake Okeechobee, whence, the water flows into Florida Bay. Immediately south of the Lake is an extensive area of sugar cane production, made possible be extraordinary agricultural subsidises, and which massively pollute the areas downstream. Being downstream, the Everglades are particularly vulnerable to the vagaries of water deliveries through structures built and operated by the Army Corps of Engineers (ACE). Their most memorable sound-bite: “We can keep the Everglades alive on life-support forever.” The sparrow lives in wetlands that dry out during its breeding season of March through June. ACE’s unprecedented flooding during the breeding seasons of 1993 to 1996 halved the sparrow’s population. Continued, highly artificial water deliveries have kept the sparrow numbers in serious jeopardy. The Fish and Wildlife Service reduced its determination of Critical Habitat to exclude those areas damaged by this flooding - and is being sued as a consequence. The central theme of this talk will be the power of endangered species in requiring proper ecosystem management and ecological restoration based on ecological principles, not political expediency.
Sustainable Management of the Boreal Forest by the Emulation of Natural Disturbances

Fire has been the main natural disturbance that shapes the structure of western boreal systems in Canada by maintaining a mosaic of successional stages and influencing the spatial distribution of species. Different types of legacies that persist from the pre-disturbance state contribute over time to recovery processes following disturbances. Consequently, different harvesting practices, such as variable retention harvesting and prescribed burning, are being implemented to emulate the effects of fire on the landscape as a management approach for maintaining biodiversity and preserving ecosystem integrity. Our research is focused to explore and better understand how these practices affect the diversity and composition of ground-dwelling arthropods and provide management recommendations to the forestry industry that best maintain biodiversity in the mixedwood boreal forest. Results suggest that the application of different harvesting practices as surrogates of fire disturbance are promoting and maintaining arthropod diversity on the landscape and thus meeting conservation and sustainability goals.

Effects of Motorized Access Closure on Elk Habitat Selection and Movement

Rapid industrial development for resource extraction and associated road construction into formerly road-less areas has greatly increased motorized access in Alberta. Roads are known to negatively affect elk in a variety of ways including displacement from habitats and disrupting movements. Managing motorized access using road closures is a commonly proposed mitigation approach which attempts to allow resource extraction while minimizing impacts on wildlife. However, it is unknown how disturbance-sensitive wildlife, such as elk, will respond to changes in access which are sometimes temporary and where the physical attributes of the road remains intact. We used a 45-day forestry closure to examine how elk would respond to a short-term access closure. During this short period, the response by elk was mixed. We used resource selection functions to document that during the closure elk selected more open habitats with higher forage values and decreased selection for cover. However, movement metrics and straight-line distance avoidance of roads remained unchanged. Our results suggest that elk can respond quickly to changes in access relative to certain aspects of their habitat selection. However, this short time period was not sufficient to negate avoidance behavior. Our results provide evidence that gating roads may be an inexpensive way to mitigate their impacts on elk ecology.

The Challenge of Translating Academic Science into Regulatory Practice

There is a common perception that a major impediment to the implementation of the habitat provisions under SARA is the federal government's inability to effectively translate science into policy. While it is true that implementation of the Act has been much slower than desired thanks to major challenges (which will be discussed), policy is not one of them. In fact, one contributing factor has been the reluctance of academics and recovery team members to use SARA as it was designed to be used, rather than expecting the Act to adapt to scientific and other ideals. Furthermore, the recovery of species at risk will depend as much upon other factors, such as community participation, than just on the products of science. SARA has the power to be a useful tool for the recovery of species at risk in Canada. I argue that scientists can be more effective in their contributions to recovery planning if they assist in the development of products that meet the needs of SARA rather than expecting SARA to change.
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**Title:** Climate change, connectivity and wildlife disease

Climate change is exacerbating the negative impacts of habitat fragmentation on the ecological integrity of landscapes. Conservationists have come to view ecological connectivity as a potentially powerful climate-change adaptation strategy, one that is being promulgated across the Western US, and in site-specific management efforts throughout the world, through a suite of new wildlife policies such as wildlife corridors and assisted migration. While connectivity conservation presents enormous opportunities for climate-change adaptation, the serious implications of wildlife-disease transmission have yet to be addressed. We will discuss attempts to fill a critical gap in understanding potential effects of connectivity-enhancing strategies on wildlife diseases in one of the most important to be addressed. This research is important for developing guidelines for incorporating disease considerations into decision support systems for connectivity planning-such as those being used in the implementation of the Western Governors' Association Wildlife Corridor Initiative.

P2.146 Pocewicz, Amy*; Kiesecker, Joseph M.; Jones, George P.; Copeland, Holly E.; Daline, Jody; Mealor, Brian A.; The Nature Conservancy, University of Wyoming, University of Wyoming; apocewicz@tnc.org

**Evaluating whether existing conservation easements have reduced development and maintained biodiversity**

Conservation easements are the primary tool used to restrict development and achieve conservation goals on private lands, but empirical evaluations of their effectiveness are lacking. We compared sagebrush ecosystem biodiversity and recent rates of change in road and structure densities on properties with and without easements held by The Nature Conservancy in Wyoming, USA. To distinguish easement effects from biological or management-related differences, properties were stratified by residential development pressure and property managers surveyed about management. We found that easements resulted in less development and positively influenced biodiversity. In areas with high development pressure, easement properties were less impacted by structures and tended to have fewer, less-developed roads than properties without easements. Easements in these areas also had increased use by some wildlife species relative to properties without easements. Development pressure had a significant effect regardless of easement status in some cases, including higher cover of exotic plant species and fewer mammal burrows in high pressure areas. There were no significant differences in land management practices, but managers of properties with easements tended to seek land stewardship support more often than other managers. Given the importance of easements and the significant financial investment being made, it is essential to continue to evaluate whether easements are effective elsewhere.

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**Adaptive Co-Management in Policy and Practice: The Issues of Context and Fit**

Adaptive co-management is a marked departure from past rational-comprehensive models of conservation and natural resources management. It brings together the ongoing learning and experimentation dimensions of adaptive management with the linking spirit of collaborative management to engender an approach characterized by pluralism and communication, shared decision making and authority, connections within levels and across scales, and capacity to adapt and change. The potential of adaptive co-management to enhance the social-ecological resilience makes its transference to different places and circumstances often desirable. This paper argues that attention to context and a problem of fit are critical when professionals are contemplating applying adaptive co-management as a policy and/or practice. A framework is offered to assist professionals with these considerations. Its utility is illustrated by considering two distinct case studies - a recreational or sport fishery in Ontario, Canada and a shell fishery in Oita, Japan. Closing reflections stress the need for care and forethought when considering application of adaptive co-management.

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**Landscape features influence postrelease predation on endangered black-footed ferrets**

Predation can be a critical factor influencing recovery of endangered species, although influences of predators are not always sufficiently understood to allow prediction of predation risk. We investigated whether landscape features could be used to model predation risk from coyotes and great horned owls on the endangered black-footed ferret. We used movement and mortality data of reintroduced ferrets from three sites in South Dakota and two landscape analyses to determine whether 1) exposure to landscape features associated with predators affected survival of ferrets and 2) ferrets considered predation risk when choosing habitat within the hunting range of owls or near coyote corridors. Exposure to areas near owl perches reduced ferret survival, but coyote movement corridors and electric fences had no appreciable effect on survival. Ferrets were located within the hunting range of owls more than would be expected at random in two sites. Densities of coyote corridors near ferret locations were no different than expected at random in all three sites. These results suggest that repatriated black-footed ferrets selected resources based on factors other than predator avoidance. We demonstrated that considering an easily quantified landscape feature (i.e., owl perches) can enhance success of reintroduction efforts for black-footed ferrets. However, development of predictive models and management strategies is not necessarily straightforward for all predators.
Quantifying Avian Species' Spatial Relationship to Landcover Heterogeneity in Southern Ontario

Although considerable research has examined the factors limiting species' ranges at local and continental spatial scales, less attention has been granted to the relationship between species' spatial distributions and landscape attributes at regional or landscape spatial scales. Since land management decisions are often made at these scales, understanding what features of the landscape maintain biodiversity is critical to the effective implementation of conservation strategies. This research investigates the spatial relationship between landcover heterogeneity (Ontario Land Cover - 1991-1998; 8 landcover types) and avian species' distributions (Ontario Breeding Bird Atlas - 2001-2005; 60 species) in terms of spatial boundary overlap. Boundary analyses (detection and statistics) were performed and tested using a randomization procedure. A positive and significant spatial relationship was found between landcover heterogeneity and avian distributions at the regional scale; the mean distance from avian to landcover boundaries was low and the direct spatial overlap of the two boundary types was high. These results have implications for conservation efforts in southern Ontario, and show that boundary analysis can effectively quantify ecological boundaries and could be used as a tool in conservation planning. Future research should focus on assessing the spatial relationship between landcover heterogeneity and avian distributions for different functional and taxonomic groups.

Woodland caribou habitat selection: A comparison of indigenous ecological knowledge and western science habitat modeling approaches

Woodland caribou (Rangifer tarandus caribou) are federally listed under the Species at Risk Act in Canada and are declining throughout their distribution. There is a growing need for an effective approach to integrate indigenous ecological knowledge (IEK) with western science to inform woodland caribou recovery plans. To test the hypothesis that IEK and western scientific approaches are equivalent, we compared predictions of resource selection function (RSF) models with habitat models derived from IEK. Winter RSF models were developed with data from 10 GPS collared caribou in the territory of the Taku River Tlingit First Nation (TRTFN) in northern British Columbia. Habitat suitability index models were generated with data from semi-directed interviews with TRTFN hunters and elders. Both models indicated caribou select for low elevations pine-lichen complexes and had high classification success. The RSF model also revealed that caribou avoided areas in the proximity of human activity and roads. Comparison of habitat rank between the two models established that the IEK model predicted higher habitat quality in areas near human developments. Thus, IEK reflects historical caribou habitat but does not include the cumulative effects of modern human activity. Our results suggest IEK could be used to identify baseline conditions necessary for caribou recovery. This approach has the potential to promote new methods for defining habitat recovery goals across northern Canada.

The REDD mechanism: new opportunity or disaster?

This paper explores the feasibility of achieving socially acceptable REDD projects. It shows that beyond a widely accepted rhetoric that emphasizes local participation and rights over access to resources, it is necessary to formally address the political economy of resource degradation and right violations. Strong regional and global tendencies to resource capture and social marginalization have already been identified as the key processes that could transform the REDD mechanism into a social and environmental disaster. Managerial tools like social standards and procedures for certification are currently being developed to tackle these issues, but can hardly be expected to address them at large scale. By translating concerns over access to resources into local indicators that mostly relate to the subsistence economy, these tools suggest that technical or managerial solutions will suffice to design efficient REDD projects. Against or in complement of this approach, this paper argues in favor of less planning and managerial efforts, and for the development of legally binding simple rules that explicitly address political economy issues at global scale. Such rules could be, for example, the channeling of REDD payments to communities having historically constituted use rights over the resources in question.

The Serra do Urubu is a complex of Atlantic Forest fragments, located in Northeastern Brazil. Ten globally threatened bird species are found there. Due to the high numbers of threatened and endemic birds, it is considered by BirdLife/SAVE Brasil an Important Bird Area for priority action. Despite this richness in diversity, the regional level of poverty is very high and remaining forests are being exploited, especially for charcoal production. In 2007 SAVE Brasil initiated a program to communicate the biological importance of the region to the local community. The program trained a group of 30 teenagers to act as disseminators of the Serra do Urubu conservation importance to the general public. It showed that to effectively conserve the Serra do Urubu it is important to involve the community in the process of conservation, to target various audiences, to maintain a continuous process of education, and to establish a strong relationship based on trust and understanding with the local people. An Education Center was established to work with concepts, values and conservationist attitudes. To date, the educational activities involved about 860 participants. The group of teenagers is crucial to the activities proposed on the center, because they developed a feeling of responsibility for the local natural resources and their conservation. They inspire and motivate the community to preserve the Serra do Urubu biodiversity, and will hopefully continue to do so for future generation.
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Fitness-related habitat suitability modeling indicates extreme nationwide fragmentation of suitable breeding habitats of endangered raptors

We used fitness-related species data in habitat suitability modeling (HSM) to quantify the suitable breeding habitats of two endangered raptors in Finland. The study design based on a unique nationwide data set consisting of confirmed breedings of the Golden Eagle (Aquila chrysaetos) and the Peregrine Falcon (Falco peregrinus). We used presence-only nesting site data and 14 explanatory variables from five environmental factor groups (climate, topography, land cover, human impact and habitat connectivity) to construct Maxent models at the resolution of 2 x 2 km (n= 83 423). We found that the Golden Eagle avoids strongly human altered landscape and favors coniferous forests in topographically variable landscape. The distribution of the Peregrine Falcon is most correlated with highly connected open peatlands. The suitable breeding habitats of the Golden Eagle and the Peregrine Falcon were observed to be extremely fragmented in Finland. Inclusion of land cover variables to HSMs improved model performance and revealed the extreme fragmentation pattern of suitable nesting habitats. Our findings suggest that disregarding land cover in HSM would produce an overoptimistic figure of the breeding habitat of the raptors which in turn may cause a significant source of error in broad-scale conservation planning. Our results highlight the importance of preservation of the currently unprotected suitable habitats to ensure the long-term survival of these raptor populations.

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Bird-friendly Light?

Millions of birds are affected by artificial light emitted from offshore installations they encounter during migration each year. Many are attracted and disoriented by the lights, causing collisions and exhaustion resulting in death. Because safety requirements or technical design rule out switching off these lights, new solutions are needed. Our idea was to investigate the effect of changing the spectral composition of the light on bird reactions. In 2003 we did a pilot study at the North Sea coast during autumn migration with colored filters in front of light sources, which showed that nocturnal migrants react stronger to white and red light, compared with blue and green light. Based on these results and a literature survey, we hypothesized that the red part of the spectrum (575-650 nm) causes most problems for migrating birds, and developed new light types containing less red, whilst still ensuring safe working conditions and good visibility for humans. We tested these light types in the field and found a positive correlation between the relative intensity of red in the spectrum and birds’ reactions to the light sources, independent of total light intensity. The mechanisms underlying these results still need further investigation, but we already managed to develop a commercially available light type that may be defined as (more) bird-friendly.

SY42 Posewitz, James; Orion The Hunters' Institute; cinnabar@bresnan.net

Embedding a Conservation Ethic in a Human Culture

When the Europeans settled the North American Continent there was little sign of a conservation ethic among the people. Following the American Revolution and formation of the United States, the unrestrained exploitation of natural resources produced environmental and human disasters of continental proportion. In 1871 the Peshtigo Fire in the Great Lakes Region claimed 1,500 human lives. In 1910, the Big Burn in the Northern Rockies took 3 million acres in two days sending ash and smoke as far as Greenland. The Dust Bowl of the 1930s sent the soil of North America s Great Plains eastward to the Atlantic and coated the decks of ships 300 miles off shore. In the wake of these disasters a conservation movement was born. Initially it came from a few enlightened East Coast patricians as the 19th Century closed and the 20th unfolded. Conservation was an idea brought by enlightened leaders and distributed from the top down in American society. Following the Great Depression of 1929, the idea and responsibility for conservation passed to the people where it prospered, grew strong and restored wildlife abundance to an entire continent.

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Optimal monitoring for conservation

As the impact of humans on biodiversity continues, and attempts to ameliorate those impacts mature, the ability to accurately and efficiently monitor the response of biodiversity to impacts and management interventions is assuming ever-greater importance. In this talk we call for a new approach to monitoring research: a systematic exploration of the ability of different kinds of monitoring to support decision-making in an effective and cost-efficient manner. To date optimization in the field of monitoring has been dominated by either fixed budget. This traditional approach is flawed because the objectives are inadequate. More recently there has been increasing interest in trading-off Type I and Type II errors. In this paper, we move beyond these approaches and argue that more real world issues: management objectives, the size of the management budget, and the costs and benefits of monitoring are fundamental to formulating the right optimal monitoring problems. We describe and review the essential components of a new research program in optimal monitoring that starts with the definition of a quantifiable objective. We illustrate our case with diverse examples ranging from monitoring iconic mammals, to optimal choice of indicator taxa, to optimal active adaptive management. We show how mistakes are made when objectives are trivial, wrong or unstated.
\textbf{P1.202} Pouliot, D*; Masse, D; Samson, C; Paradis, S; Parc national du Canada La Mauricie, Agence Parcs Canada, Agence Parcs Canada; Claude.Samson@pc.gc.ca

\textit{Evaluation of survival and dispersal rates of translocated juvenile wood turtles in La Mauricie National Park of Canada}

One of the largest populations of Wood Turtle (Glyptemys insculpta), a threatened species in Canada, is located in the Shawinigan River Watershed (SRW), partially located within La Mauricie National Park (LMNP) borders. Despite the presence of suitable habitat, only a few observations of turtles had been reported within the park. A restocking program, involving the translocation of juveniles, has been developed in LMNP to increase the local population. Before implementing the program, a pilot study was conducted to evaluate the effects of translocation on survival and dispersal rates of turtles. In 2006, 16 juvenile turtles (3-10 years old) were captured from the SRW outside the park and translocated to LMNP. The turtles were radio-tracked from May 2006 to October 2009. Survival rate during the active period (May-October) averaged 0.980 ± 0.020 (n= 309.4 days-contact per year), while dispersal rate averaged 0.928 ± 0.072 (n= 219.7 days-contact per year). Survival and dispersal rates of translocated turtles were not significantly different (p>0.05) from survival and dispersal rates of 47 juveniles radio-tracked in the SRW outside the park from 2004-2007 (survival: 0.887 ± 0.053, n= 1993.3 ± 876.5 contact days per year; dispersal: 0.960 ± 0.023, n= 1970.3 ± 870.6 contact days per year).

We conclude that, on a short term basis (4 years), the translocation did not negatively affect the survival and dispersal rates of juvenile Wood turtles in LMNP.

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\textit{Assessing The Need For Assisted Migration Of Artemisia californica In Coastal Sage Scrub Habitat}

The use of assisted migration as a conservation strategy to mitigate species losses due to climate change has recently been debated in the literature. While much of this debate has focused on moving species outside of their current ranges, less well considered are the consequences of, or potential need to move locally adapted genotypes of species within their current ranges. We summarize the literature on "genotype assisted migration" and present results from an empirical study characterizing the need for such a strategy for Artemisia californica, a foundational species of coastal sage scrub habitats in California. We examined geographic variation in the response to predicted climate change in five populations of A. californica across a four-fold precipitation gradient along 700 km of this species range. In a common garden experiment where we manipulated precipitation, we found clinal variation in ecologically important traits of A. californica, including growth rate and resistance to herbivores. This provides evidence of strong local adaption to climate across this species’ range, as well as extended consequences of this adaptation for A. californica’s associates. Consequently, we suggest that assisted migration of A. californica genotypes from south to north should be considered in habitat restoration plans. Implementing assisted migration during habitat restoration provides a unique opportunity to increase adaptive genetic variation of a species within its current range, particularly for populations at range margins.

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\textit{The source of mycorrhizal inoculum affects forest restoration}

The potential benefits of arbuscular mycorrhizal fungi (AMF) to forest restoration are widely recognized but the source of fungi used in restoration is rarely considered. I compared the growth and nutrition of tree seedlings (Inga spectabilis) planted into heavily and weakly degraded tropical pastures that were inoculated with AMF from either heavily or weakly degraded soils. Despite small geographic distances between heavily and weakly degraded soils in this study, I found that AMF communities from these different sources differed in both their taxonomic composition and in their impacts on host plant performance. One year after transplanting, Inga spectabilis originally inoculated with AMF from heavily degraded soils were significantly larger than controls and those given AMF from weakly degraded soil. Moreover, AMF from heavily and weakly degraded soils improved host plant growth more when combined with their resident soil type, providing evidence that AMF are adapted to their soil of origin. These findings suggest that efforts to restore native forest could be improved by using mycorrhizas from more heavily degraded soils and by nurturing mycorrhizal associations in their soil of origin.

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\textit{A framework for incorporating patch dynamics into conservation planning}

Patch dynamics, or spatio-temporal changes in physical and biological characteristics, have received most attention in terrestrial ecology but have also been studied by marine scientists. Ways of incorporating patch dynamics into conservation planning are, however, poorly explored, despite the important implications of these dynamics for the persistence of species. We present a two-part framework for building patch dynamics into conservation planning. First, data and analyses are needed to identify and understand patch phenomena: real-time data to which managers can respond at temporal scales of days or weeks; time-series data that allow planners to understand the key parameters of dynamics of interest; and simulations that project dynamics into the future and allow planners to explore uncertainty and the potential effects of climate change. The second part concerns planning responses. A vital step toward planning for patch dynamics is to identify explicit patch-related objectives for individual conservation areas or whole systems of conservation areas. From the manager's viewpoint, these can relate to either disturbance (e.g. fire, coral bleaching) or resources (e.g. rainfall, marine chlorophyll) and, ideally, to the organisms that respond to these changes. Objectives allow planners to review the effectiveness of existing systems of conservation areas and to apply theory and empirical testing to design expanded systems of conservation areas that achieve objectives.
Limitations of global prioritizations for conservation, and ways of minimizing them

Global prioritizations to guide conservation investments first became prominent in the scientific literature in the early 1980s. Since then, many different data sets and analytical methods have been applied to the problem of where in the world to spend limited funds and time to most effectively arrest the loss of biodiversity. All of these approaches have had limitations, some of which arise inevitably from the necessary extent and resolution of the analyses. These limitations have restricted the relevance of global prioritizations to conservation actions at regional and local scales. We review six limitations here and suggest ways of minimizing them in the future. The limitations are: 1. the very coarse spatial resolution of assessments that prioritize whole ecoregions or similar units; 2. the lack of explicit conservation objectives in studies that have analysed patterns of rarity, richness and threat; 3. the absence of testing of predictions about the best way to achieve objectives with limited resources; 4. the lack of socio-economic considerations in many prioritizations; 5. the tenuous relevance of many global-scale data sets to conservation activities on the ground or in the water; and 6. the lack of effective protocols for linking global, regional and local prioritizations by downscaling and upscaling information.

Use of bioclimatic models to identify refugia and conservation prioritization in a changing climate

Current and past conservation strategies were largely developed under an assumption of a stationary climate. These strategies may fail with changing climates, especially when acting synergistically with existing anthropogenic pressures. The Wallace Initiative is a global effort to rapidly assess the potential impacts of climate change on nearly 100,000 plant and animal species using biodiversity data from the Global Biodiversity Information Facility (GBIF) and the maximum entropy (MaxENT) algorithm to develop models of their current distribution. Climate change data from the Community Integrated Assessment System (CIAS) is then used to look at different future scenarios from multiple General Circulation Models. Governments and conservation organisms have dedicated extensive time and resources to protect a substantial proportion of biodiversity. As the climate changes these investments at risk? Should biodiversity conservation efforts and targets now be modified to take into account a dynamic climate? To assess this, we used models of more than 65,000 plant species to calculate projected changes in percent species richness. These data were then combined with data on current threats to develop a pilot technique for setting conservation priority areas in the Amazon region. These areas included potential refugia (based on habitat changes) as well as areas where adaptation efforts may have to be intensified.
Toward Effective Critical Habitat Policy: Framing the Issues

Simple in theory but complicated in practice, critical habitat is (or is becoming under the Canadian Species at Risk Act (SARA)) the most contentious requirement of North American endangered species legislation. Though SARA requires that critical habitat be identified within 1-2 years, in cooperation and consultation with others, to the extent possible, based on the best available information, and ultimately legally or effectively protected from destruction, these provisions have been variably interpreted and inconsistently applied by different communities of practice. There is a clear need to do a better job at identifying and protecting critical habitat, lest the necessity become optional through legislative amendment or simply rendered ineffective through either extreme or insignificant application. Improvements may be had by appreciating different societal perspectives on the general problem. Is there sufficient information? Which habitats are really critical? What are the best protection mechanisms? How can efficacy be evaluated? Systematic consideration of multiple viewpoints—cultural, economic, legal, philosophical, and scientific—may be necessary if critical habitat outcomes are to be both ecologically beneficial and workable on the ground.

Population Fragmentation and Inter-area Movements of Grizzly Bears in Western North America and Creating Options to Adapt to Climate Change

Population fragmentation of grizzly bears in western North America has been reported on a small scale however, because grizzly bears range so extensively and are susceptible to excessive human-caused mortality, a multi-regional understanding of the extent of fragmentation is needed to fully understand the problem and its potential solutions. We carried out an extensive fragmentation assessment over ~1,000,000 km2 across their distribution in the northwest US, Alberta, and much of British Columbia, Canada. Our analyses used ~3040 genetically sampled, and 639 radio collared bears. Clustering methods detected fragmentation and resulting sub-populations and individual migrant detection determined density of fragmentation using genetic assignment methods and radio and GPS telemetry. We found extensive fragmentation in southern BC, Alberta, and NW US and present a map depicting a female-fragmented metapopulation with abundance estimates of subpopulations. We identify small isolated, at risk subpopulations to large regional source subpopulations. This fragmentation related to patterns of settlement, traffic, and mortality. We discuss whether our results depict a functional anthropogenic metapopulation or a stage in the progression from panmixia to isolated populations to extinction. This fragmentation will be exacerbated by climate change, and we conclude future metapopulation function will only result from appropriate management ultimately allowing ecological adaptation.

The effect of anthropogenic noise on the distribution and abundance of urban songbirds

Songbirds use vocal communication for mate attraction, territory defense, and reproduction. These functions are potentially perturbed in the presence of chronic anthropogenic noise. The noise produced by traffic, which spans the frequencies of many bird songs, is particularly prevalent in cities where many songbird species have exhibited marked population declines. Some songbird species are known to increase the pitch of their songs near roads, presumably to avoid masking by traffic noise. We hypothesized that variation in this ability among species is likely to correlate with their abundance in urban areas. We tested this idea by estimating the abundance of four species of songbirds, two species that are prevalent and exhibit highly variable vocal patterns, and two species that have declined in urban areas across North America and exhibit less variable vocal patterns. We distributed sampling sites along a gradient of anthropogenic noise in Edmonton, Alberta. After accounting for variation in vegetative structure, our results indicate that the abundance of the two common species was unaffected by noise level, whereas the abundance of both declining urban species was lower in noisier areas. We suggest that anthropogenic noise exacerbates habitat loss to contribute to the decline of some songbird species in urban areas.

Design and Management of Ecological Networks to Optimize Biodiversity within Agroforestry

Agroforestry production dominates many South African landscapes, with agroforestry companies controlling more than 1.5 million hectares. Mitigation measures are being sought to reduce the impacts of agroforestry on the local environment. Ecological networks of remnant natural ecosystems particularly grasslands, are such a mitigation measure. These networks aim to stem biodiversity loss and to maintain ecosystem processes. The South African forestry industry has already allocated 500 000 ha, one third of the plantation holdings, as ecological networks among and within timber plantations. However, little scientific research is available on the effectiveness of these huge ecological networks for biodiversity conservation and maintenance of natural ecosystem function, although initial findings are encouraging. Results show that although there was marginally greater diversity and greater habitat quality outside the ecological networks, many groups and species are using these ecological networks. Furthermore, 250 m corridor width appears to be a fairly robust figure for the minimum size of an effective corridor, provided high habitat quality is retained.
Interdisciplinary work in ecosystem management research

Ecosystem management (EM) is an interdisciplinary field within the broader area of ecology. It addresses environmental problems by supporting and promoting practices that cross disciplinary divides. The work presented here presents an evaluation of EM researchers’ definitions of interdisciplinary work, as well as their understandings of interdisciplinary practices in order to better situate EM work in the broader context of interdisciplinarity in science. We identified key EM researchers using a modified systematic review process, resulting in a set of 119 on-line questionnaire responses followed by a targeted set of 15 key-informant, semi-structured telephone interviews. Results indicate that researchers differ on the terminology used for interdisciplinary research however, they share a common understanding of what interdisciplinary research is, both a “way to do research” and a “way of thinking about research”. Differences between researchers suggest that there is a growing interest in developing deeper engagements with theoretical discussions of interdisciplinarity taking place outside their own EM field. Results are discussed in the context of the contributions that the theories of interdisciplinary science can make to solving environmental problems.

Conservation and reclamation in the mineable oil sands: adapting policy and regulations to emerging knowledge

This presentation will introduce the regulatory context in which oil sands mines operate, and discuss how new knowledge is affecting emerging policy, regulations and practices specific to reclamation. Extensive and intensive disturbance of the natural boreal landscape occurs during oilsands mining. Requirements for reclamation after disturbance are at times prescriptive such as those that govern soil salvage and placement criteria, whereas others are outcome-based, such as the condition that reclaimed lands be capable of supporting self-sustaining locally common boreal forest ecosystems. Mine operators are required to articulate long term plans through life of mine closure plans and related planning documents and to report annually the details of on the ground conservation and reclamation activities which reflect the particulars on how closure and reclamation plans are implemented. To assist in this process, several guides, manuals and frameworks for reclamation have been developed and are continually revised. Whereas the current process provides flexibility and adaptive management opportunities in developing acceptable reclamation and closure options throughout the life of a mine, it can result in challenges in defining measures of reclamation success at the time of certification.

Is the Critical Habitat Beast Hamstringing Endangered Species?

Is the Critical Habitat Beast Hamstringing Endangered Species? Critical Habitat is perceived by the Canadian federal government and by some environmental groups as being a key component of recovery for Threatened and Endangered species. But the Species at Risk Act requirement to designate Critical Habitat has been met with suspicion and open resentment amongst rural communities, industry groups and provincial governments. This has interfered with progress on voluntary stewardship initiatives which, in the past, have been the most successful way to achieve conservation and recovery for species at risk in Alberta. Critical habitat designations and the expectations associated with “Effective Protection” of Critical Habitat, have led Canadians down a road to the use of litigation to guide decisions and policy. This presents a fundamental shift away from the stewardship approaches previously used for species at risk and for wildlife management in general. Critical Habitat may be best implemented when "Effective Protection" is clearly described upon designation.
The fate of endangered interior Fraser coho salmon caught incidentally in a First Nations pink salmon beach seine fishery in the lower Fraser River.

We used radio telemetry to monitor migration success in endangered interior Fraser River coho salmon (Oncorhynchus kisutch) following incidental capture in a First Nations beach seine fishery for pink salmon in the lower Fraser River, British Columbia. We also evaluated the use of a novel reflex assessment technique (RAMP - Reflex Action Mortality Predictors) for measuring the condition of fish at release and for predicting migration success following a bycatch event. Fifty interior coho salmon were radio tagged and released following incidental capture. Their post-release movement was monitored by fixed-station radio receivers throughout the Fraser watershed (i.e. from tagging site to natal sub-watersheds).

We also blood sampled an additional 50 coho in order to profile physiological condition at time of release. In total, 4.8% of coho caught died immediately, while 12% of tagged individuals were categorized as short-term mortalities (i.e., died within 72 hrs of release) and 26% were long-term mortalities, based on tracking data post-release. Time entangled in fishing gear had a strongly predictive of immediate mortality, while reflex impairment effectively predicted long-term post-release mortality - individuals with greater reflex impairment at release exhibited higher rates of migration failure. Future studies are needed to quantify natural en route mortality in the absence of fisheries interactions and to develop strategies for reducing mortality of coho incidentally captured in seine nets.
In 2003 Madagascar made an unprecedented commitment to triple the surface area of protected areas throughout the country in an effort to conserve its unique biodiversity and essential ecosystem services. Implementing this commitment involved creating a new legal framework, selecting sites, establishing resource use rules, and developing governance arrangements. The Ankenihney-Zahemana Corridor (CAZ) is among the most advanced in its establishment as a protected area. Having received temporary protected status in 2005, CAZ is a functional Category VI protected area. Relying on key principles of good governance such as transparency, monitoring, and clear rules, multiple partners have worked to develop a co-management system that involves stakeholders at various levels. We describe the partners involved, as well as the co-management structure, its role and its adaptability to a changing context. Progress to date is promising but challenges such as low local capacity for protected area management, communication difficulties due to weak infrastructure and a vast geographic area, and the multitude of participating actors with varying roles remain. In addition, the recent political upheaval in Madagascar has had catastrophic effects on natural resources in much of the country, but the co-management arrangement at CAZ has proven to be resilient against outside interests.

**Physical and Chemical Characteristics of Water in the Mogi-Guaçu River, SP, Brazil**

Seasonal characterization in surface water quality is important for evaluating inputs of anthropogenic or natural sources. The aim of this study was to evaluate the seasonal influence in water quality between Cachoeira de Emas dam and Jaguari-Mirim mouth in the Mogi-Guaçu river. Collections were carried out from April 2003 to September 2004 in two sites of Mogi-Guaçu river. The measured variables were temperature, dissolved oxygen Secchi transparency, electrical conductivity, pH, alkalinity, hardness, nitrate, total phosphorus, inorganic phosphate, total phosphate, nitrite, silicate, ammonium and pluviometric precipitation. Principal component analysis (PCA) point out the main indicators of water quality that allowed evaluating the situation of quality of the Mogi-Guaçu river in the sampled sites. The results indicate seasonal influence between two sites due to pluviometric precipitation upon the limnological variables dynamic, especially as to inputs and dilution of nutrients in the system.

**Jaguar Presence in the Mexican State of Puebla, central Mexico**

Despite the importance of jaguar existence in the state of Puebla in Central Mexico, its presence and distribution is unknown. We determined the presence and distribution of this felid within the state, as well as determine its relation with human populations in the area. Data was gathered by studying maps to determine places with topographical characteristics and towns that were named after predators; surveys among Government offices, non-governmental organizations, Ranchers Associations and local communities were made, also camera traps were set in order to determine jaguar presence. Six towns and 2 geographical aspects with reference to Tigers were found within the state. Twenty seven government and local ranchers associations were asked for information on big felids, 3 of them had information on jaguar. Out of 105 surveyed people, 60 answered; gathering 98 felid-mentions, from which 23% corresponded to jaguars, 19% to pumas, 12% to ocelots. Confident jaguar reports were gathered from northern Puebla. Camera trapping proved the existence of ocelots and other medium and small carnivores. There were different jaguar representations within the state especially when comparing northern Puebla to other areas. Despite the lack photographic evidence, reports from several years indicate the possibility of vagrant individuals. We conclude that Puebla has two important corridors for Jaguar and other species, one along the Sierra Madre Oriental and another one connecting the latter with the Sierra de Occaso. We expect that further development of this project will help to delimit the principal areas.
Natural and anthropogenic sources of forest disturbance affect the habitat use of bats. Using Anabat II bat detectors we investigated the effects of a recent infestation of spruce beetles (Dendroctonus rufipennis), forest fire, and logging, on the habitat use of bats (Myotis lucifugus) in the southwestern Yukon. In general, bat activity was greater in beetle-affected forests, less in burned, and least in logged forests, but this depended on proximity to water and time of year. This pattern may be explained by increased predation risk in open areas near solstice or roost abundance, but could not be explained by temperature, wind speed, avoidance of clutter or insect abundance. In beetle-affected forests, bat activity was not significantly affected by density of dead trees, canopy closure, or time of year. However, bat activity was inversely related to tree density which may imply that the eventual thinning of trees caused by tree mortality may benefit bats.

Human impacts of compensated exclusion from protected areas: lessons from the establishment of the Derema Corridor, north-eastern Tanzania

The establishment of a conservation corridor between forest reserves in the East Usambara Mountains, Tanzania, involved excluding hundreds of small-holder farmers from the area and paying monetary compensation for their livelihood losses. Through a combination of qualitative and quantitative social research methods, the social impacts of the intervention and the livelihood responses of affected people were investigated. The results suggest that a failure to unambiguously identify rights-holders to resources in the area, inadequate commitment and follow up by the involved conservation agencies, and limits to the agency of local actors in the arenas of decision-making where the conditions of conservation and compensation were negotiated contributed to the unpredictability of the process and its outcomes, which were mostly experienced as negative. Many of the affected rights-holders, especially women, were not compensated for their lost assets. The poorest people were among the most affected whereas few wealthy people received the largest compensations and were able to invest in improved livelihoods. Clear definitions of local rights to resources coupled with fair and timely compensation, inclusive mechanisms for participation, and a sustained presence and commitment of the conservation agencies, are seen as pre-requisites for forest conservation interventions involving compensated human displacement that are to avoid negative social consequences to the affected people.
Boreal Forest Caribou in Canada

Caribou are among the most challenging elements of boreal forest biodiversity to conserve, owing to factors such as the species' inherently low reproductive capacity, association with older coniferous forests, and naturally low densities. Listed as threatened across Canada and in most corresponding jurisdictions, caribou have become a symbol for the conservation of this biome. In spite of mounting scientific consensus regarding the relationship between anthropogenic disturbance and caribou population persistence, the progress on the recovery front has in most cases not extended beyond planning. The persistence of many boreal forest caribou populations appears incompatible with the ongoing pace of industrial development, as illustrated by the poor condition of those contending with resource extraction activities within their ranges. Maintaining the current stronghold of this wide-ranging species in the northern parts of its range will be an important test under scenarios of an expanding resource extraction mandate and a changing climate. This presentation will review the status of this ecotype in Canada, exploring its utility as a conservation tool to guide the management of cumulative effects in sensitive northern boreal forest environments.

Integrating Indigenous and Scientific Knowledge to Improve Amazonia’s Management: NDVI, Traditional Activities and Bushmeat Species

A scientific expedition to the Venezuelan Amazonia was carried out in June 2009. It was focused on the integration of scientific technologies and methods with traditional and local knowledge held by indigenous communities, in order to implement an integrative approach to the conservation of Amazon rainforest. The scientific approach was based on generating a map of vegetation types using NDVI layers. To do this, we obtained 218 layers (03/2000-03/2009) from the MODIS sensor. The layers were aggregated in periods of two months to improve their quality. Unsupervised classification and subsequent similarity analysis were carried out on these maps and an optimal number of 16 classes of NDVI were obtained. Six indigenous communities were visited to check whether these NDVI classes have a meaning for indigenous people. They identified, on maps, those territories used for hunting, fishing, and agriculture activities, and also the location of some relevant wildlife species, mainly peccary, deer, agouti, curassow, and tapir. The human activities and peccary and deer were significantly linked to concrete NDVI classes. Finally, the NDVI maximum has been declining along the last 9 years, mostly in the upper classes. Results evidence that it is feasible to integrate indigenous and scientific knowledge in a common endeavor to manage and preserve biodiversity, and to enhance indigenous capability, in the Amazonia.

Evaluating Collaborative Conservation: A Framework for Early Assessment

Not all collaborations are created equal. Nor should they be. In this paper, we define collaborative conservation as multi-party projects, programs, or decision-making processes that use a participatory approach to achieve conservation objectives. Research in collaborative conservation tends to establish generic evaluation criteria against which cases are assessed yielding mixed assessments. Given the variable conditions under which collaboration takes place, we suggest evaluations of collaborative conservation should be tailored to the local context and that a set of evaluation criteria be considered prior to parties engaging in collaboration. To this end, we propose a framework of factors that can shape the outcome of collaborative arrangements. These include: rationale for collaboration; goals and objectives; representativeness and inclusion; timing of engagement; type of engagement; support mechanisms; and benefits to participants. We demonstrate how the weighting of these factors varies according to differences in leadership or support for collaboration. We propose that sensitivity to differences in leadership and influential factors can improve chances of achieving desired conservation outcomes and encourage researchers and/or evaluators to become more directly involved in the collaboration process.
Rural residential development is currently the fastest-growing land use in the U.S. Conservation development has emerged as a promising strategy for minimizing the ecological impacts of rural development and protecting biodiversity on private lands. Widespread adoption of this approach requires development regulations that allow flexibility in site design to achieve conservation objectives and encourage management activities to protect ecological resources over time. We examined county development codes in 11 western states, and of 414 counties, 32% had at least one ordinance that establishes guidelines or creates incentives for conservation development. Rates varied widely among states, ranging from two counties (6%) in New Mexico to more than half of counties in Washington and Colorado. We reviewed these regulations on the basis of their conservation objectives, breadth of applicability, and guidelines for ecological site analysis, protected area design, protected area management, and developed area design. In addition, we investigated various factors that might explain the adoption and rigor of conservation development regulations, including recent land use change, county demographic characteristics, planning capacity, and state enabling legislation or model ordinances. We demonstrate the development patterns likely to result from typical design guidelines and conclude with recommendations for how regulations could be improved to increase the conservation value gained from conservation design.

Do different spatial scales of timber harvest disturbance affect dynamics of snowshoe hare population fluctuations?

Disturbance scale affects the disturbance's influence on ecosystem function. In sub-boreal British Columbia conventional timber harvesting typically leaves small clearcuts (40-200 ha), creating landscapes with spatial configurations different from those following fires (patches 500 ha). From 2001 through 2007 we monitored abundance of snowshoe hares (Lepus americanus; fecal pellets counts), a species selecting regenerating disturbances, and their obligate predator, lynx (Lynx canadensis; scat deposition rates and snow tracks), a species with home range similar in size to fire-created patches, in three landscape types (2,000 ha each): (i) conventional harvesting; (ii) extensively disturbed (> 80% burned or cut in last 40 years); (iii) no stand-replacing disturbance in last 70 years. Only in the extensively disturbed landscapes did hare density change significantly between years (0.6 to 2.3 hares/ha, similar to a cyclic increase, peak and decline), and exceed the apparent threshold for boreal lynx reproduction of 0.5-1.0 hares/ha. Hare abundance was consistently higher in conventionally harvested and undisturbed landscapes. At a landscape scale appropriate to lynx home ranges, patch size of disturbance affects hare population dynamics. Conventional timber harvesting seems to dampen the amplitude of population change, possibly by enhancing mortality by generalist predators.

Climate change impacts on Pacific salmon have far-reaching ecological and economic consequences given their pivotal role in freshwater, terrestrial and marine ecosystems and their importance to human communities. Predicting these impacts is complicated by obstacles to downscaling coarse-grained climate models to salmon watersheds, resolving uncertainties in climate change scenarios, and understanding mechanistic responses of salmon and their habitats. Timing traits are likely to face strong, potentially conflicting selection pressures as the optimal periods for migration, spawning, emergence and growth shift with abiotic and biotic changes in freshwater and marine environments. We developed an individual-based model to explore demographic consequences of plastic and evolutionary responses in timing traits for different salmon life histories, under a range of scenarios. We characterized climate-induced selection for a generalized coho (Oncorhynchus kisutch) life history, and applied this model to several US and Canadian watersheds, for which downscaled projections of changes in temperature and flow profiles under a range of climate scenarios were available. Preliminary results suggest that phenotypic responses might facilitate persistence in some populations and regions, whereas extinction is unavoidable for others. Our model provides a flexible tool to explore how evolutionary and ecological processes interactively affect salmon persistence in a changing climate, ultimately informing management actions.

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Landscape heterogeneity and fragmentation may reduce the abundance and dispersal of animals. One mechanism may be the reluctance of animals to cross areas of non-habitat. This idea has been implemented in management strategies to limit the spread of pests. We investigated the extent to which forest harvesting affects the local distribution of three species of bark beetles (Scolytinae) by trapping beetles near and far from harvest edges in both intact forests and harvested ones (clearcuts and thinned stands). Fewer beetles were caught in clearcut stands than in adjacent intact forests, but there was no effect for thinned stands. However, beetles captured in clearcuts had more fat than those in intact stands. Moreover, the number of beetles captured in harvested areas likely underestimated the local abundance because the likelihood of encountering traps is expected to be low because of movement paths and pheromone dispersion. We also did not detect a build-up of beetles at the forest edge. Thus, although our beetle captures generally supported the idea that dispersal is reduced through non-habitat, clearcuts were not an absolute barrier particularly to individuals with greater energy reserves. The same reduction in dispersal across non-habitat areas may have different implications for pest species and those at risk, and should be considered in forest management.

Protected areas and indigenous lands already declared in the Amazon, are covering approximately 333 million hectares (≈ 53, 7% of the area evaluated), their level of implementation is extremely variable. We evaluated the hectarage of 204 different ecological systems (NatureServe, 2008) in regards to their viability, threat levels and coupled this information the efforts governments and communities are devoting to effective management (i.e. planning, governance and resources). We focused the analysis on both, the representation of terrestrial ecological systems that naturally occur in Amazon basin and how effectively managed they are, on these reserves and communal lands. We found that 40% (83) of ecosystems captured by reserves can be considered to reach a 10% threshold for effectively conserved area, using the VMT scoring system. The effectiveness is lower in areas considered under higher risk of climate change and human disturbance, mostly in eastern Amazon at the "Brazilian deforestation arch" and at the foothills of the Andes, the Tepayes in Venezuela and Beni savannas in Bolivia.
Treating Policy as Hypothesis: An evaluative framework for assessing success of biodiversity conservation strategies

In Ontario, the Crown Forest Sustainability Act (CFSA) requires forest managers to emulate natural disturbance as a mechanism for conserving biodiversity and ecological processes. The intent of the CFSA is implemented through landscape and stand level Forest Management Guides. In this presentation I will discuss stepwise development of an evaluative framework based on focal songbird species to test whether new forest management guidelines are successful in meeting these conservation objectives. We selected 13 focal species associated with the range of natural variability in forest structure as our “songbird community bioassay” for assessing success of conservation strategies, and then developed resource selection functions, forest harvest simulations, and natural disturbance simulations to project the effect of alternative management polices and practices on the focal songbird community. In this “virtual” assessment we found that some spatial harvest planning strategies that focus on conservation of moose and aquatic reserves performed poorly relative to planning strategies that reflect more natural disturbance processes. We then present a field-level monitoring strategy that treats policy as hypothesis, and is designed to test whether the management options now incorporated into the Forest Management Guides has been successful in conserving forest songbird biodiversity.

Impact of differing release strategies on the long-term survival of a reintroduced population of an endangered New Zealand passerine.

Reintroduction is a commonly used tool in the recovery of endangered species, and has been an important component of the conservation of the endangered endemic passerine, the hihi or stitchbird (Notiomystis cincta) in New Zealand. Previous studies, in hihi and other species, have examined the impact of a variety of release techniques on short-term survival of individuals in the post-release phase. However the impact over longer term periods is rarely looked at, despite an increasing awareness of the impacts of chronic stress associated with reintroductions. This study examined the effect of two differing release strategies - immediate and delayed release - on the survival of reintroduced hihi over a six-month period at a mainland restoration site. Results indicated that while there was no difference in short-term survival, delayed-release birds had lower long-term survival probabilities than those released immediately. This suggests delayed-release strategies have a considerable adverse effect, and I recommend they not be used again with hihi.
Mapping the margin: Comparing marginal value of tropical forest remnants for ecosystem services

Nature supports human livelihoods and economies in countless ways. These ecosystem services powerfully link conservation and human well-being, with promise to expand the constituency, and funding, for conservation. Fulfilling this promise, however, requires scientific information that directly informs specific conservation and policy decisions. Which habitat patches, for example, provide the highest marginal value of services in a landscape? Such information can help target and optimize conservation investments to meet needs of people and biodiversity. Here we use a simple tool for modeling and mapping ecosystem services, InVEST, to predict the marginal value of different forest remnants in a Costa Rican agricultural landscape. We use crop pollination services as a model, and use InVEST to estimate the value of forest patches in supplying wild pollinators to surrounding coffee fields. We then simulate the destruction of each patch in turn, and calculate the resulting reduction in coffee production throughout the landscape. We find that forest remnants vary several-fold in marginal value. Valuable remnants are often, but not always, attractive also for biodiversity conservation. Conservation will therefore involve both win-wins and tradeoffs, but understanding both can help optimize investments to improve biodiversity and human well-being.

Habitat Fragmentation on the Genetics of Two Typical Calcareous Grasslands
Calcareous grasslands in Central Europe are semi-natural communities with high species richness originated by sheepherding. Recent land use changes caused a decline in the number, extent, and connectivity of fragments. We selected two calcareous grasslands from the Southern Franconia Alb in Germany to investigate whether habitat fragmentation had an effect on the genetic diversity and structure on populations with contrasting population size and connectivity. Twenty-nine populations of Diambus carthusianorum and nineteen populations of Anthyllis vulneraria distributed over the landscape were analyzed with seven and eight polymorphic microsatellites. For both species, population size was significantly correlated with allelic richness (r = 0.7 p

Patagonia Inc and the Story of Freedom to Roam

The power of storytelling is an untapped asset in advancing conservation biology. The best science means little if it cannot be relayed as a story and used to inspire change. There is a growing disconnect between the scale of mounting conservation challenges and societal will to address them. We need to find new paths to achieve conservation success or the next great extinction crisis may be the story of our own demise. Sustainability is a core value Patagonia Inc and our founder Yvon Chouinard said it was our Sacred Trust with the planet. In 2008, Patagonia launched an innovative conservation effort known as Freedom to Roam to advance wildlife corridor conservation and ecological connectivity. Freedom to Roam represents a new model for corporate social responsibility and is comprised of a coalition of people, businesses, conservation and recreation groups whose goal is to bring awareness of connectivity conservation to the forefront of public understanding. Much knowledge has been generated by the conservation science community during the past two decades on connectivity. Yet, somehow this knowledge has had limited penetration into the din of public discourse. How can we move the conversation of connectivity to the person on the street and into the corridors of power? This is the story of Freedom to Roam.
In spite of greater bat species diversity in tropical forests, most work on forest and tree characteristics that are favorable to bats has been conducted in temperate forests. In February 2009, as part of a long-term study of roost selection that takes place during an undergraduate field course, we radio-tagged three Noctilio albiventris and two N. leporinus to locate their day roosts. We collected data in the same dry forest fragment as in 2005 and 2007, bringing the total radio-tagged Noctilio to 12. As in past years, all Noctilio roosts were located within 40 m of water and of the seven roost trees that were identified since 2005, four were occupied by bats tagged in 2009, indicating long-term roost occupancy in those species. Four of the roosts were in Terminalia oblonga which grow near water and form extensive cavities within their relatively small trunk (dbh < 0.8 m compared to 1.2 - 2 m for the other tree roost species). Because tropical forest composition is characterized by high tree species richness and low population densities, we expected that bats would select large trees without preference for species. Our results suggest that a `large size' of trees is not a sufficient indicator of the conservation potential of tropical forest fragments.

Due to incomplete knowledge about the myriad of species, structures and processes in forest ecosystems, conservation planning must involve the use of shortcuts. One possibility is to use the requirements of focal species as a guide for setting conservation and restoration targets. Woodpeckers (Aves: Picidae) have been proposed as potential focal species because of their dependence on attributes that are negatively affected by forest management. Based on large-scale field studies, we evaluated the usefulness of woodpeckers as focal species for forest biodiversity conservation across regions in northern Europe. Woodpecker species richness was positively related to forest bird diversity, as was the occurrence of specialized woodpecker species such as the three-toed (Picoides tridactylus), middle spotted (Dendrocopos medius) and white-backed woodpeckers (D. leucotos). Presence of the white-backed woodpecker was also related positively to the species richness of red-listed deciduous-forest cryptogams. The occurrence of specialized woodpeckers was positively related to forest naturalness and conservation value. Based on the woodpeckers' requirements for different types of dead wood and large trees, we suggest tentative targets for management which are expected to benefit threatened species sharing the same forest types. Our studies, together with similar findings from North American forests, suggest that woodpeckers may be a useful focal group for forest biodiversity conservation.

The consumption of marine mammal products drives tense global struggles over conservation, rights, and values. Since 1990, people in at least 106 countries have consumed the products of approximately 80 species of marine mammals. Most such consumption is poorly regulated, if regulated at all. Geographic remoteness and the migratory behavior and highly mobile character of most exploited marine mammals present both theoretical and practical challenges to ensuring that any use is sustainable. In seeking insights to inform governance institutions that better accomplish conservation goals, we first describe three broad categories of marine mammal procurement - Targeted, Non-Targeted, and Opportunistic. After assigning consumption patterns to these three categories, we focus on regions where consumption is related to food or economic security. Here, the transition from opportunistic or non-targeted to targeted procurement is contributing to what Read (2008) called a 'looming crisis,' a crisis requiring approaches to conservation that transcend a marine mammal-centric view of governance. Our results reinforce lessons learned for terrestrial harvests of wild meats, i.e. both the ecological needs of marine mammals and the local socio-cultural needs of people must be incorporated into governance institutions. This requires closer attention to why people might cooperate to both meet local human needs and accomplish global conservation goals, despite differences in worldviews.
Knowledge of how tree populations have responded to past climate fluctuations through migration, adaptation, and extirpation is key to properly understanding and managing species responses to current and future climate change, from both an ecologic and genetic perspective (1). My research involves simulating potential habitat of key tree species of western North America for several time steps since the last ice age. Also, subsequently comparing the modelling results with fossil and pollen data in will identify potential locations of species' glacial refugia, providing insight into migration patterns and genetic development of modern species-key responses to changing climates (2). To estimate past climate to 18,000 years ago (the Last Glacial Maximum), I have used back-predictions from the modeling results with the published genetic reconstructions based on field data, potential areas of geographic refugia have been isolated and reconstructions of the distinct genetic populations have been attempted.

P2.7 Roberts, David*; Hamann, Andreas; University of Alberta; d-ro@shaw.ca
Reconstructing Tree Species Habitat, Migration, and Genetic Diversity in Western North America Since the Last Ice Age.

P1.38 Robinson, HS; DeCesare, NJ*; Hebblewhite, M; Musiani, M; University of Montana, University of Calgary; nick.decesare@umontana.edu
Predator-mediated indirect effects of fire on caribou habitat in Banff and Jasper National Parks

Fire management is an important tool in the conservation of ecosystems in Canada's national parks. Both natural and human-induced fires can benefit certain species, while other species may be negatively impacted. We used GPS collar data for wolves (N=34), primary prey species (elk, N=11; moose, N=28) and a threatened secondary prey (caribou, N=40) and resource selection analysis to model the effects of fire on these species' habitat and interactions. Wolf distribution in the study area was driven by elk and moose densities, with spatially variable overlap among wolves and caribou. Our models demonstrated that fire may reduce caribou forage (a direct effect). Fire may also reduce caribou habitat quality by altering wolf predation patterns (an indirect effect). Overall, models showed positive effects of fire on habitat for both predator and primary prey, but a potentially negative effect on caribou. We therefore integrated wolf and caribou spatial models to delineate a spatial index of caribou "safe zones" (areas selected by caribou and not by wolves). While currently planned prescribed fires in Banff and Jasper were shown to reduce the area of favorable caribou habitat by 2%, they reduced the area of "safe zones" by 10%. Thus, conservation managers should account for the indirect, predator-mediated impacts of fire on caribou habitat in addition to direct effects of habitat loss.

P1.81 Rock, J. C.; Goodbrand, L.; Austin, D. A.*; Parks Canada; deborah.austin@pc.gc.ca
Nest exclosure use at Piping Plover nests in National Parks: evidence of a potential trade-off between enhanced productivity and nest abandonment.

Nest exclusions are widely used to protect ground nesting birds from predators. However, little information exists on their effectiveness as a means of protecting species at risk. Although exclusion use can improve hatch success, it is known to have resulted in adult depredation. We examined whether exclusion use affected nest fate (success, depredation or abandonment) of endangered Piping Plover within Kijik-Jujik, Kouchibouguac and Prince Edward Island National Parks from 1988 to 2007. Exclosure use improved hatch and fledge success by 26.7% 8.3% and 21.0 Å 6.4%, respectively and increased the number of chicks fledged per egg laid by 12 Å 4.5%. Exclosure use decreased egg depredation by 37.0 Å 5.2 % but increased nest abandonment by 10.3 Å 5.0 %. Thus overall, while improving productivity, exclusion use also increased nest abandonment. Circumstances surrounding nest abandonment were mostly unknown but in 10 of 152 cases, nests were abandoned because adults from exclosed nests were depredated. Predators are clearly the most important factor limiting productivity at these sites however the extent to which they influence adult survival and apparent abandonment requires investigation. During the study, egg loss to predators increased across years suggesting that predators will likely continue to be a key management issue for Piping Plover in Atlantic Canada. Before any new management strategies are adopted, they should be tested carefully for potential impacts and once in place, their efficacy should be assessed regularly.

SY41 Rodrigâ–guez, A*; Rodríguez, B; Estación Biológica de Doñana CSIC, SEO/BirdLife; airmis@eib.csic.es
Attraction of petrels to artificial lights in the Canary Islands

The extent and intensity of artificial night lighting has increased with urban development worldwide. The resulting light pollution is responsible for mortality among many petrel species that are active at night on their breeding grounds. We report light-induced mortality of petrels during a 9-year study on Tenerife, Canary Islands. A total of 9880 birds from nine species were found grounded, the majority of which were Cory's Shearwaters. Most grounded birds were fledglings (96%), which fall apparently while leaving their nesting colony for the first time. For almost all species, grounding showed a seasonal pattern linked with their breeding cycle. Certain phases of the moon influenced grounding of shearwaters, with the extent of grounding being reduced during phases of full moon. The ratio of fledglings attracted to lights to fledglings produced annually varied between species and years. Mean rates of adult mortality also varied between species. These light-induced mortality rates are of concern for petrels and small shearwaters. Thanks to efforts involving cooperation with human residents, 95% of grounded birds returned to the wild. To minimize this impact we recommend several conservation measures: continuing rescue campaigns, shielding upward radiation and reduction of light emissions during the fledging peaks. Furthermore, a monitoring program for petrel populations must be implemented, as well as further studies to assess the fate of released fledglings and continued research to address why petrels are attracted to lights.
**Global priorities for conserving mammalian evolutionary history**

Species are the most frequently used currency of biological diversity but they are not equivalent in terms of the amount of unique evolutionary history they represent, and that would be irreversibly lost if they became extinct. Phylogenetic diversity is a biodiversity measure that takes account of phylogenetic relationships (and hence evolutionary history) between taxa. The phylogenetic diversity contained in the species that exist today is part of the raw material on which future evolutionary processes will operate. Keeping these pieces is fundamental to leaving the options open for future evolution. Previous studies indicate that the phylogenetic diversity is being lost at a faster rate than expected from species loss, suggesting that conservation action may need to target evolutionary history directly. Here we present the first global assessment of the priority regions for the conservation of mammalian evolutionary history. The priority areas identified are driven by mammalian clades that are both highly restricted in space and are highly threatened as a group, such as the lemurs (Infraorder Lemuriformes) in Madagascar, the gibbons (Family Hylobatidae) in Southeast Asia and the golden moles (Family Chrysochloridae) in southern Africa.

**Assessing landowner interests in contracts and easement for endangered species conservation**

Global privatization and land tenure trends are making private lands more critical for endangered species (ES) conservation. Over 90% of ES in the U.S. rely on private lands for habitat, yet tools available for balancing ES conservation and development pressures remain limited (e.g., mitigation banking). Short-term ES conservation contract programs are being applied in the U.S., but little is known about landowner interest in such contracts or how landowner interest varies between contracts and easements of set lengths. We addressed this need with a survey of North Carolina Farm Bureau members (n = 735). We compared competing models for predicting landowner interest in ES conservation contracts, and found a 6 variable model including social responsibility orientation (SRO), acres owned and past enrollment in conservation programs best (wi = 0.66). Analysis of P coefficients suggested landowners with stronger SRO were less interested in ES contracts, while those with past enrollment in a conservation program were more interested. Landowners ranked ES conservation significantly lower in importance than other conservation activities. Contracts were preferred over easements for short durations (20 years).

**The Effects of Artificial Night Lighting on the Nocturnal Activity of the Terrestrial Red-backed Salamander, Plethodon cinereus**

As human development encroaches into natural habitats, artificial night lighting increasingly becomes an additional stressor for wildlife. Nocturnal animals are especially vulnerable to artificial night lighting (ANL), as physiology and behavior of these species has evolved in dark nocturnal environments. Studies exposing amphibians to constant bright light provide evidence for changes to normal metabolism, growth, and behavior, but few of these studies have used treatments of ANL comparable to that found in affected habitats. We examined the effect of ANL on the nocturnal activity of the terrestrial Red-backed salamander, Plethodon cinereus. Previous work using transects in a forested habitat found that salamanders emerged from under cover objects late when exposed to ANL than under natural dark conditions. In a controlled laboratory setting, we exposed salamanders (N = 16) to nocturnal illuminations of 1 lx, 10-2lx, or 10-4lx in a repeated-measures design: each salamander was exposed to each illumination for 10 d, and then the behavior of the salamander was observed using infrared cameras for one night. We predicted that salamanders would delay emergence and exhibit less activity under higher nocturnal light levels than under lower light levels. Based on the results of this study and previous research, salamanders delay emergence when subjected to ANL, suggesting a negative impact of ANL on time available for foraging and breeding.
Hotspots and predictors of biological diversity

Identifying regions of the world that hold high biological diversity is one of the main goals of conservation biology. Much debate and research focuses on how best such hotspots should be assigned. We study the species richness of seven taxa (amphibians, birds, mammals, reptiles, flowering plants, ferns, and conifers + cycads) of all World countries, to identify those with the highest species richness relative to expectations. We remove country area effects using linear regression and check for outliers based on prediction limits and residuals. We then add latitude, altitude, insularity and number of ecoregions in a country to the model and test their effects using a stepwise multiple regression procedure. We show that the hotspots identified may depend on the taxon used to identify them. Different predicting factors of richness likewise vary between taxa. Nevertheless, it is important to properly correct for area as it is usually the key explaining factor of species richness. We also found a significant positive relationship between countries’ average species richness and percentage of its protected areas. Overall we use a novel modeling approach in order to correctly identify regions which are species-rich and therefore of conservation concern. We also demonstrate the importance of using a multi-taxon approach for hotspot identification.

The Effectiveness of Interpretation in Altering Attitudes and Behavioral Intentions of Wildlife Watching Visitors in Tofino, British Columbia

Threats to the marine environment are considerable, yet marine conservation efforts in Canada and elsewhere languish, in part through the lack of public support. Marine tourism focussing on wild life viewing provides an opportunity to build public support for marine conservation, but theory suggests that the likelihood of influencing public opinion is higher if the wildlife viewing experience is directed toward influencing attitudes and behaviours toward marine conservation. This study focuses on whale watching tours in British Columbia. Questionnaire interviews with a random sample of 492 whale watchers provided data on interpretive information provided on tours, and visitor responses in terms of changes in conservation attitudes and behaviours. Just observing wildlife produced no significant changes in attitudes or behaviours; however, if interpretation was provided when wildlife was observed, significant changes did occur. Further, visitors indicated a desire to receive wildlife interpretation, but were not always satisfied with the level of interpretation provided by tour guides. These results suggest that there is a demand for interpretation in wildlife tours, and that interpretation can provide support for marine conservation. The study contributes to the emerging ecotourism literature, and provides suggestions for the training of tour guides and licensing requirements for tour guiding companies.

Mixed Concerns about Global Climate Change are Building Barriers to Natural Resources Conservation in the US Great Plains

Despite reports of overwhelming scientific consensus that global climate change is real and we are already observing impacts, there remains a lack of government action across the United States, especially in the Great Plains (GP) region. To examine what this means for natural resources conservation, we conducted a survey of government officials in twelve GP states. Responses from over 900 decision-makers represent state, tribal, and local governments. Results show barriers to government action include a lack of funding and leadership, and no sense of urgency; 52 percent of respondents indicate they are not concerned about climate change in general. However, respondents indicate they are concerned about possible effects of climate change on natural resources. For example, 64 percent believe climate change will have impacts on rainfall patterns for their jurisdiction; but 63 percent indicate they do not foresee any solution options to address climate change. These results highlight a need to reframe the discussion of climate change. By integrating climate change into relevant conservation issues that are already a priority for GP decision-makers, such as management of invasive species and water resources, decision-makers might overcome some of these barriers to government action.
The Global Distribution of Mammals
The habitat suitability models developed on the basis of the 2009 IUCN Red List of Threatened Species represent an unprecedented opportunity to extend and deepen our current knowledge on the distribution of the world's mammals. These habitat suitability models, developed inside each species' geographic range and based on land cover, human impact, elevation, and hydrological features, provide both an ecological characterisation and a fine-resolution estimate of the potential distribution of each mammal. Based on this dataset we conducted a global analysis of all terrestrial mammals to determine patterns of species richness, threat, endemism, and distribution of specialist vs. generalist species worldwide. We investigated the ecological and geographic patterns that underlie the observed difference between the area of geographic ranges and the area of suitable habitat for each, which can bias the perception of the conservation status of mammals and misdirect conservation efforts. Our results highlight the importance of an ecological perspective on species distribution in a world increasingly dominated by human-modified habitats.

Optimal allocation of conservation resources to species that may be extinct
Statements of extinction will always be uncertain because of imperfect detection of species in the wild. Two errors can be made when declaring a species extinct. Extinction can be declared prematurely, with a resulting loss of protection and management intervention. Alternatively, limited conservation resources can be wasted attempting to protect a species that no longer exists. Rather than setting an arbitrary level of certainty at which to declare extinction, we argue that the decision must trade off the expected costs of both errors. Optimal decisions depend on the cost of continued intervention, the probability the species is extinct, and the estimated value of management (the benefit of management times the value of the species). We illustrated our approach with three examples: the Dodo (Raphus cucullatus), the Ivory-billed Woodpecker (U.S. subspecies Campephilus principalis principalis), and the mountain pygmy-possum (Burramys parvus). The dodo was extremely unlikely to be extinct, so managing and monitoring for it today would not be cost-effective unless the value of management was extremely high. The probability the Ivory-billed woodpecker is extinct depends on whether recent controversial sightings were accepted. Without the recent controversial sightings, it was optimal to declare extinction of the species in 1965 at the latest. Accepting the recent controversial sightings, it was optimal to continue monitoring and managing until 2032 at the latest. The mountain pygmy-possum is currently extinct, with a rapidly declining sighting rate. It was optimal to conduct as many as 66 surveys without sighting before declaring the species extinct. The probability of persistence remained high even after many surveys without sighting because it was difficult to determine whether the species was extinct or undetected. If the value of management is high enough, continued intervention can be cost-effective even if the species is likely to be extinct.

Partitioning stand-structure attributes in landscape-scale inventory and monitoring surveys to characterize the status of forest sustainability
Characteristics and thresholds defining forest sustainability have been studied and debated for many years. Tangible indicators that provide an objective picture of the status of forest ecosystems are needed for practical applications. While some consensus has been reached in defining key elements of sustainable forest management, practical methods and metrics for assessing sustainability are few or lacking. We used landscape-scale inventory and monitoring data from the Forest Inventory and Analysis (FIA) program of the US Forest Service to examine some of the possible metrics to characterize sustainability. Using data from the State of Arkansas, USA as a case study we partitioned stand structure across this probability-based sample to determine amounts of forest land by arbitrarily defined stand attributes. For example, one key element in defining sustainability is the amount of forest land retained in large dimensioned, older stands. Less than 52,000 hectares (Â± 21,700 at 0.95 C.I.) of Arkansas' 7,284,600 hectares of timberland were in stands with a quadratic mean diameter (QMD) â 445 cm d.b.h., mostly as a result of past and continuing logging practices. The amount of large dimensioned older stands across the landscape needed to satisfy ecosystem sustainability goals is a difficult threshold to establish, especially given the conflicting social, political, and economic factors that need be considered.

Spatio-temporal dynamics in abundance of cavity-nesting Bufflehead and Goldeneye
The boreal forest, which provides key breeding habitat for waterfowl, is experiencing unprecedented expansion of industrial activities. Among waterfowl, cavity nesting ducks are the most vulnerable to human activities because of their specific habitat requirements. Our objective was therefore to examine how the spatial structure of Bufflehead (Bucephala albeola) and both Goldeneye (B. clangula and B. islandica) populations has changed over the last decades in the boreal forest, while accounting for both spatial and temporal autocorrelation in density estimates. To this end, we developed a hierarchical Bayesian state-space model using the USFWS' annual Waterfowl Breeding Population and Habitat Survey, which has taken place across western and eastern Canada since 1955 and 1990, respectively. We observed both spatial and temporal dependencies for the Bufflehead populations. While the population has increased in the last 50 years, most of this increase has occurred in northern Manitoba and Saskatchewan outside of the region recognized as the core breeding zone for this species. We also detected a possible range expansion in the East. In contrast, the Goldeneye species populations remained stable overall. At first glance, one could conclude that current habitat alteration levels are not detrimental to cavity-nesters, but the increase in bufflehead suggests that other factors may outweigh the negative effects of industrial activities.
Species distribution models are commonly used to predict species responses to future climate change. However, their usefulness in conservation planning and policy is controversial because they are difficult to validate across time and space. Here we capitalize on small mammal surveys repeated over a century of climate change in Yosemite National Park, USA, to assess model predictions. Historical (1900-1940) climate, vegetation and species co-occurrence data were used to develop multivariate adaptive regression spline (MARS) models for three species of chipmunk. Models were projected onto the current (1980-2007) environmental surface and tested with contemporary resurveys of each species. Even with the inclusion of vegetation and species co-occurrence, we found that climate alone was the dominant predictor explaining chipmunk distribution within an era, but climate was not consistently an adequate predictor of all species’ responses over time. We conclude that caution should be used when using predictive distribution models for conservation planning because they are difficult to validate across time and space. Here we capitalize on small mammal surveys repeated over a century of climate change in Yosemite National Park, USA, to assess model predictions. Historical (1900-1940) climate, vegetation and species co-occurrence data were used to develop multivariate adaptive regression spline (MARS) models for three species of chipmunk. Models were projected onto the current (1980-2007) environmental surface and tested with contemporary resurveys of each species. Even with the inclusion of vegetation and species co-occurrence, we found that climate alone was the dominant predictor explaining chipmunk distribution within an era, but climate was not consistently an adequate predictor of all species’ responses over time. We conclude that caution should be used when using predictive distribution models for conservation planning under future climate change, unless the physiological and biological range limits of the species of interest are well understood.
A Future Role for Earth Scientists: The Carbon Cops

As the global change politics morphs from “is it real” to “what do we do about it”, the global carbon cycle takes center stage. Many political solutions, such as carbon caps and trading carbon credits will require very rigorous global, consistent monitoring of components of the carbon cycle if society expects these policies to be fair and to work. Will we leave this carbon monitoring to Wall Street? Not a chance! Earth science better get ready for a new role.

Threats for Globally Threatened bird species at Zhumai-Maishukyr lake system, Kazakhstan

Bird monitoring within Tengiz-Korgalzhyn Region (except Nature Reserve) has been carried out to greater or lesser extent only during last 8-9 years. Collected data helped to show the importance of the region for breeding and migrating birds, it was recognized internationally and, within the established network of Central Asian IBAs, 8 sites have been identified by researchers of the national NGO ACBK. However, only one of these IBAs has a protection status. One the example of one IBA - "Zhumay-Mayshukyr Lake System" we want to show what is threatening such rare and threatened bird species, as White-headed Duck or Black-winged Pratincole, as well as great number of other waterbirds using this site. We will show what can be done to minimize these threats and recommend activities to be included into the IBA management plan, which we hope will further act as an example for other similar IBAs in the region.

REDDy or not: Toward research and action on institutional arrangements for REDD in West and Central Africa

There are an ever-growing number of initiatives in West and Central Africa designed to position countries and localities to benefit from proposed programs to Reduce Emissions from Deforestation and Forest Degradation in Developing Countries (REDD). Our paper lays out an urgent research and action agenda for the institutional dimensions of REDD. We first examine structural constraints that will inhibit many rural dwellers in the regions from benefiting from these international initiatives, including weak tenure and property rights, corruption and a history of disinvestment in rural areas. We then discuss how initiatives often fail as a result of outsider ignorance of social realities, through elite capture and other factors. Institutional arrangements must be addressed at every scale. Decisions to reforest, deforest or retain forest have important gender implications. The appropriate scales and units for managing forests need to be debated widely. Linking institutions across boundaries and vertically needs to be addressed for transparency, monitoring and achieving scale. We present examples of cocoa agroforestry and community forestry and discuss what is needed to improve these efforts. There is a foundation of knowledge and practice in the regions to draw on and we describe ways to access and disseminate that knowledge.

Human impact on the survival of Pacarana populations (Dinomys branickii) in Colombia: coupling habitat and population viability models

The pacarana (Dinomys branickii) is an endangered species threatened mainly by habitat loss and hunting. We analyzed the survivorship probabilities for hypothetical populations of Pacarana in Colombia under different habitat loss and hunting scenarios. We first examine structural constraints that will inhibit many rural dwellers in the regions from benefiting from these international initiatives, including weak tenure and property rights, corruption and a history of disinvestment in rural areas. We then discuss how initiatives often fail as a result of outsider ignorance of social realities, through elite capture and other factors. Institutional arrangements must be addressed at every scale. Decisions to reforest, deforest or retain forest have important gender implications. The appropriate scales and units for managing forests need to be debated widely. Linking institutions across boundaries and vertically needs to be addressed for transparency, monitoring and achieving scale. We present examples of cocoa agroforestry and community forestry and discuss what is needed to improve these efforts. There is a foundation of knowledge and practice in the regions to draw on and we describe ways to access and disseminate that knowledge.

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SCB 24th Annual Meeting

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Changing the Way People Relate to Nature

All across the developing world, farmers, fishermen, community leaders, and families are struggling to meet basic life needs in the face of dwindling natural resources. Simultaneously, conservationists are lamenting the ineffectiveness of protected areas and the lack of public support for environmental change. One thing is clear: while conservation has long been science-driven, success will ultimately come down to changing the way people relate to nature. In the face of a global extinction crisis, climate change, dwindling fish stocks, and disappearing forests, conservationists find themselves in dire need of a new set of tools—tools for changing behaviors and inspiring civic action. Rare and its partners have been testing and refining an innovative method for social change that is helping fill this need. It’s called a "Pride" campaign, so named because it inspires people to take pride in the species and habitats that make their communities unique, while also giving them real alternatives and incentives to change environmentally destructive behaviors. Rare has launched more than 150 Pride campaigns in 50 countries. These have reduced overfishing and illegal logging, improved management of protected areas, increased adoption of more sustainable agriculture, and saved multiple species on the brink of extinction.

Identifying Opportunities for Conservation Where Wildlife Habitat and Natural Hazard Areas Overlap

A recent study conducted by the University of North Carolina and the Environmental Law Institute found that areas vulnerable to natural hazards in coastal and riverine communities often overlap with priority habitat areas identified in State Wildlife Action Plans. However, the research showed that local land use planners and hazard mitigation specialists, whose plans play a crucial role in conserving priority habitat, overwhelmingly lack knowledge of SWAPs at best, and at worst viewed wetland conservation as antithetical to their objectives. Habitat restoration in these areas can provide multiple benefits, including wildlife conservation as well as natural flood protection. Using GIS mapping, an evaluation of state and local land use and hazard mitigation plans, and case studies, the joint study found reason for optimism, as diverse options exist for optimizing synergies and facilitating collaboration among land use planners, hazard mitigation planners and conservationists. The study’s recommendations include facilitating increased cooperation among interested parties, revamping aspects of existing planning frameworks at the federal, state, and local level, and identifying innovative funding sources as well as existing federal programs that would support the conservation of flood prone areas that provide high-quality wildlife habitat.

Influence of Highway 197 on Habitat Occupancy Rate of Marten in Forillon National Park of Canada

Forillon National Park of Canada (FNPC) is facing an isolation issue, caused in large part by Highway 197 which separates the park from the remaining Gaspé Peninsula. American Marten (Martes americana) is rare in the park, despite the availability of a relatively suitable habitat. We suspect that this scarcity is caused by a reluctance of martens to cross Highway 197, therefore reducing immigration and preventing the population from reaching a density representative of the park ecosystem. The objective of this study was to compare the species occupancy rate within the park to the occupancy rate on the other side of Highway 197. Marten occurrence was measured in late fall and early winter on 67 sites in 2008 and 108 sites in 2009. Each site was baited and lured, and marten presence was detected by tracks on the snow, hair collection, and surveillance cameras. Occupancy rates within the park (0% in 2008 and 2% in 2009) was significantly lower (p
**Impacts of Human Activity on Caribou Resource Selection and Physiological Health in the Alberta Oil Sands**

Human development is a growing threat to caribou populations globally. Threatened caribou in Alberta's oil sands are thought to have been in decline for the past 14 years and extirpation is anticipated. We developed novel monitoring methods to guide resource management and mitigate environmental threats to this system. Detection dogs were used to non-invasively sample caribou, moose and wolf scat during three winters of oil exploration. Scats were then used to assess resource selection, diet, DNA-based measures of population abundance and hormone-based measures of psychological and nutritional stress. Resource selection by these species was related to their physiological health and the intensity of human land use. High intensities of human use constrained resource use by caribou and reduced their physiological health, providing a more serious threat to caribou than previously thought. Moose, on the other hand, were able to nutritionally compensate for increased human exposure because they did not alter their selection of forage rich resources. Our study suggests better ways to manage human landscape use in the oil sands and provides an innovative method to effectively monitor the complex interactions between humans and wildlife.

**Monitoring of populations of endemic plant on the eastern part of Lake Baikal**

Botanical survey and further monitoring of rare plant's populations is the one of the main methods of their conservation. Usually, rare and endangered species have small isolated populations and dynamic of their demography can be influenced by human activity. We studied populations of rare endemic species Craniospermum subvillosum on the eastern part of Lake Baikal in 2007-2009. Experimental plots were situated on the sandy dunes which are popular places for recreation during summer period. Three points of our study has different level of human impact. The biggest recreation was observed near village Bezymyannaya, middle - near village Turka, and the lowest - near village Goryachinsk. Each year we estimated quantity of each population and analyzed their demographic structure. Our results showed that the lowest density of population observed near Bezymyannaya (0.05 individuals per square meter). Age structure characterized by small part of juvenile plants and was mostly presented by old and generative individuals. On the contrary population near village Goryachinsk characterized by big density (0.13 individuals per square meter) and has the high quantity of juvenile plants (43.17% of total individuals). All studied populations have relatively stable age structure, but further increasing of human impact can lead to rapid decreasing of their quantity.

**Woodland Resource Use and Raptors: A Cost-effective Strategy for Nest Site Conservation**

The conflict between woodland resource use and wildlife has complex socio-economic and ecological implications. As resources committed to nature conservation are often limited, inexpensive participatory programmes may represent a powerful tool for conservation. Such tools have however seldom been considered and applied. We present results from a participatory conservation project run in North Karelia (Finland) between early 1990s and 2004. The aim was to preserve nest sites of raptors (common buzzard, goshawk and honey buzzard) on private lands subject to intensive forest management. After preliminary surveys to locate raptor nests in the area, landowners were approached and proposed to voluntarily set aside the forest stand with an occupied nest. Participation was exclusively based on self-motivation and self-induced values, with no incentives involved. The project was extremely successful, as almost all the approached landowners showed a positive response. The consequences of this conservation intervention on the local raptor population are currently being analysed. Although limited to a local area, these results clearly demonstrate that an inexpensive participatory model can work, at least in some socio-economic and environmental conditions. Given its potential as a tool for cost-effective conservation, we urge to test and evaluate this approach on a wider scale.

**Woodland Resource Use and Raptors**

El Niñó is a climatic event that originates in the tropical Pacific Ocean, which has received considerably attention in conservation because of its effects on reproduction and survival of animal species. The population of leatherback turtles (Dermochelys coriacea) that nest in Northwest Costa Rica constitutes ~50% of the Eastern Pacific leatherback turtles and has declined by ~90-95% due to past egg poaching and incidental capture by fisheries. We measured emergence success of leatherback turtle hatchlings on Playa Grande Costa Rica from 2004-2009 and formulated a mathematical model to calculate emergence success related to climate from 1976 to 2009. Droughts induced by low precipitation levels during El Niñó events, resulted in high mortality of leatherback eggs, reaching the highest levels during the strong El Niñó event in 1987. More frequent or stronger El Niñó events as a result of climate change may prevent population recoveries of depleted Eastern Pacific leatherback turtles.
Monitoring the Effect of Sulphur Emissions on Lichens in North-Central Alberta

Lichens are an important component of boreal ecosystems and a well tested indicator of sulphur dioxide (SO2) emissions. Cenovus FCCL Ltd. participated in a biomonitoring program to assess changes in sulphur content in lichens near one of their facilities from 2007 to 2009. Fourteen experimental plots were established between 0 and 10 km along two transects aligned with prevailing wind directions. Five control plots were established 95 km west of the facility in an area free of intensive SO2 emission sources. Lichen samples were collected annually for bioassay analysis and ambient SO2 levels were recorded. Results showed that ambient SO2 levels were below thresholds at which lichen abundance has been reported to decline. Sulphur content in lichen tissue increased over time and fell within the range of values reported from similar research in the area. The effect of distance and direction from the facility was not consistent, but there was evidence that sulphur content was higher proximate to and southeast of the facility. In 2009, lichens at control plots had higher sulphur content than those at experimental plots, highlighting the difficulty associated with locating appropriate control sites in a landscape characterized by increasing oil and gas development. To conclude, sulphur emissions from the facility are not high enough to cause short term lichen injury and follow up work is required to determine whether this conclusion holds in the long term.
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Modeling lichen availability for caribou after fire and grazing in the Northwest Territories

The barren-ground caribou (Rangifer tarandus groenlandicus) is the most abundant sub-species of caribou in the Northwest Territories of Canada. However, the Bathurst herd has been decreasing at mean annual rate of about 5% since 1986. In recent years declines have become dramatic, at more than 20% per year. One of the most important factors restricting survival of caribou is winter food availability. Lichen is the most important winter forage, and its abundance is sensitive to the history of wildfire and of foraging by caribou. We used a simple non-spatial simulation model to estimate the carrying capacity of the winter range, taking into account the stochastic fire regime and foraging intensity. We included the potential area of lichen-bearing forest, demographics (fecundity, survival), and movement dynamics to explore possible mechanisms that were responsible for this decline. Our results found that study region cannot support the herd sizes characteristic of the 1990s, which suggests that overgrazing of winter habitat may be one factor contributing to the recent population declines. The effects of fire on food supply are minor compared to grazing at high population levels.

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Measuring ecosystem health at regional and local scales: the value of integrated monitoring

Human land uses usually alter native biodiversity and degrade ecosystem health. We use information from the Alberta Biodiversity Monitoring Institute (ABMI) to highlight how an integrated monitoring program can be used to assess ecosystem health at both regional and local scales. The ABMI surveys terrestrial and aquatic biota (thousands of species), terrestrial and aquatic habitats (hundreds of elements), and landscape composition and pattern at 1656 sites spaced in a grid pattern throughout Alberta. At the regional scale, intactness is determined separately for each species and for each habitat element by comparing observed abundance to the abundance expected if no human development had been present. Intactness measures for individual species and habitat elements are then integrated to determine a single measure of ecological health for the region. To assess ecological health at a local scale, a modified reference condition approach is used; maximum likelihood models are used to assess intactness of the species and habitat structures. This information is then integrated into a single measure of ecological health. Since information on species and habitats in natural and human disturbed areas are required for both spatial scales, integrated data collection increases cost efficiencies. In addition, by collecting similar data at both scales, it is possible to evaluate whether management actions at local scales are effective at maintaining regional ecosystem health.

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Incorporation of Human Impacts on the Extinctions and Threat of Extinctions of Avifauna on Oceanic Islands

Islands are an increasingly important area of focus for conservation of avifauna because many factors that have been shown to contribute to decreases in species richness are amplified. Geographical factors, such island area and isolation, have been found to have the greatest effect on the threat of extinction of avifauna on oceanic islands. These geographical factors impact the threat of extinction more than biological variables, such as size of avifauna and mammalian predators, because of their direct influences on the number of extinct and threatened avifauna as well as the indirect influences through the biological factors. The purpose of this study is to incorporate potential human causal factors that, in conjunction with the geographical variables, also influence the biological factors on the extinction and threat of extinction of avifauna on oceanic islands. The percentage of human population in agriculture per capita, human population, population density, growth rate, and gross national product (GNP) were all incorporated in the causal modeling approach using path analysis. The human population of the oceanic islands is strongly related to the area of the island but not significantly to the extinction of oceanic avifauna. Although human causal factors impact the avifauna on the islands, it is not as important as an indicator of extinction or threat of extinction of avifauna as geographical factors of the islands.

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Why Boreal Water Conservation at the Catchment Scale Matters: Industrial Development Impacts to the Athabasca River

Canada contains more surface freshwater than any country on Earth. Industrial development can disrupt freshwater resources across large areas. Oil sands extraction not only denudes boreal forest and wetland landscapes during extraction, but also continues to affect freshwater integrity during processing and after extraction has occurred. The oil sands industry reports increasing emissions of several toxic chemicals to Environment Canada's National Pollutant Release Inventory (NPRI). But the oil sands industry and Alberta government have continued to claim to the public that all of the toxins in the Athabasca River are from natural bitumen seeps and that the industrial contribution is insignificant. To test this claim, in 2008 we did a comprehensive sampling and analysis of water from the Athabasca River and several of its tributaries, snowpack, vegetation and fish in the lower Athabasca watershed. Sampling sites were chosen in both developed and undeveloped reaches of the rivers within the bitumen-rich McMurray Geological Formation. We found that industry contributed substantially to concentrations of polycyclic aromatic hydrocarbons, mercury, lead, arsenic, and many other toxic chemicals. Releases were both via airborne pathways and runoff from developed industrial sites. We conclude that oil sands development is contributing substantially to the pollutant burden of the Athabasca River, and have the potential for increasing concentrations of contaminants in fish and other organisms, and potentially disrupting key ecosystems and traditional lifestyles downstream within the World Heritage Peace-Athabasca Delta. To protect these globally important resources, conservation and sustainable development at the catchment or watershed scale must be implemented across Canada's Boreal region.
In Europe wetlands have been drained and converted for centuries leaving the remaining wetlands fragmented and often in a degraded state. During the last decades efforts have been made to restore and preserve wetlands for various purposes. However, climate change issues have often been neglected in regional wetland planning. But with relatively high European political ambitions for climate change mitigation; biodiversity protection; energy, water, food, and civil security, the question arises how to optimally govern wetland conservation and restoration sites in order to maximize market and non-market benefits. The study that is introduced here tries to evaluate these preservation potentials of freshwater wetlands in Europe under consideration of changing climatic conditions. Scenarios are developed within an interdisciplinary framework by developing consistent links between suitable modeling systems from the fields of meteorology, hydrology, geography, biology, and economics. The resulting GIS-integrated multi-objective modeling of wetlands is able to assess impacts and responses of wetlands under implementation of systematic conservation planning methods.

Boreal regions in Canada contain a significant proportion of the world’s remaining intact forests, and represent some of the last opportunities to avert the conservation crises plaguing most other ecosystems. However, they are also experiencing significant land-use pressures, and northern reaches are already showing effects of climate change. Current conservation paradigms reflect a history of reactive post-hoc efforts, and have led to constraint-based management strategies and the mistaken impression that conservation is a cost to resource development, rather than a fundamental component of sustainability. Planning proactively for conservation requires a precautionary approach that acknowledges the uncertainty inherent in all management decisions, and more sophisticated strategies that maintain or enhance resilience at very broad spatial scales. We describe a scientific framework for large-scale conservation: the conservation-matrix model (CMM), which exploits the strengths of systematic and dynamic conservation planning and adaptive resource management. Related land-use planning involves identification of a comprehensive protected areas network, including system-level ecological benchmarks, and management regimes that systematically enhance learning by treating management activities as carefully designed, incremental, and rigorously monitored experiments. We highlight the potential of the CMM to maintain the full range of natural and cultural values that boreal regions currently support, in conjunction with enhanced resource development, and provide criteria for, and their application to, the design of system-level benchmarks across boreal regions of Canada.

Understanding the ecology of Woodland caribou requires extensive observations in space and time. Scientific interpretation is often confounded by the interaction of natural and anthropogenic landscape change. It is rarely possible to determine baselines for vital rates or patterns of range use in the absence of significant landscape disturbance. Because caribou occur at low densities over vast areas, studies are often constrained financially and temporally relative to the lifespan of a caribou. We report on two forest-dwelling populations of Woodland caribou that have been monitored for at least 10 years. These populations occupy ranges with less than 10% anthropogenic disturbance. Individual caribou were followed for 1-13 years (n=150). The size and stability of annual ranges was evaluated over time and we calculated annual adult female survival and calf recruitment. Results indicated that range size was variable and contingent on the length of the monitoring period. Calf recruitment averaged 20% (CV = 0.26) and was higher than for populations in more disturbed landscapes. Adult female survival was high (x = 0.88) though variable (CV = 0.25) due to mortality associated with hunting. Results provide baseline data to address the proximate and cumulative impacts of development on woodland caribou ranges in Labrador.
Critical habitat for boreal caribou in Canada: concepts and conservation challenges

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The boreal population of woodland caribou, distributed across a vast area of Canada, was assessed as threatened under the Species at Risk Act (SARA) in May 2002. In June 2007, a draft National Recovery Strategy (NRS) was completed. However, although earlier versions of the NRS included extensive deliberations on the concept of critical habitat for boreal caribou, critical habitat was not identified in the draft NRS. In August 2007, largely in response to threats of legal action, Environment Canada (EC), the lead federal agency responsible for recovery planning for boreal caribou, launched a scientific review to apply the best available science to support identification of critical habitat. The undertaking was framed as an exercise in decision analysis and adaptive management, was guided by an 18-member science advisory group, and involved analysis and synthesis of data across the entire distribution of boreal caribou in Canada. The resultant report recommended that critical habitat for boreal caribou be identified at the scale of local population ranges, and expressed the current conditions on each range relative to its probability of supporting a self-sustaining local population (the recovery objective specified in the draft NRS). EC concluded that the information provided was insufficient to support identification of critical habitat for boreal caribou, and subsequently launched a second phase of science work, which is ongoing. A revised NRS is now scheduled for 2011. Here I review the scientific underpinnings of the concept of critical habitat for boreal caribou, the process of identifying it, and the institutional challenges in implementing conservation and management actions to protect it.

The promise and peril of applying conservation science to policies for woodland caribou conservation in Canada

Woodland caribou (Rangifer tarandus caribou) have been heralded as a conservation icon by environmental organizations, a flagship, umbrella and indicator species by conservation scientists, and they have the dubious distinction of being the most widely distributed Species at Risk (SAR) in Canada. One of three subspecies of caribou in Canada, woodland caribou belong to two, distinct ecotypes - boreal and mountain. While some details of their life history vary, they share a common requirement for large areas of older, intact forest, and high sensitivity to human activities that alter the composition and configuration of their ranges, and resultant predator-prey dynamics. Their status as a SAR has had a significant influence on the development of best management practices in forestry, energy exploration and development, and access management, and affords them special consideration in land-use planning. Legal listing of the southern mountain and boreal populations under the federal Species at Risk Act also demands that critical habitat be identified and protected, which functionally requires that ecologically-constrained resource management be applied over very large extents of land. While these conditions hold considerable promise for promoting the development of far-reaching policies based on system-level conservation science, the resource conflicts and opportunity costs associated with recovery and conservation of woodland caribou at current or increased population levels across its current distribution pose a risk that crisis-oriented conservation science will be applied to determining minimum levels for persistence. A “purveyor beware” approach is warranted.

Managing woodland caribou in Alberta, Canada: the Case for Triage

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The objective of our study was to document the status of woodland caribou (Rangifer tarandus) herds in Alberta, Canada, and to contrast the current recovery strategy with the triage approach. To do this we modeled three types of recovery effort - protection, habitat restoration, and wolf control - and estimated the opportunity cost of recovery for each herd. We also assessed herds with respect to a suite of factors linked to long-term viability. We found that all but three herds will decline to critical levels (< 10 animals) within approximately 30 years if current population trends continue. The opportunity cost of protecting all ranges by excluding new development, in terms of the net present value of petroleum and forestry resources, was estimated to be in excess of 100 billion dollars (assuming no substitution of activity outside of the ranges). A habitat restoration program applied to all ranges would cost several hundred million dollars, and a provincial-scale wolf control program would cost tens of millions of dollars. Recovery costs among herds varied by an order of magnitude. Herds also varied substantially in terms of their potential viability. These findings suggest that woodland caribou in Alberta meet the conditions whereby triage should be considered as an appropriate conservation strategy.
Effects of oilsands exploration and development on biodiversity

In this presentation I will review specific differences between natural disturbances and disturbances associated with oilsands exploration and development and I will discuss how these differences affect biodiversity using various species as examples. The oilsands deposits all lie within Alberta’s boreal natural region. Multi-scale natural disturbances, such as wildfire and insect outbreaks, are typical of the boreal forest, and the species that inhabit this ecosystem are adapted to these disturbances. Disturbance and renewal is in fact necessary for the continued existence of the full suite of boreal species. The negative effects on biodiversity associated with oilsands exploration and development can be traced to differences between anthropogenic and natural disturbances. Two of the key differences relate to the large spatial extent and long duration of disturbances associated with oilsands development. A third important difference relates to form - linear features, such as roads, pipelines, and seismic lines, have no real natural correlate. They cause habitat fragmentation and provide human access to a much greater proportion of the forest than would otherwise be the case, leading to various secondary effects including an increase in disturbance, hunting and poaching, and collision mortality. Some species are able to tolerate anthropogenic disturbances well, but others are not. The result is a decline in the abundance of so-called sensitive species.

Improving the relationship between humans and elephants can further the conservation of elephants and provide economic benefits to humans. Such improvement can be facilitated by studies that provide information on the behavior of elephants and on the perception of humans regarding elephants. Using a conservation behavior, we are gathering data that serves both purposes. At Addo Elephant National Park, South Africa, we studied the influence of matriarchs during interactions between elephant family groups. We also examined the relationship between matriarch age and a measure of fitness. In northern Tanzania, we examined the relationship between perceived and actual causes of crop damage by wildlife. Farmers answered questions and we compared their responses to our quantification of damage to their corn crop. Our results support the hypothesis that older matriarchs secure higher fitness for group members through inter-group competition over resources. Human perception of crop damage appears to be influenced by the extent more than the frequency of damage. Because matriarchs influence group movements, altering their actions may reduce HEC. If this helps curtail the extent of damage, this could improve the human perception of elephants by farmers. Coupling our understanding of elephant behavior with human perception is an important next step in the reduction of HEC and thereby the conservation of elephants and their habitat.
Do forests act as barriers to butterfly movement? An experimental study to quantify the influence of boundaries and habitat types on Fender’s blue dispersal

Understanding movement across the landscape is a critical challenge in an age of rapidly changing landscapes due to pressure from fragmentation and climate change. Fundamental to this is how organisms move across multiple boundary and habitat types. We investigate dispersal behavior of an endangered blue butterfly (Icaricia icarioides fenderi) to quantify movement across woodland boundaries and through meadows, open woodlands and closed forest which comprise the butterfly’s landscape. In 2007 and 2008 in Oregon, USA, we conducted experimental releases at 9 ecotones and mapped 657 butterfly flight paths. Contrary to previous expectation, woods are not an absolute barrier to butterfly movement, but rather butterflies have a detectable per move probability of crossing this boundary (0.02 - 0.17 depending on sex and ecotone). Once butterflies have crossed the boundary, habitat-specific diffusion rates based on a correlated random walk are comparable in prairies and opens woods and depend on presence of lupine/breeding habitat (0.9 - 5.6 m2/sec depending on sex and habitat). Findings are significant for understanding the mechanisms of animal dispersal in complex landscapes as well as predictions for large-scale movement in the context of novel landscapes due to fragmentation, climate change and habitat restoration.

Do forests act as barriers to butterfly movement? An experimental study to quantify the influence of boundaries and habitat types on Fender’s blue dispersal

The Burrowing owl is a federally listed endangered species that continues to decline throughout its Canadian range. The prairies have seen a steady increase in petroleum development, raising concerns about potential impacts to species at risk, such as the burrowing owl. Roads are the most abundant petroleum-related disturbance in the prairie landscape, with the greatest potential to affect burrowing owl nest success and nest site selection. We examined whether roads acted as sinks and/or ecological traps for burrowing owls. From 2003 to 2009 in Alberta, Canada, we monitored 322 burrowing owls to fledging. Our analysis shows that density of the most common road type (gravel) has a negative effect on burrowing owl nest success. Resource selection analysis shows that owls select nest sites closer to gravel roads and in areas with higher densities of gravel and paved roads. The presence of an ecological trap was examined by using arrival date as an indicator of preference. We found that earlier arriving owls select nest sites surrounded by higher densities of paved and gravel roads, but did not select nest sites closer to roads of any type. Roads are one of the most prominent features in the grasslands and they may be attracting owls to nest in areas where they are at higher risk of road mortality. In the future, we will explore how additional road characteristics may influence owl survival, nest success and fledging rate.

The role of online social networks in grassroots conservation outreach

Use of online social media has soared amongst both private individuals and conservation groups, but very little is known about the impact or potential of Social Networking Sites (SNS) as a public outreach tool. We studied the campaigns of three Wisconsin non-government organizations (NGO) conservation groups and their use of Facebook, which is currently the largest SNS in the world at more than 350 million active users. Specifically, we examined whether conservation outreach on Facebook is changing (1) member demographics, (2) communication methods and preferences, (3) public involvement levels in conservation, or (4) member relationships and their influence (social network theory). Our preliminary findings suggest that Facebook is not a preferred communication method for conservation group members, but that Facebook groups may provide increased visibility of an organization within member networks, peer influence, and stronger social ties amongst members. The findings of this study suggest there is potential for conservation groups and educators to increase their public visibility and internal cohesion with a Facebook campaign.

Conservation of bird functional diversity and ecosystem services in tropical forest, agroforests, and agricultural ecosystems

Although most bird species avoid agricultural areas, nearly a third of all birds occasionally use such habitats, often providing important ecosystem services like pest control, pollination, and seed dispersal. Combining literature review with a meta-analysis of world’s birds, I compared tropical bird species that prefer forests, agricultural areas or both, with respect to body mass, diet, habitat and resource specialization. Compared to primary forests, in agro-forests species numbers of large frugivorous and insectivorous birds (especially terrestrial and understory species) often decline. In contrast, nectarivores, small-to-medium insectivores (especially migrants and canopy species), omnivores, and sometimes granivores and small frugivores do better, frequently by tracking seasonal resources. However, changes in guild species numbers do not necessarily translate to changes in relative abundance, biomass or function, and more studies are needed to quantify these important measures. The findings suggest that the replacement of forests and agro-forests with simplified agricultural systems can result in shifts towards less specialized bird communities with altered proportions of functional groups. These shifts can reduce avian ecosystem function, affect the ecosystem services provided by birds, and create further conservation problems in agricultural landscapes.
Creation of Management Frameworks Contributes to Effective Land use Planning

The creation of a management framework allows cumulative impacts to be considered, analyzed and acted upon in a way that optimizes the mitigation of impacts to the environment. In the oilsands region of Alberta a number of these management frameworks have been developed and forwarded to the appropriate regulatory agencies. These documents have made a significant contribution to the efforts to develop a land-use plan that strikes a new balance between development and the environment. The guidance provided by the frameworks is acknowledged as forming a significant portion of the management of air, water, land and biodiversity in the region. The creation of these environmental management frameworks is very challenging. Doing this in the context of a multi-stakeholder organization is even more difficult task. The effort is deemed worthy as it is recognized by regulators that multi-stakeholder groups contribute meaningfully to the overall responsible development of the region.

Grizzlies: Linking the parts for a healthy grizzly future

Assuring the future of healthy grizzly populations in the transboundary Rockies of the US and Canada will require providing wildlife movement opportunities between the large blocks of public land in this area. This will allow animals to disperse; avoid inbreeding; access important seasonal habitats like winter range; access water; and seek food and shelter across the landscape. Population connectivity will also increase the resiliency of grizzly populations to climate change effects that may change the distribution and availability of important foods. Enhancing connectivity will require building local knowledge, support, and understanding among land managers, private landowners, local political officials and key agencies like transportation departments about why maintaining and enhancing the ability for bears to move is important. Resources will be focused on the following strategies: 1) Improving the opportunity for grizzly movement within and between the large blocks of public and provincial lands in the transboundary Rockies of the US and Canada between the Yellowstone ecosystem and ecosystems to the north in southern British Columbia and Alberta; 2) Identifying specific movement opportunity areas and improving the permeability of highways at these locations with highway crossing structures and associated wildlife fencing to guide animals to these structures; 3) Private land conservation involving easements and acquisitions, and assistance in sanitation and ways to live with bears in key linkage areas; and 4) Building public support and understanding among the residents of mountain valleys about the benefits of healthy, interconnected populations of grizzlies.

FEAUNAL AND FLORAL DIVERSITY OF MANGROVE WETLANDS OF CAMOTES ISLANDS, CENTRAL PHILIPPINES

Serapion N. Tanduyan*, Ponciano C. Bontia; Rachel Luz Vivas-Rica; Ricardo B. Gonzaga; Virginia D. Bengsig; Hemres M. Alburo Cebu Technological University, San Francisco, Cebu Campus Tel: (032) 497-0318; e-mail: tanduyan@yahoo.com The animal and plant components of mangroves in Camotes Islands were assessed due to the declining condition felt by the fishermen basis for drawing conservation options. Transect and barrier nets were used to assess the flora and fauna respectively. It shows that there are 30 species of mangroves found belonging to 13 families and 35 fish families with 74 species and 18 families of invertebrates with 25 species.

FAUNAL AND FLORAL DIVERSITY OF MANGROVE WETLANDS OF CAMOTES ISLANDS, CENTRAL PHILIPPINES

Serapion N. Tanduyan*, Ponciano C. Bontia; Rachel Luz Vivas-Rica; Ricardo B. Gonzaga; Virginia D. Bengsig; Hemres M. Alburo Cebu Technological University, San Francisco, Cebu Campus Tel: (032) 497-0318; e-mail: tanduyan@yahoo.com The animal and plant components of mangroves in Camotes Islands were assessed due to the declining condition felt by the fishermen basis for drawing conservation options. Transect and barrier nets were used to assess the flora and fauna respectively. It shows that there are 30 species of mangroves found belonging to 13 families and 35 fish families with 74 species and 18 families of invertebrates with 25 species.
P2.54 Setiasih, N*; Sartin, J; Reef Check Foundation Indonesia; nsetiasih@reefcheck.or.id  
Marine Manage Area as Reef Guardian to Mass Coral Bleaching in the North Bali  
Coral Reef at the North Bali was hit by mass coral bleaching in May-June 2009, spans over 120 km shoreline. The water temperature recorded up to 30°C. During the time, up to 40% coral bleaching was noted. The non-resistance coral colonies had a high degree of bleaching, up to 100%. The old massive resistance colonies were also encountered in some area. There were 3 marine manage areas along the surveyed shoreline. Interestingly, in general, reefs at marine manage areas were relatively less affected. This has bought urgency for a more detail research for coral reef resilience, as well as higher effort for protection for coral reef.

P2.100 Setiawan, A*; Nugroho, TS.; Wibisono, Y; Ikawati, V; Djuwantoko; Wildlife Lab, Forest Resource Conservation Dept, Faculty of Forestry, Gadjah Mada University, Yogyakarta, Indonesia; wawan5361@yahoo.com  
Population Status and Conservation of Javan Gibbon (Hylobates moloch), in Central Java, Indonesia  
A survey of distribution and population status of Javan gibbon (Hylobates moloch) was conducted during August 2009 - February 2010 in Central Java, Indonesia. We survey 10 localities and found 56 groups of gibbon, total 132 individuals. The data were obtained using line transect methods. Javan gibbon found in fragmented unprotected forest, altitudinal distribution from 250 - 1900 meters asl. Sokokembang forest in Western part of Dieng Mountain and Mt. Slamet probably two largest habitat for gibbon population in Central Java, where occupied by 4.49 gibbons/km² and 1.7 gibbons/km². For survival of the gibbon in their eastern most range distribution, it's important to secure the remaining forested habitat in Central Java.

P2.204 Sewald, Jessica; Root, Karen*; Bowling Green State University; jsewald@bgsu.edu  
Assessing Bat Species Composition and Relative Foraging in a Mixed Disturbance Environment  
Summer Foraging requirements for bats are poorly understood, especially in areas highly fragmented, located in an urban/suburban matrix, and in critically endangered oak savanna habitats. The Oak Openings Region of Northwest Ohio includes all three conditions and collecting bat species assemblage and relative foraging activity information for species in this region will increase our understanding of habitat requirements for foraging. I hypothesize that species assemblage will include those found at high abundance throughout the state, that predictors of relative foraging activity will be structural rather than compositional characteristics, and that relative flight activity will be greater in oak savanna areas. A total of 16 points were sampled within two metroparks in the Oak Openings region five times from June 1st to September 2nd, 2009. Established methods of echolocation monitoring using an Anabat SD1 monitor were employed and data at the microhabitat, local and landscape scale were collected. Preliminary Results indicate that structural configuration of habitat (ie canopy cover) is more critical to relative activity than composition at local or landscape level. Species composition includes myotis spp, perimyotis subflavus, Eptesicus fuscus/Lasionycteris noctivagans, Lasiusus borealis, L. cinereus, and Nyciiceus humeralis. However, further monitoring is necessary at Oak savanna sites to determine its relative importance for foraging.

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SP4.11 Shannon R. White*; Dr. Edward W. Bork; Dr. James F. Cahill Jr; University of Alberta; shannonrwhite@gmail.com  
Three years of climate change and herbivory in native grassland: Effects of precipitation, defoliation and warming on community composition and productivity  
Climate change is predicted to both increase temperature and change precipitation patterns in northern grasslands. Furthermore, grazing from wild and domestic ungulates will act synergistically with climate change to impact grasslands. This may have ramifications for conservation of the rough fescue prairie, as already only five percent of the original extent remains, and what does remain is often overgrazed. We conducted a manipulative experiment in native rough fescue prairie to determine the impacts of warming, altered precipitation, and grazing on primary productivity and community composition. The study used a factorial design of warming, precipitation, and defoliation (simulated grazing) treatments. The abiotic and biotic conditions of the plots were surveyed, including plant cover estimates and the harvest of a subplot for vegetation biomass data. Ordinations indicated changes in community composition due to precipitation and defoliation treatments, but community composition was robust to warming. Total productivity declined with increasing defoliation and decreasing precipitation. Temperature did not affect total productivity, but it did affect forb productivity. Under drought conditions, warmed plots had higher forb biomass than unwarmed plots. These results suggest that community composition and productivity in rough fescue prairie will be affected by grazing and precipitation, with potential for interactions with climate warming.
Keeping it in the REDD? Accounting for the social and environmental costs and benefits of Mexico’s national payments for ecosystem services program

As international climate change negotiators define the degree to which market-mechanisms will play a role in the design and governance of Reduced Deforestation and Degradation (REDD) policy, it is crucial to understand both the environmental and social impacts of previous iterations of these types of initiatives. Mexico’s federal payments for ecosystem services (PES) program is one of the world’s largest and most elaborate avoided deforestation schemes. My study of program impacts was based on multidisciplinary methods: semi-structured interviews with program participants, intermediary organizations and administrators combined with analysis of satellite images to determine impacts to deforestation rates. Interview data that found participants entered land at low risk of deforestation was corroborated by GIS analysis that indicated only a small decrease on enrolled properties. Socioeconomic impacts varied greatly but in general were likely not to be long term. The type and strength of both environmental and social impacts were largely dependent on the strength and structure of pre-existing institutions. Lastly, I found that true commoditization of ecosystem services rarely occurred and the program has been reinterpreted by program participants and intermediaries as a federal subsidy in recognition of the value of rural environmental stewardship.

The increasing pressures on global biodiversity and the lack of data on the number and abundance of species has motivated conservation planners and researchers to use more readily available information as proxies or surrogates for biodiversity. ‘Habitat’ is one of the most frequently used surrogates but its assumed value in marine conservation planning is not often tested. The present study developed and tested three alternative habitat classification schemes of increasing complexity for a large estuary in south-east Australia and tested their effectiveness in predicting spatial variation in macroinvertebrate biodiversity and selecting estuarine protected areas (EPAs) to represent species. The three habitat classification schemes were: (1) broad-scale habitats (e.g. mangroves, seagrass), (2) sub-division of each broad-scale habitat by a suite of environmental variables that varied significantly throughout the estuary, and (3) sub-division of each broad-scale habitat by the subset of environmental variables that best explained spatial variation in macroinvertebrate biodiversity. Macroinvertebrate assemblages differed significantly among the habitats in each classification scheme. For each classification scheme, habitat richness was significantly correlated with species richness, total density of macroinvertebrates, assemblage dissimilarity, and summed irreplaceability. However, in a reserve selection process designed to represent examples of each habitat, no habitat classification scheme represented species significantly better than a random site selection. Habitat classification schemes may represent variation in estuarine biodiversity, however, the results of this study suggest they are inefficient in designing representative networks of estuarine protected areas.

Wildlife Mortality in Jasper National Park: An Examination of Train Spilled Grain

Train collisions with animals are an important source of wildlife mortality in Jasper National Park, and monitoring the quantity of grain spilled by railcars signals if this contribution to mortality is being addressed. Grain products leak from trains as they travel due to improper loading or faulty gate mechanisms on railcars, especially in areas where trains stop and wait. In Jasper National Park, large carnivores and ungulates are struck by trains as they feed on spilled grains or rail-killed carcasses. Rail companies have improved maintenance for some grain cars and use vacuum-mounted railcars to clean up large spills in an attempt to reduce these attractants. We measured the quantity of grain spilled on the railway over the first two years of a three-year national program to repair malfunctioning grain cars. Grain was sampled in 2 ft x 2 collection boxes located between the rails at 26 sites in an area of the park with historically persistent grain spills. We dried and sifted samples to remove debris and obtained a weight/day. We tested the effect of time and grain car traffic on grain spill rate using a generalized mixed effects model. The quantity of grain spilled did not decline during the period of the repair program; however our analysis identified seasonal peaks in grain spill rate. Our study reveals that current efforts in railcar maintenance and on-site clean-up have not yet resulted in a change in grain spill rate in the park.
SY35 Shury, TK; Parks Canada Agency; todd.shury@pc.gc.ca

Confronting disease as a barrier to large scale bison restoration in North America

Infectious diseases have historically and continue to present enormous challenges to the recovery of wild bison populations in North America. Federally reportable diseases such as tuberculosis, brucellosis and anthrax which impact international trade in cattle pose the most serious challenges currently, but other diseases such as malignant catarrhal fever and paratuberculosis have potential to limit the distribution and abundance of bison in future reintroduction sites. Properly conducted, rigorous disease risk assessments must be completed prior to reintroduction or translocation into new habitats, or we risk leaving a legacy of disease management issues for future generations. These diseases often create artificial boundaries that will not allow bison to resume their ecological niche as a keystone herbivore in North American ecosystems (TB and brucellosis in particular). Managing diseases in which bison are the reservoir will require particularly creative long-term investment and conciliatory efforts by land management, regulatory agencies and stakeholder groups in a multi-jurisdictional landscape where success will likely be expensive and measured in decades rather than years. These long-standing issues must be successfully resolved if future success is to be achieved at a landscape scale. Funding for basic research into immunodiagnostics, vaccines and bison containment strategies will be necessary to achieve the vision outlined by the Vermejo Statement.

P2.112 Sierra-Corona, R; Solis-Gracia, V*; List, L; Paz, F; Ceballos, G; Instituto de Ecología, UNAM, Centro Regional de Investigaciones Multidisciplinarias, UNAM; lomorange@hotmail.com

Janos Biosphere Reserve: A socio-environmental perspective.

The Janos Biosphere Reserve located in Chihuahua, Mexico, covers more than half a million hectares of native grasslands and forests, and it is one of the most biological diverse reserves in North America. Janos is one of the last extensive grasslands in northwestern Mexico, where this ecosystem has experienced severe degradation processes due to anthropogenic activities. Large regions have lost their capacity to provide environmental services and sustain local inhabitants. This, linked to lack of economic alternatives has forced peasants to sell their rangelands to industrialized agricultural producers. Land owners are becoming employees, poverty and migration to cities in Mexico and in the US is growing and new environmental and social problems are arising. In this study we evaluate in detail the root causes of biodiversity loss in the Janos reserve, to find solutions for these complex problems. We used a historical analysis that focused in the identification of the environmental problems, stakeholders, and socio-environmental conflicts. We identified two environmental conflicts fueled by authority’s corruption; land use change due to grassland plowing, and the competition for the water supply, where the irrigation of expanding crops is reducing the available water for human settlements and ranching. Next steps include a socio-economic evaluation in the whole region to direct our efforts to the issues whose solution will have the greatest impact in conservation.

3.4 Sikes, Benjamin A.*; Hawkes, Christine V.; Section of Integrative Biology, University of Texas, Austin; benesikes@gmail.com

Utilizing natural soil biotic communities to enhance ecosystem resilience and recovery

Terrestrial ecosystem conservation and restoration often attempt to manipulate plant assemblages to achieve a desired community. Plant interactions with soil biota have emerged as major factors determining the structure and long-term stability of plant communities. Moreover, soil microbial communities underpin many ecosystem responses to global climate change, habitat modification and atmospheric deposition. Yet the vast diversity of soil biota remains a largely untapped resource in ecosystem conservation and restoration. Specific groups of soil biota can play different roles in ecosystem functioning and resilience to disturbances such as climate change and invasions. Manipulations of soil biota thus provide a novel pathway to achieving aboveground results, and have the potential to substantially broaden our conservation and restoration toolkit. We will describe our prototype project designed to help develop microbial manipulation strategies. Specifically, we will ask how manipulation of four major soil microbial groups (Ascomycetes, Arbuscular Mycorrhizal Fungi, Eukaryotic Algae and Cyanobacteria) can improve recovery of endangered plants and prevent reinvasion of non-native pasture grasses in a disturbed Florida scrub ecosystem. The microbial treatments will be compared to conventional restoration treatments. Ultimately, our goal is to directly increase the effectiveness and efficiency of land management by integrating soil community ecology into conservation and restoration science.

15.4 Sibanda, M*; Shumba, E; WWF Zimbabwe; msibanda@wwfsarpo.org

Climate Change and Carbon Financing under Reduced Emissions from Degradation and Deforestation in Miombo of southern Africa

An investigation of the policy environment and potential for national and community benefits of carbon finance through reduced emissions from degradation and deforestation (REDD) was done in 5 Miombo countries in southern Africa. These were Botswana, Malawi, Mozambique, Zambia, and Zimbabwe. The policy environment in most countries is favourable to the introduction of REDD due to the basis that community based natural resources management (CBNRM) programmes that have matured in most of the sub region. CBNRM projects have encouraged good natural resources stewardship benefitting nature and the poor communities in the region. Therefore income from REDD would be additional to what CBNRM projects already generate for national and local economies. Institutions at national level must be put in place for purposes of measuring, reporting and verification. Debate rages on how the funds accruing from REDD would be distributed from national to local level although several models from CBNRM are available for improvement. Forest areas for carbon stocks are proposed based on a preliminary analysis using GIS. There is a need to develop in southern Africa national communication strategies in order to exploit the opportunities available with the emergence of REDD in the global Climate Change discourse.
The Common And The Endangered Bradypus Sloths - Is There A Correlation Between Genetic Diversity And Endangered Species?

This study presents the first genetic analysis on the critically endangered pygmy-sloth, Bradypus pygmaeus. We compared four distinct populations of the common three-toed sloth (B. variegatus) and one pygmy-sloth population using the four microsatellites currently available for sloths. The populations analyzed were from the Brazilian Atlantic Forest (AFNorth, n=16; AFSouth, n=7), Western Amazon Forest (WA, n=6) and Northeast Panama (P, n=8). The pygmy three-toed sloth only occurs on one island, Escudo de Veraguas, in Panama (I, n=11). Through this distinct sampling effort some alerting results were obtained.

I) The mean number of alleles is less than two, with one to three monomorphic loci, in all populations except WA (MNA=3.750). II) This population shows the higher genetic diversity (average gene diversity=0.68; Ho=0.50 to 0.83; He=0.63 to 0.75), with more private alleles. III) Assignment tests failed to attribute individuals to the AF populations. IV) Finally, differentiation indexes are higher among intraspecies populations (FstAF-S/WA=0.87) than among Panama populations (FstP/I=0.007). This pygmy-sloth genetic characterization is certainly influenced by the common demographic history between mainland and island sloths. Nevertheless, it also highlights the need for closer attention for other non-endangered sloth populations occurring in threatened habitats. The population inhabiting the longest stable region, WA, has higher diversity than the AF populations, which has the same low genetic diversity seen in the critically endangered sloth.

Present and Future Status of Biodiversity on Managed Forest Landscapes in Maine, U.S.A. as Determined Using Multi-Scale Condition Indicators

Commercial forest owners are expected to maintain biodiversity; however, few tools are available to quantify success. Indicators are useful for assessing the condition of representative elements of biodiversity, but require research and testing. We evaluated status and scale sensitivity, and predicted future trends (2007-2032) for 9 stand- and landscape-scale condition indicators across 139,225 ha of managed forestland. Early-successional habitat for shrubland birds, and late-successional deciduous and coniferous stands were particularly rare across the entire study area and our results indicate that those conditions are at high risk now and in the future. At the landscape-scale, predicted habitat for lynx represented only 25% of forestland area. Further, requirements for an aggregated configuration of suitable habitat required by American martens may be especially difficult to achieve without directed conservation planning. Increasing scale had relatively little effect on stand-scale indicators; however, scale greatly influenced landscape-scale indicators. Our data suggest that landscapes should be at least 400 km² in area to effectively conserve area-sensitive indicators. Our projections indicate that all condition indicators will decline an average of 52% from 2007 to 2032 if current forest harvesting trends continue. Thus, enhanced planning and directed management for selected biodiversity conditions will be required to avoid future loss of forest biodiversity.
Assessment of locals’ attitude is crucial to improve relationship between Protected Area (PA) and people by guiding for policy and management decisions. Locals tend to be alienated from conservation when not allowed to use the sustenance resources due to stringent legal protection of the PAs. Conservation attitude of communities in the vicinity of Valmiki Tiger Reserve in the Himalayan foothills in India was assessed. The study area is a Priority Level 1 Tiger Conservation Unit in contiguity with Chitwan National Park and Parsa Wildlife Reserve in Nepal. Locals are dependent on the Reserve for various resources, extraction of which is an offence as per the current legal provisions. Questionnaire survey and focused group discussions were conducted in four sample villages close to the ‘core area’ of the Reserve. Conservation attitude, assessed on the basis of five specific questions, was categorized into no, low, moderate and high conservation attitudes, and analyzed as a function of socio-economic, forest dependence, awareness and human-wildlife conflict factors. Ordinal Logistic Regression was used to explore the influence of explanatory variables on conservation attitude. Conservation attitude was found to be low to moderate. The model reflected that better affluence and increased forest dependence of locals tend to improve their conservation attitude.

In the spring of 2007 a survey was conducted evaluate the awareness of the conservation status of two groups of polar animals which have received much attention in the media (primarily due to risks to their populations posed by global warming): polar bears and penguins. A total of 243 people participated in the survey, conducted at George Mason University, Virginia. Respondents included students, faculty and staff. A high number of surveyed participants (75%) had taken an environmental class at the university. However, knowledge of protection issues regarding polar bears and penguins was exceptionally low. When asked if polar bears (Ursus maritimus) are considered to be endangered under U.S. law, 65% said yes. At the time of the study polar bears were being considered for listing as “threatened” under the US Endangered Species Act, a lower category than “endangered”, but were not listed until May 15, 2008. Moreover, 43% of those surveyed believed that penguins were considered to be endangered under U.S. law, despite having no status or listing under US law at all. More than fifty percent of the participants considered polar bears (69%) and penguins (53%) endangered internationally; the IUCN listing polar bear was changed from “least concern” to “vulnerable” in 2006, but the species as a whole was not considered to be “endangered”, as yet. Of the 18 listed species of penguin, the Galapagos penguin (Spheniscus mendiculus), yellow-eyed penguin (Megadyptes antipodes), northern rockhopper (Eudyptes moseleyi) and erect-crested penguin (E. s. sclateri) are considered to be endangered, although seven species are considered to be “vulnerable” e.g. the southern rockhopper (E. chrysocome) and Macaroni (E. chrysolophus) penguins. The most well known penguin species, the emperor penguin, Aptenodytes forsteri, is listed as “least concern”. Thus despite their high media profile, awareness of the actual conservation status of these animals is low. The study suggests greater public outreach is required to make the pubic aware of the conservation status of even high profile species.
Afghanistan: Conservation in a Country in Conflict

Afghanistan lies at the juncture between Paleartic, IndoMalayan, and African biotic realms, and therefore has a rich biodiversity. For example, there are at least 9 species of cat extant in Afghanistan now, with two others only recently extirpated from the country. It is home to such iconic species as snow leopards (Uncia uncia), Marco Polo sheep (Ovis ammon polii), and Markor goat (Capra falconeri). From deserts to mixed deciduous forests to high alpine grasslands, there are wildlands and wildlife worthy of conservation. The Wildlife Conservation Society began its current project on Biodiversity Conservation in Afghanistan in 2006. The project involves local communities in three regions of Afghanistan, and with the central government to help them develop the legal framework and policies for protected areas, protected species, and conservation. There was very little in the way of a legal framework for conservation in Afghanistan when we began, and very little expertise in conservation in the Afghan government or academia. Security declined significantly over most of the life of the project thus far, but may improve in 2010. Despite these challenges, we have made significant progress. Here, we report on our accomplishments to date, our plans for continued work, and the challenges of working for conservation within a country in conflict.

Improving the accuracy of surveys for an at risk amphibian on Alberta’s Great Plains

Management of at risk species requires accurate estimation of population size and distribution, but for species that occur at low abundance across a large area this is often complicated by imperfect detection. Northern leopard frogs (Lithobates pipiens) are classified as Threatened under Alberta’s Wildlife Act and their effective management is impeded by a poor understanding of their demographics. In 2009 we undertook eight repeat surveys (four in spring and four in late-summer) of 69 sites across 90,000 km2 of Alberta and measured several covariates which may influence the probability of detecting northern leopard frogs. Probability of detection was lower in spring compared with late-summer but so was site occupancy. Because northern leopard frogs breed in spring and migrate in late-summer, surveys in spring will be more useful in determining permanent occupancy since some late-summer occupancy may be temporary. During spring wind chill, wind speed and water temperature were important predictors of probability of detection. Survey accuracy for northern leopard frogs can be greatly improved by avoiding strong, cold winds and by surveying when water temperature exceeds 17 degrees Celsius.

Wolf Pack Stability Promotes Dispersal and Recovery Area Connectivity

Packs that had stable breeders were more likely to have a subordinate wolf disperse the following year, although dispersal was affected by several factors. Our results suggest that harvest strategies should consider lightly harvesting or protecting some wolf packs enhancing dispersal between recovery areas. These results contribute to the growing body of evidence from other studies on wolf survival and mortality and gene flow that harvest should not occur uniformly throughout any recovery area, especially when considering control of problem wolves occurs irrespective of location. We note, however, that our assessment was in a park setting.

Rabbits, hares and pikas (Lagomorphs): endangered, keystones, and sustainably used - Models for effective conservation action

The approximately 90 species of lagomorph (rabbits, hares and pikas) run the gamut of roles in natural ecosystems. Some species are among the rarest of animals on earth, while others serve important roles as keystone species and ecosystem engineers. Some species have value in commerce and for sport hunting. Others represent a scourge as alien invasive species. Several lagomorph species are heavily impacted by disease, making them a model for how disease can impact native (and non-native) species. Several lagomorphs appear to be important indicator species for the effects of global warming. One species, the European rabbit (Oryctolagus cuniculus) is most of these wrapped into one! I will highlight activities of the IUCN/SSC Lagomorph Specialist Group to engage in activities that lead to positive conservation action utilizing cutting edge approaches to identify and recover threatened species (Tehuantepec jackrabbit, Lepus flavigularis; Zacatuche Romerolagus diazi; Amami island rabbit Pentalagus furnessi), preserve ecosystems utilizing the positive ecosystem role played by some lagomorphs (Plateau pika Ochotona curzoniae); European rabbit O. cuniculus); and the sustainable use of others (Sylvilagus species in North America). LSG activities demonstrate how a species approach can be used broadly to effect positive conservation action with wide-scale application.
Quantifying observer effort for opportunistically-collected wildlife sightings records

Opportunistically sightings networks can be a useful and practical method for identifying the geographical and temporal distribution of species in areas where systematic surveys are unrealistic. However, without records of when and where observers travelled, it is impossible to determine whether geographic or temporal variation in sightings reflects variation in effort or variation in the species of interest. We created a GIS model to reconstruct a plausible distribution of effort of the main categories of voluntary observers reporting whale, dolphin and sea turtle sightings. Observers were grouped into categories such as commercial whale watchers and ferry crew. Effort for each observer was estimated using patterns typical of his or her category, including trip distances, proximity to home port, standard ferry routes and maximum sighting distances. We also estimated the relative effectiveness of each category at sighting, identifying and reporting cetaceans, and used both types of estimates to create an effort layer for each observer category. The layers were combined to give a spatially explicit overall estimate of sightings effort. We then applied the effort model to our sightings database to calculate an index of sightings density per unit effort for use in estimating species densities. The method provides a practical approach to estimating observer effort applicable to a range of studies making use of opportunistically-collected data.

A mapping-based niche comparison of California endangered and threatened species and their closest relatives

Niche conservatism in endangered and threatened taxa has been largely ignored in the literature. Using Environmental Niche Modeling (ENM), we modeled the ecological niches and evaluated niche conservatism in 23 California endangered and threatened taxa and their closest relatives. Species persist within a limited set of biotic and abiotic conditions defined as the niche. Although little empirical evidence exists, theory suggests that closely related taxa should exhibit low niche differentiation and share similar threats of extinction. This concept of niche conservatism proposes that rates of adaptation outside of the fundamental niche are often slower than the extinction rate. ENM is a powerful explorative tool that has been used increasingly to answer fundamental questions about niche theory. We used extensive museum collection databases, accessed through Global Biodiversity Information Facility (GBIF), and the Genetic Algorithm for Rule-Set Prediction (GARP) package to model the fundamental niches of each of the 46 taxa. Our study aimed to compare a diverse set of endangered and threatened taxa to elucidate potential patterns of niche conservatism across a broad group of clades. Understanding niche dynamics and the underlying mechanisms driving speciation is important, especially for endangered taxa. Moreover, identifying patterns and commonalities among such a wide array of endangered taxa could benefit species management decisions.
Habitat preference and activity budget of Civettictis civetta, recently re-introduced into the reserve was studied using direct and indirect observations. Footprints, feeding spots, faecal spots, and civetone were employed as signs in indirect estimation. Temporal and spatial distribution of these signs in the three vegetation of the reserve was investigated. Fifty-eight percent of the signs were made between 7pm-12am, 40% between 1am and 6am, 1.4% between 7am and 12pm. No signs were made between 1pm and 6pm. On nights when the moon is full, this activity rhythm is altered as no signs were recorded throughout such nights. Fifty-one percent of the signs were located in savannah grassland, 26% in swamp forest and 21% in mangrove forest. This species was found largely nocturnal, with a preference for savannah grassland for its daily activities. Though largely omnivorous, palm seeds were the predominant fruits in the faecal droppings. Traces of illegal poaching activities were recorded within the reserve. There is a need for specialised studies to determine the population dynamics of this species especially in this reserve. Further analysis of the faecal droppings is also required to determine the animal-species preference of this species so as to develop an effective conservation programme for the animal

**Mapping Habitat Loss and Human Elephant Conflict in Priority Landscapes**

Habitat loss and resulting human elephant conflict (HEC) are leading threats to wild Asian elephants. Yet, baseline data for evaluating habitat loss has not been compiled for most of the range and little information land cover, change and HEC is available for systematic assessments, monitoring, and conservation planning. The World Wildlife Fund’s Asian Rhino and Elephant Action Strategy (AREAS) Programme and the Smithsonian National Zoological Park, World Wildlife Fund, US, World Wildlife Fund AREAES Programme, World Wildlife Fund India, World Wildlife Fund Indonesia; songerm@si.edu

**The black and white of rhino conservation: why has the conservation of rhino in South Africa been so effective, and can it continue?**

Contrary to the general downward trend in conservation status of many large mammals, especially mega-herbivores, the two species of rhinoceros (the white rhino (Ceratotherium simum) and black rhino (Diceros bicornis)) in South Africa have been steadily increasing. We ask why South Africa has been so effective at not only conserving them but how they have improved their status. For this paper we compare the effectiveness of rhino conservation in south Africa with other areas. We suggest the effectiveness stems from a number of factors which we describe. These are: 1) the use of a managed metapopulation approach to preserving and increase numbers, 2) the use of expert opinion and an increasing use of evidence based conservation, 3) effective use of fences and other forms of security to protect them, 4) a combined effort by many organisations, sharing costs and reducing individual effort and 5) a group of highly motivated and dedicated individuals driving the process. The combination of these factors, along with financial and political stability have all contributed towards success. I therefore make suggestions that, in some other selected situations, that this is the way to go for conserving some other species. For instance another successful conservation program in South Africa having some of the above conservation factors running is the South African wild dog (Lycaon pictus) conservation effort. I suggest the recent widespread increase in rhino poaching, including in South Africa, is a threat to rhino conservation, but not so much in south Africa as elsewhere, owing to the effective conservation measures in place and the ability to react to this adversity.
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Assessing the risk of invasion by common reed (Phragmites australis) in a protected wetland

Common reed is a growing concern in North America, as its rapid progression is associated with a degradation of local plant diversity and ecosystem functions. Few control methods of the species have proven to be cost-effective. In vulnerable sites such as protected areas, an assessment of invasion risks allows managers to choose the best method of intervention (e.g. prevention, early control). We aim to develop an approach to help predict the risk of invasion by common reed, focusing on a protected wetland in Southern Quebec for which we have mapped all colonies of common reed. Based on data acquired through remote sensing and field studies, we are studying the incidence of various environmental factors (e.g. land cover/land use, distance to various perturbations) on the current distribution of the species. A model based on maximum entropy approach is then used to map the potential distribution. Results show that invasion risks are higher in areas located closed to roads and ditches and in certain land cover such as high marshes, fallow land and built-up area. These predictions will be used by managers as a tool to target the best management approach and sites to prioritize, and will improve our current knowledge of reed ecology.

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Effects of social trust in government on attitudes towards wolves and wolf management in Alberta, Canada

Wolf depredation on domestic livestock continues regardless of the number of wolves culled. In addition, perception of conflict may by high regardless of the level of livestock losses. Under these circumstances, managing agencies could reduce conflicts by fostering participation. People (including residents and, ideally, all interest groups) feel included and heard, and this produces positive attitudes towards wolf management practices. In general, social trust in the agency has been identified as an important driver of attitudes towards environmental issues. This research examines the variables affecting social trust in relation to wolf management issues. Data collected through a mail survey of residents in Southwestern Alberta was used to examine the mediation role, social trust plays between a person’s values and attitudes toward wolf issues. A structural model was used to examine 571 responses over 27 questions. Our findings show that social trust in the managing agency does play a crucial role linking a person’s values to positive attitudes towards wolves. Our results illustrate the important role played by agencies in determining their constituents’ attitudes towards wolf issues. From a broader perspective, this study suggests that communication, education and participation by local residents are key to managing environmental management conflicts, which inevitably have conservation implications for wolves in this area.
Science drives management of Braya on the Limestone Barrens

The Newfoundland and Labrador Endangered Species Act was established to protect species at risk. For each listed species, such as Braya longii (endangered) and B. fernaldii (threatened) a recovery team is established. The Limestone Barrens Species-at-Risk Recovery Team is composed of specialists, government managers, community and industry members, and students. Comprehensive teams are essential in ensuring the best scientific data is collected and used in management decisions. The LBSARRT, established in 1998, ensured that the definition of Braya critical habitat and stewardship priorities are based on scientific evaluation. Recent management concerns surround the mitigation of Plutella xylostella (diamondback moth) infestation and three pathogenic threats. Demographic data recorded annually (1998-2006) in 13 Braya populations on undisturbed and anthropogenically degraded habitats and summarized into deterministic projection suggest severe Braya declines. Management options were explored by adjusting Braya survival rates and the removal of P. xylostella. Reductions in pest abundance, restoration of degraded habitats, and Braya introductions into undisturbed, unoccupied habitat will improve Braya viability. This research has allowed managers to set biological significant priorities in mitigation plans.

Are rare plant populations on degraded habitats less valuable for conservation?

Habitat loss and fragmentation is a severe threat to the persistence of rare plants, requiring conservation biologists to consider the use of degraded habitats in species recovery. Approximately 30% of the limestone barrens of Newfoundland, Canada, home to Braya longii (endangered) and B. fernaldii (threatened), have been anthropogenically degraded. The presence of insects and pathogens. Plutella xylostella (diamondback moth) infested 30% of B. longii and 16% of B. fernaldii died from root rot, 18% of B. longii lost flowering stalks to rot, and 27% of B. fernaldii had flowering stalk and leaf deformities. More insect infestations and the majority (66-100%) of pathogen infections occurred on degraded habitat. The presence of pests was linked with statistically higher mortality rates and declines (9-75%) in seed production compared to flowering plants that were neither infected nor infested. Presently, degraded habitats are considered important reservoirs for Braya seeds and receive legal protection. However, their ability to act as a pest reservoir and lack of within population genetic diversity brings into question their conservation value. Our research suggests that rare plant populations surviving on disturbed or degraded habitats need to be screened for potential negative impacts to undisturbed populations. Some habitats may need to be restored as part of recovery efforts.

A comprehensive ground-based framework for quantification of human impacts on wildlife and habitat

Ground-based monitoring of human impacts on wildlife and habitat is a critical component of conservation efforts, especially in biodiversity hotspots with significant human populations. Currently most efforts to monitor human impacts are limited to encounter rate indices, such as number of snares/km walked. However, such indices bear an unknown relationship with true impact prevalence because they do not account for imperfect detection, and are especially misleading when detectability varies spatially or temporally. We adapted a standardized detection-non-detection survey and a statistically robust framework to explicitly estimate detection probability and hence quantify the distribution and intensity of human impacts. We applied this framework in a multiple-use zone in the southern Western Ghats as a critical component of quantifying threats to connectivity for large mammals. Although very little evidence of poaching was detected during field surveys, our models indicate that 5 percent of the sampled area was impacted by it, a 110% increase from naïve estimates of poaching presence. Our results highlight the influence of human settlements on the prevalence of several human impacts over the landscape. Our approach combines simple, cost-effective field methods with a robust analytical framework to quantify impact prevalence, prioritize conservation efforts and evaluate their outcomes. It also provides conservation managers with an intuitive visual tool for adaptive management.
Relating Bird Species Traits Directly to the Landscape: An Application to Urban Planning

Within urbanising landscapes, multivariate analyses that focus on species traits promise to be useful conservation tools because they can predict which traits may be affected by particular development decisions. By understanding how landscape vegetation and attributes relate to species traits, planners will have a greatly increased awareness of how faunal communities in the landscape will be affected by urban development. In our paper, we explored the conservation applications and implications of multivariate analysis for a pre urbanised landscape. We used RQ analysis, a three-table ordination method, to directly relate species traits to environmental variables. We found that community composition was strongly influenced by landscape vegetation and attributes, and that species traits were clearly and directly related to environmental variables. These results increase our understanding of how the planned urban development for the landscape will affect bird communities, and have the potential to better focus species monitoring on those with traits that will be affected by development, and to proactively address negative effects. Our study has demonstrated that RLQ analysis can be effectively applied in urban planning, that its application informs our understanding of ecosystem structure and processes within a landscape, and hence aids conservation.

Tracking progress towards 2010: what do the global indicators tell us?

In response to global declines in biodiversity, over 190 countries have pledged under the Convention on Biological Diversity (CBD) ‘to achieve by 2010 a significant reduction in the current rate of biodiversity loss at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on Earth’. This ‘2010 Biodiversity Target’ has since been incorporated into the Millennium Development Goals. The 2010 Biodiversity Indicators Partnership (2010 BIP, www.twentyten.net) is a GEF funded global initiative that is mandated by the CBD to track progress towards the 2010 Biodiversity Target and strengthen the development, availability and use of biodiversity indicators at multiple scales. The 2010 BIP secretariat is based at UNEP WCMC and has worked with 41 international partner organizations since 2007 to develop indicators within 22 Headline themes over seven focal areas. We present the results of the initiative; highlighting biodiversity indicators within the CBD’s flagship 2010 report ‘Global Biodiversity Outlook 3’; and including novel aggregation of 31 biodiversity indicators into a narrative of (i) current pressures on biodiversity, (ii) biodiversity status, (iii) policy and practical responses and (iv) benefits (ecosystem services); concluding that the 2010 Biodiversity Target has been missed.

Combining Static and Dynamic Landscape Variables in Predicting Species’ Range Shifts Under Climate Change

Methods to predict future range changes commonly involve species distribution (niche) models based on climatic variables. Values for these dynamic variables are predicted for the next several decades using the results of climate models. However, species distributions also depend on factors other than climate that are either expected to stay static into the future (e.g., soil type) or for which future scenarios may not be available (such as those from remote sensing). Ecological niche models built using present-day conditions and projected to future conditions can be misleading if the correlations between static and dynamic variables change in the future. The question of how best to combine dynamic variables predicted by climate models with static variables is not trivial. Using a set of artificial species displaying a range of life history traits and dispersal capabilities, we tested various methods for combining these different types of variables under future climate scenarios. We evaluated each method for how well it predicts both future available habitat and risk of extinction. Alternative methods include using the static variables as masks, and including them as independent explanatory variables in the model. The method that gives the most accurate results depends on the type of interaction (e.g., additive vs. multiplicative), the degree of correlation between the static and dynamic variables, and the degree to which these change in time.

Alberta’s Oilsands - The pace of landscape transformation and change in ecological integrity

The boreal forest biome of northern Alberta contains the world’s 2nd largest remaining deposit of oil. During the past half century, the pace and tempo of bitumen extraction in this region has increased exponentially and created a profoundly anthropogenic landscape through the construction of seismic lines, surface mines, wellsites, access roads, pipelines, processing plants, settlements, and workforce. Yet, the bitumen development of this region is still young, and most of the landscape transformation has yet to occur. This region also supports a large forestry sector whose longterm viability is challenged by the cumulative effects of a sympatric forestry and hydrocarbon sector. Against a backdrop of "range of natural variability", this presentation will chronicle the historical development of this landscape, will identify the current metrics of the anthropogenic and natural landscape, and will describe plausible future development trajectories. A suite of indicators will be presented including landscape metrics (landscape composition, fragmentation, age class structure), and economic metrics (bitumen production, wood production, GDP, revenue, workforce).
Incorporating Ice Related Mortality into the Assessment of Northwest Atlantic Harp Seals, <em>Pagophilus groenlandicus</em>

Northwest Atlantic harp seals give birth and nurse their pups on the drifting pack ice of Atlantic Canada. Weaned young also use ice as a resting platform and having adequate ice is critical for survival. Comparing pupping locations to ice types indicates that females appear to prefer thin-medium first year ice. Both extent and thickness of ice has declined over the past decade, with 2010 being one of the lowest in 40 years. At the same time, harp seals have been hunted extensively in both Canada and Greenland. Harp seals are assessed every 4-5 years using a population model that relies upon survey estimates of pup production. As such, the impact of ice-related mortality will not be reflected in the surveys for many years. A factor to account for increased mortality due to poor ice has been incorporated into the model since 2004, but the importance of including this factor must be evaluated. Under scenarios of a constant harvest, ice mortality at 30% in a single year would result in significant changes in the population trajectory within a decade, although they would not be detected in pup production for at least 20 years. Repeated ice-related mortality of 10% had an impact if it occurs 6 or times in a decade. Changes in the population and pup production could not be detected before significant changes in the population can occur. Therefore, possible changes in natural mortality due to poor ice must be taken into consideration in order to management this species properly.

Evaluation Of Bear Rub Surveys To Monitor Grizzly Bear Population Trends

Wildlife managers need reliable estimates of population size, trend, and distribution to make informed decisions about how to recover at-risk populations, yet obtaining these estimates is costly and often imprecise. The grizzly bear population in northwestern Montana has been managed for recovery since being listed under the U.S. Endangered Species Act in 1975, yet no rigorous data were available to evaluate the program's success. We used encounter data from 379 grizzly bears identified through bear rub surveys to parameterize a series of Pradel model simulations in program MARK to assess the ability of noninvasive genetic sampling to estimate population growth rates. We evaluated model performance in terms of: 1) power to detect gender-specific and population-wide declines in population abundance, 2) precision and relative bias of growth rate estimates, and 3) sampling effort required to achieve 80% power to detect a decline within 10 years. Simulations indicated that ecosystem-wide, annual bear rub surveys would exceed 80% power to detect a 3% annual decline within 6 years. Robust design models with 2 simulated surveys per year provided precise and unbiased annual estimates of trend, abundance, and apparent survival. Designs incorporating 1 survey per year require less sampling effort but only yield trend and apparent survival estimates. Our results suggest that systematic, annual bear rub surveys may provide a viable complement or alternative to telemetry-based methods for monitoring trends in grizzly bear populations.
Black Bear Density In Glacier National Park, Montana, USA

No demographic information exists on the status of Glacier National Park’s (GNP) black bear (Ursus americanus) population. In 2004, we sampled the black bear population within GNP plus a 10 km buffer using noninvasive hair collection methods as part of a 7.8 million-acre study of the regional grizzly bear (U. arctos) population. We collected 5,645 hair samples from 550 baited hair traps, and 3,807 samples from multiple visits to 1,542 natural bear rubs. Microsatellite analysis identified 600 (51% F) individuals from the 2,848 samples identified as black bears. Data from individual bears were used in closed population mark-recapture models to estimate black bear population size and density in the 6,600 km² greater GNP area. Preliminary results suggest that the density of GNP’s black bear population was equal to or greater than other interior populations sympatric with grizzlies, despite the high density of grizzlies in this area. This project represents the first estimate of black bear abundance for this area, and demonstrates the efficiency of multi-species projects adaptive to predicted climate change than a comparable ecosystem where cattle were the competing herbivores, more persistent and higher streamflows, and lower rates of grassland fragmentation due to the nature of the simplified management regime needed for their production. As a result, the prediction is that large-scale bison restoration would support both more individuals and more species. Because the number of species is correlated with ecosystem multifunctionality, it is predicted that ecosystems where bison occur at scale would be more resilient, be able to provide a wider array of ecosystem services, and be more adaptive to predicted climate change than a comparable ecosystem where cattle were the primary grazers.

Environmental regulation of Festuca campestris grassland resistance to invasion by Poa pratensis

Invasion of non-native species such as Poa pratensis has become a serious threat to the ongoing conservation of native rough fescue grasslands in Alberta, Canada. Conservation efforts are currently limited by a poor understanding of the ecological mechanisms responsible for regulating resistance of native grasslands to encroachment by P. pratensis. Using a multi-factorial field study, we tested various mechanisms with the potential to alter Poa encroachment over 3 years, including changes in environment (water addition, nitrogen addition and litter removal), and defoliation during either summer or winter, in a factorial design. After one year summer defoliation was the most important factor altering community composition, including favoring P. pratensis encroachment. In contrast, low water conditions led to reduced P. pratensis. Vegetation responses at the community level suggested there were two divergent responses among most plant species, including one group that reacted similarly to P. pratensis, and another that responded similar to the climax grass species (Festuca campestris). The latter group was negatively affected by summer defoliation and preferred low water conditions, but was relatively resistant to winter defoliation. Overall, we conclude that summer defoliation and soil moisture availability were the primary determinants of changes in composition of these Festuca campestris grasslands.
P2.141 Stevens, A.F. Joy*; Bayne, Erin M.; Wellicome, Troy I.; Canadian Wildlife Service, Environment Canada, Department of Biological Sciences, University of Alberta; joy.stevens@ec.gc.ca  
Use of habitat selection models in unsampled environments for Burrowing Owl (Athene cunicularia) conservation in Canada

Habitat selection models explore species-environment relationships using empirical data, however, the utility of such models for conservation also depend on their ability to predict species occurrence in unsampled environments. This is particularly important for rare or endangered species in Canada, such as the burrowing owl (Athene cunicularia), which depend on critical habitat identification and protection for population recovery. Previously, we created six predictive home-range habitat selection models for the current distribution of burrowing owls in Alberta and Saskatchewan based on parameters that describe soil, climate, geography, land-use and grassland fragmentation. In this study, we applied these models to the 1990’s burrowing owl range in Manitoba and evaluated their predictive ability using current and historical burrowing owl locations. Importantly, the habitat selection models can predict burrowing owl occurrence in Manitoba, however, the spatial distribution of suitable habitat sometimes varied from the known distribution based on field observations. These results will aid in the identification of critical habitat and increase survey efficiency for burrowing owls in Manitoba, a population that is almost extirpated. We conclude that habitat selection models can be extrapolated outside of the area they were designed for, provided that the results are verified with known species locations or additional field surveys.

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Mainstreaming systematic conservation plans into multi-sectoral land-use plans at a local level: Key lessons from South Africa  
The mainstreaming of systematic conservation plans into the land-use (town and regional) planning sector is a key challenge to the successful achievement of biodiversity conservation objectives at a local level. A major impediment to success is the frequency of design of conservation plans in isolation of socio-economic considerations, often resulting in poor support for the implementation of such plans. The Cape Floristic Region (CFR) and Maputaland-Pondoland-Albany recognised centres of diversity and endemism are currently subject to rapid transformation that threatens priority biodiversity along the eastern seaboard of South Africa. Key lessons from two systematic conservation planning projects in the Eastern Cape Province of South Africa, in which different multi-sectoral integrative approaches have been applied, will be shared. These projects involved the development and Ministerial gazetting processes for a Bioregional Plan for the Nelson Mandela Bay Municipality and an Environmental Management Framework for the central coastal zone of the Province. The approaches applied to resolve potential conflicts with other sector plans (e.g., agriculture, housing, industry) and integrate the outcomes of the conservation plans into overarching land-use planning frameworks highlighted a number of successful mainstreaming mechanisms. These mechanisms will be explored, including evaluation of the land-use needs of other sectors during the development of the conservation plans, inclusion of multi-disciplinary expertise in the conservation planning teams, capacity building, the development of conservation “champions” within implementing agencies, and the design of planner-friendly conservation products.

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Resource Selection by the Canadian Toad at an Oil Sands Mine in Alberta, Canada

The Canadian Toad Bufo (Anaxyrus) hemiophrys, a species listed under Alberta’s Wildlife Act, is a valued ecosystem component in environmental impact statements (EISs) for proposed mining developments in the oil sands. A good understanding of habitat selection is fundamental to making accurate predictions for an EIS. Our objectives were to examine patterns of habitat selection using Resource Selection Functions (RSFs) and to test the prediction that Canadian Toads select reclaimed habitat during post-breeding movements at an oil sands mine. RSFs were based on radio-telemetry data collected on 16 toads in northeastern Alberta during 2005 and 2006 (599 used locations in total). Toads travelled at a maximum speed of 655 m/d and as far as 2000 m from the first capture location. We combined data on used and available locations with environmental information to build a suite of a priori models. Based on Information Theory, top models were those with habitat type and proximity to nearby resources (e.g., hibernacula) as covariates. RSFs indicated strong selection for open habitat types (including reclaimed areas and industrial clearings) over treed habitat. However, RSFs failed to show selection for reclaimed habitat over non-reclaimed, open habitat. Field observations suggested that herbaceous grassland cover with a dense deadfall layer provides important microhabitat for foraging and refugia. The Canadian Toad may be more of a habitat generalist than previously thought.

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Conservation Impacts on Forest Carbon Budgets: Preliminary Results from Canada's National Parks  

Forests and forest sector activities exert strong influence on the atmospheric concentration of greenhouse gases. Forest conservation is being considered as a climate change mitigation strategy. Since 1885, national parks in Canada have been established to conserve important ecosystems. Here we examine the impacts of forest conservation in national parks on current forest carbon (C) stocks and stock changes. We hypothesized that avoidance of timber harvesting in these parks should result in higher stand ages and higher C densities, but reduced net uptake of C compared to the surrounding managed forest. Park forests are, however, affected by natural disturbances: wildfire and insects can have large impacts, often with multi-decadal legacies. Using the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3), we compared contemporary forest C budgets for selected national parks in western Canada to the C budgets of their surrounding managed forests. Preliminary results indicate that although harvesting was excluded, natural disturbances caused C losses from park forests in some years, followed by C uptake during succession. Conservation, therefore, is by itself no assurance of a long-term sustained forest C uptake. On average, park forests were found to sustain higher ecosystem C densities, but by transferring C to harvested wood products (HWP), managed forests also contribute to climate change mitigation through increased HWP C stocks and substitution benefits.
Role of woody vines in determining abundance and movement of small mammals in a logged Bolivian forest

Woody vines maintain connectivity in logged forests for small mammals and are necessary for meeting their needs for foraging, dispersal, and refugia. I evaluated the importance of vines and vine tangles for terrestrial and arboreal small mammals in a transitional Amazonian forest in eastern Bolivia. Based on captures in sites representing a range of logging disturbance, I compared the abundance of animals with the availability of food (invertebrates and fruit) and vine density, followed movements of individuals using spool line to determine whether vines are selectively used as substrates, and used giving up densities to determine if vine tangles serve as refugia by comparing foraging intensity under vine tangles and in open areas. Preliminary results suggest that animal abundance and diversity are positively associated with an intermediate density of vines even though these sites do not correspond with those with high insect abundance. However, vines do not explain differences in abundance and distribution of animal species and were not selectively used as movement substrate. Finally, small mammals foraged more beneath vine tangles than in other sites, suggesting tangles play an important role as refugia for some species. These results help identify ecological mechanisms that explain the structure of the small mammal community in forests disturbed by logging.

Status and Conservation of Wild Reindeer (Rangifer tarandus sp) in Svalbard and Southern Norway

Svalbard reindeer (Rangifer tarandus platyrhynchus) are endemic to the Svalbard Islands of Norway. As a result of overharvest and subsequent population declines, harvesting of the arctic sub-species of Rangifer was banned in 1925. A limited and regulated harvest was reopened in 1983. The population dynamics at the main reindeer areas on the west coast are characterized by large climatic and density-driven fluctuations, whereas little information is available from the remote and climatically different northern and eastern parts of the archipelago. Approximately 90% of all European wild reindeer (Rangifer tarandus) live in 23 isolated mountain areas in southern Norway, where land transformation and habitat fragmentation are the main conservation issues. Herds are monitored and managed by harvest at the scale of sub-populations, whereas land management authorities operate at the municipality and county level - a scale smaller than the home range of herds. This results in a complex mix of responsibilities and loss of reindeer habitats from piecemeal construction of human infrastructure. Larger regional land management plans are currently being established, hopefully leading to more holistic management of reindeer habitats. Other knowledge needs include: direct and secondary effects of harvesting, effects of climate change, and mitigations of closed migration corridors and important grazing habitats.

Artificial lighting schemes can damage bat foraging habitat directly through loss of land and fragmentation or indirectly by severing commuting routes from roosts, polluting commuting and foraging habitat. The effect of street lighting on bat activity was tested in experiments along commuting routes of lesser horseshoe bats at eight sites across Wales and South West England. Hedgerows were illuminated at a mean of 53 lux using two portable high pressure sodium street lights. Bat activity was recorded using AnaBat remote acoustic detectors. Repeated-measures analysis of variance (ANOVA) was used to test the effect of experimental treatment on bat activity. Treatment type had a significant effect on bat activity (p = ...
Landscape resistance to dispersal: predicting long-term effects on a small and isolated wolf population in southwestern Manitoba, Canada

Abstract: Landscape fragmentation affects wildlife population viability, in part through the effects it has on individual dispersal. Considerable fragmentation of native habitats and loss of forest cover has occurred in association with agricultural development over the past 50 years in our study area - the region surrounding Riding Mountain National Park (RMNP) in southwestern Manitoba, Canada. However, some forms of human disturbance impinge on dispersal without simultaneously fragmenting habitats. In this study, we examined how protected area boundaries, roads outside the protected area boundaries, and hostile human behaviour have altered dispersal success without simultaneously fragmenting habitat. We simulated dispersal using HexSim, a spatially-explicit individual-based population model, parameterized with data on wolves (Canis lupus) in the RMNP region. Scenarios that accounted for negative human attitudes and roads outside the protected area boundaries exhibited lower mean population size than scenarios that ignored these details. In contrast, increasing deflection from protected area boundaries did not appear to have a significant consequence for population viability. Our results illustrate how habitat fragmentation itself can fail to account for the impacts on wildlife imparted by some forms of dispersal barriers.

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Habitat Use of the Sumatran Tiger in Forest and Plantation Landscapes

Abstract: Sumatran tigers are threatened by habitat loss, but habitat use by tigers outside of natural forests has rarely been studied. We investigated tiger habitat use in major landcover types (natural forest, acacia plantation, oilpalm plantations, rubber plantations, and mixed agriculture) in southern Riau Province, central Sumatra. We examined the habitat use of tigers in 28 17 x 17 km grid cells, surveyed an average of 40 independent 1 km transects in each cell. In total we sampled 1094 km of transects. We recorded tiger detections and habitat variables in 100 m segments. Tigers used natural forest areas in higher proportion (15.2%) than availability and used plantations of acacia (3.7%), oilpalm (0.8%), and rubber (0.5%) less than availability. Tiger habitat use in acacia plantations was influenced by distance to a core forest habitat, low levels of human activities, and older age stands. Within natural forests, general vegetation conditions influenced detection probability of tigers, with observers more likely to detect tigers in less dense forests. Tigers prefer native forests over any type of plantation, but could potentially use older acacia plantations with low human activity, as well as riparian forests, as movement corridors to travel between natural forest patches across the fragmented landscape. This information is important for the restoration of tiger population in Sumatra’s forest and plantation landscapes through the improvement of habitat connectivity.

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Habitat Use of the Sumatran Tiger in Forest and Plantation Landscapes

Abstract: Sumatran tigers are threatened by habitat loss, but habitat use by tigers outside of natural forests has rarely been studied. We investigated tiger habitat use in major landcover types (natural forest, acacia plantation, oilpalm plantations, rubber plantations, and mixed agriculture) in southern Riau Province, central Sumatra. We examined the habitat use of tigers in 28 17 x 17 km grid cells, surveyed an average of 40 independent 1 km transects in each cell. In total we sampled 1094 km of transects. We recorded tiger detections and habitat variables in 100 m segments. Tigers used natural forest areas in higher proportion (15.2%) than availability and used plantations of acacia (3.7%), oilpalm (0.8%), and rubber (0.5%) less than availability. Tiger habitat use in acacia plantations was influenced by distance to a core forest habitat, low levels of human activities, and older age stands. Within natural forests, general vegetation conditions influenced detection probability of tigers, with observers more likely to detect tigers in less dense forests. Tigers prefer native forests over any type of plantation, but could potentially use older acacia plantations with low human activity, as well as riparian forests, as movement corridors to travel between natural forest patches across the fragmented landscape. This information is important for the restoration of tiger population in Sumatra's forest and plantation landscapes through the improvement of habitat connectivity.

SP10.11 Sunarto Sunarto*, Marcella J. Kelly, Sybille Klenzendorf, Dean F. Stauffer, Mike R. Vaughan, Zulfahmi, Harry Kurniawan, Karmila Parakkasi; Virginia Tech, WWF US, WWF Indonesia, sunarto@vt.edu

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Dolphin-watching tourism in Chilika lagoon, India: Opportunities and Limitations

Abstract: Chilika lagoon in India harbors an endangered population of Irrawaddy dolphins. Since the 1980’s, the lagoon has been in a state of social and biophysical flux. The role of communities in managing their primary livelihood of fishing has been limited by administrative and environmental forces. The adaptive capacity of communities to deal with external changes has been variable. Through interviews and questionnaires we explore the socio-economic buffering capacity provided by locally operated dolphin-watching tourism to socio-ecological changes in the Outer Channel of Chilika lagoon. We identify a direct dependency between local communities and tourism which mimics the strength of their linkage to fishing. Fishers can switch between fishing and tourism activities, creating diverse income opportunities. The mechanism adds support to research elsewhere that multiple livelihoods offer a source of resilience to socio-ecological uncertainty. Growth of the industry has been unlimited since 2001 with approximately 750 boats currently active in an area of 30km2. We conclude that locally managed eco-tourism provides opportunities for communities to buffer environmental changes such as declines in fish catches. However, without strengthening local institutions, the largely unmanaged development opportunities provided by tourism could fail to accomplish the desired goals of either fishermen or those seeking to conserve Irrawaddy dolphins.

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SY63 Sutherland, Glenn D.*; Waterhouse, F. Louise; Environment Canada and Cortex Consultants Inc., British Columbia Ministry of Forests; gsutherland@cortex.ca
Conservation lessons across borders: critical habitat protection for the endangered Canadian population of Northern Spotted Owls

With limited connectivity to the US population, the endangered Canadian population of Northern Spotted Owls faces imminent extirpation. Assessments of landscape management options using spatially-explicit modelled representations of population dynamics and habitat supply – particularly representing the multi-scaled functional nature of critical habitat - have informed successive stages of Spotted Owl recovery efforts under SARA. Important lessons from this collective, multi-staged effort are: (1) a critical habitat for larger-ranging species is imprecisely defined, frustrating adequate policy implementation dependent on differentiating among multiple marginal utilities of habitat value; (2) projections of critical habitat condition integrating weighted habitat quality values across site, territory, connectivity, and population factors, assisted stakeholders to identify ecological and socio-economic risks of alternative decisions, although agreement on assumptions was difficult to achieve; (3) spatio-temporal habitat projections provides a consistent means for making iterative refinements to management plans as policy responses to the population’s status changes. We conclude that the large investment of effort to develop an effective suite of tools for applying the science behind critical habitat does improve the transparency of the information used during the process and offers a framework for effectiveness monitoring, but does not necessarily expedite a policy driven process.

SY4 Sutherland, WJ; University of Cambridge; w.sutherland@zoo.cam.ac.uk
Why collaborate with practitioners to generate priority research questions?
It is widely accepted that there is a serious gap between researchers and practitioners such as policy makers. However, there has been little effort to ask practitioners what they would like to know. In 2005 we thus decided to run an exercise to identify the ecological questions that practitioners in the United Kingdom would most like answered. To our amazement, this exercise was astonishingly successful in terms of participation (38 organizations), involvement (654 individuals participated in the question generation stage), publicity (a whole page in one of the UK’s major newspapers), downloads (third highest of any of Blackwell’s 850 journals in 2006), and policy impact (underpins the research component of the UK government’s marine strategy). Key elements include inclusive collaboration, a democratic process, and the integration of practitioners and academics. Our subsequent exercises have included generation of questions for other regions, including the globe, identification of opportunities for policy development, and horizon scanning to identify forthcoming issues. This general method is now being used widely by a range of groups in different regions.

23.4 Sutherland, MB; student; maggie.sutherland@mun.ca
Caribou and its two major predators black bears and coyotes: a matter of perceptions?
Recently on the island portion of Newfoundland and Labrador populations of caribou have been declining. Coyotes arrived to Newfoundland in 1985, and for some this is a natural expansion requiring coexistence, but for others it is a non-native species that clearly must be eradicated. In Newfoundland coyotes have resulted in human-wildlife conflicts particularly with outfitters, hunters and sheep farmers. Data were collected in Newfoundland through a mail-out quantitative questionnaire representative of residents from the island portion of the province to understand attitudes of the urban (n=390) and rural general public (n=396) toward caribou, black bears, coyotes and their management. Although black bears are responsible for more predation on caribou than coyotes, the general public perceives the predation issue as mainly a coyote problem. This perception of coyotes has lead to strong negative attitudes toward coyotes including a general lack of future generation values and willingness to coexist. These perceptions then lead to support for reducing coyotes and less support for addressing the stronger culprit, black bears. This research suggests the challenges wildlife managers may face when setting policy actions to reduce predators.

19.7 SUTTHACHEEP, MAKAMAS*; Thamasak Yeemin; Chaipichit Saenghaisuk; Sittiporn Pensakun; Wanlaya Klinthong; Kanwara Saengmanee; Watcharachai Donsomjit ; Marine Biodiversity Research Group, Department of Biology, Faculty of Science, Ramkhamhaeng University, Huamark, Bangkok 10240 THAILAND; msutthacheep@yahoo.com
Monitoring on Coral Rubble Caused by the 1998 Coral Reef Bleaching in the Gulf of Thailand
The severe coral reef bleaching phenomenon in 1998 caused coral reef degradation in a large area of the Gulf of Thailand, especially at Koh Tao, Koh Samui and Koh Phangan in Suratthani Province. Most dead branching Acropora spp. and foliaceous Pavona spp. became coral rubble fields. A monitoring program has been set up to detect changes of various types of coral rubble in order to determine appropriate methods for active coral reef restoration. The results clearly showed that coral recruitment rates on the coral rubble were very low however dead small juvenile coral colonies were frequently observed on the coral rubble. Coraline algae, sponges and other cryptic fauna were also abundant. We observed that many planula larvae settled on the coral rubble at Koh Tao but they died before reaching big sizes. Therefore a cheap engineering design for stabilizing coral rubble is needed in order to increase survival rates of juvenile corals which settled on the rubble.
Analysis of Threats to Conservation of the Oregon Slender Salamander: A Practical Conservation Approach to Species with Small Geographic Ranges

Conservation of endemic species with small geographic ranges requires knowledge to determine spatial distributions of suitable habitat and careful planning to minimize threats to species. Our objective was to develop an approach based on GIS modeling to assess threats to conservation of the narrowly endemic species. Using conservation of the Oregon slender salamander (Batrachoseps wrighti) as a case study, we developed landscape habitat models and identified the association of slender salamanders to the warmer and moderately drier part of the landscape and to forest stands with tall trees. We further developed risk assessment models to identify spatial distribution of threats in relation to habitat suitability across the species’ range. Our models included fire, road density, land use allocation, and wildland-urban interface as 4 factors of potential threat. We analyzed levels of these 4 factors relative to habitat suitability across 49 5th field watersheds and identified 11 as having high concentrations of potential threats even though these watersheds currently maintain high habitat suitability. In the central-western portion of the species’ range, high concentrations of intensively managed lands and roads are considered as primary threats, whereas fire appears to be the leading threat in the southwestern portion of the range. Our approach based on the analysis of available spatial data in GIS can easily be modified to a wide variety of organisms.

SP9.3 Switalski, TA*; Nelson, CR; Peters, GM; Wildlands CPR, University of Montana, Independent; adam@wildlanedcpr.org
Activity Patterns of a Hunted Black Bear Population in Response to Different Road Access Management and Restoration Practices in Idaho

Forest roads reduce habitat quality for black bears (Ursus americanus). Land managers can mitigate negative impacts of roads on bears by controlling road access or by permanently decommissioning roads. We assessed differences in bear activity patterns and available habitat on 18 paired open and closed (gated, barriered, and recontoured) roads on the Clearwater National Forest, ID. Over the course of four years, we detected a total of 44 black bears on 3,545 camera trap nights. Bears were detected significantly more on recontoured than open roads (3.34 v. 0.51, respectively). Additionally, bears were detected at a significantly higher rate on recontoured roads than on gated or barriered roads (2.69, 0.54, 0.56, respectively). Bears were not detected on open roads during the daytime, suggesting avoidance of humans. Fruiting shrub cover was higher on recontoured than on open, gated, barriered roads. Furthermore, while gates can restrict motorized access, these closed roads provide little hiding cover and can retain long lines of sight. Our results suggest that decommissioning roads by recontour is the most effective road mitigation strategy to improve black bear habitat. These findings may have implications for grizzly bear (Ursus arctos horribilis) expansion in the region.

SP5.13 Sydne Record*; Noah Charney; Aaron Ellison; University of Massachusetts Amherst and Harvard Forest, University of Massachusetts Amherst, Harvard Forest; sydne.record@gmail.com
Projecting from the past to test the effects of informative priors on forecasts of extinction risk made by Bayesian demographic models

When applied to the management of rare species, it is critical that the estimates from population viability analyses (PVAs) have high accuracy and low uncertainty. Long-term data sets help to reduce uncertainty in estimates of PVAs, but are often difficult to collect. A possible solution to reducing uncertainty in these models is to include information from similar studies as prior data in a Bayesian demographic model. The objective of this study was to evaluate the ability of prior probability distributions to provide more accurate and less uncertain PVAs of rare species. Bayesian demographic models specifying uninform ed and informed priors were constructed for four rare plant species (Calochortus howellii, C. pulchellus, C. tiburonensis, and Pedicularis fibrusiae) that were the focus of demographic studies in the 1980s. Informative priors were derived from demographic data collected on congeners of each species. The models were projected from the 1980s until 2009, and the originally studied populations of the four species were re-censused in 2009 to validate the results of the models. The inclusion of prior data decreased the variance around estimates of quasi-extinction risk. The inclusion of prior data did not increase the accuracy of most of the projections of quasi-extinction risk when stochastic events not included in the models decimated populations, or when the populations studied for the prior data were not on the same demographic trajectories as the focal species.
SP10.3 Sylwia Czarnomska*, Włodzimierz Jedrzejewski; Bogumila Jedrzejewska; Sabina Nowak; Robert W. Myslajek; Tomasz Borowik; Cino Pertoldi; Małgorzata Pilot; Mammal Research Institute Polish Academy of Sciences, Białowieża, Poland, Association for Nature ‘Wolf’ Godziszka, Poland, Aarhus University, Aarhus, Denmark, Museum and Institute of Zoology Polish Academy of Sciences, Warsaw, Poland; s.czarnomska@zbs.bialowieza.pl

Conservation genetics and ecological connectivity of the wolf Canis lupus metapopulation in Poland

Since 2000, a national census of wolves in Poland has been conducted by Mammal Research Institute PAS in cooperation with forestry services and national parks. A monitoring programme of the expanding wolf population was conducted by assessing population genetic structure and variability, based on nuclear markers and mitochondrial DNA, parallel to the creation of a habitat suitability model. Results from over 1200 fecal samples analysed showed that, based on frequencies of mtDNA haplotypes, Polish wolves belong to three genetically distinct subpopulations (NE Poland, mid-eastern part of the country, and SE Poland). The most intense gene flow occurs from north-eastern Poland, permanently inhabited by a viable wolf population, to the western part of the country, where a recolonization process is observed. Spatial genetic differentiation, based on microsatellite alleles and haplotype frequencies, explicitly indicates Carpathian subpopulation (SE Poland) to be the most genetically isolated from the rest of the country. To establish better connectivity between subpopulations, isolated due to habitat fragmentation and road construction, a map of potential ecological corridors was designed and effort in its implementation has been undertaken.

SPY2 Tabor, GM; Center for Large Landscape Conservation/ Freedom to Roam; wildcatalyst@gmail.com

Scaling new heights to address the issue of scale in conservation

Can conservation biology rise to the occasion? What is our solution agenda for the enormous conservation challenges impacting all life on the planet? This presentation is the preamble to the Symposium entitled -- "What's the Big Idea? -- A Conversation on North American Continental Conservation." The goal of the this symposium is to examine the various facets of continental scale conservation in North America - international perspectives, transboundary approaches, climate change mitigation and adaptation, protected area connectivity and matrix conservation, wildlife corridors and species movement biology, private land and public land perspectives, and NGO, business, media, academic and governmental initiatives - all of which have science, policy and management implications. This presentation provides a road map for a touchstone collection of visionary talks on North American conservation followed by a conversational audience roundtable. The big ideas are most likely embedded in the symposium audience and our goal is to facilitate dialogue.

SY198 Takahashi, H.*; Watanabe, M.; Univ. of Tsukuba; att_rudeon_hj_3200_graphics@yahoo.co.jp

Community structure of the ground beetles in the artificial cedar forests

The main component of forest floor arthropod community in the cool-temperate zone of Japan is carabid beetles, most of which cannot fly. The spatial distribution and abundance of the carabid beetles in the forest floor were examined by the capture-recapture method using pitfall traps for 4 artificial cedar stands, July and August 2009. One hundred and forty four pitfall traps with chicken meat were placed as a grid in each stand. Beetles captured were identified species and sexes, marked individually, and then released. Such procedure was performed for 3 to 4 times in each month. Four species of Carabinae (Carabus albrechti, Leptocarabus procerulus, Damaster blaptoides and Apotomopterus porrecticollis), and 3 species of Pterostichus spp. and 6 species of Synuchus spp. were found in all stands. The number of individuals marked was 324 in C. albrechti, 256 in L. procerulus, 23 in D. blaptoides and 23 in A. porrecticollis. The stand with poor understory vegetation provided the highest diversity of the beetles, irrespective of the degree of litter layer and soil moisture. Therefore, the understory of the forest vegetation affected the community structure of Carabinae spp., except Pterostichus spp. and Synuchus spp.

3.6 Szabo, ND*; Kerr, JT; University of Ottawa; n.d.szabo@gmail.com

The effects of surrounding natural or semi-natural areas on bee diversity and abundance in agricultural fields

Given that over one-third of our food supply is dependent on animal pollination, recent declines in pollinators indicate an urgent need for management action. Although European honey bees can be used to supplement pollination by wild pollinators, the prevalence of disease among managed bees and associated population declines suggest that wild pollinators will become increasingly important for crop pollination. In some cases, pollinator abundance and diversity and pollination services on farms are enhanced by surrounding natural or semi-natural areas. We investigated the effects of surrounding natural and semi-natural areas on bee diversity and abundance on strawberry farms, a crop which receives significant benefits from bee pollination. Bee surveys were conducted at 20 farms in the Ottawa area during the strawberry blooming period in the spring of 2009. Land cover surrounding the sites was assessed using high resolution satellite images. Our results indicate that bee diversity and abundance in fields increase with increasing amounts of surrounding natural or semi-natural areas. However, the fragmentation of these areas does not significantly affect bee diversity or abundance.
In the cool temperate zone of Japan, the carrion beetle is the first consumer of the food web starting from the decomposition in the artificial coniferous cedar forests. Eusilpha japonica (Coleoptera: Silphidae), inhabiting in the artificially cedar forest was found. The quantity of food intake during the pre-oviposition period was critical for size after the second brood and the cumulative food intake during each inter-clutch interval did not have a significant relationship to the first brood and the first clutch size. Thereafter, the females more strongly than males. The difference in distribution pattern between sexes suggested that males might search for mates as well as for food. The daily food intake of adults was measured by supplying the chicken meat of known weight. A lone female fed on the meat twice as much as a lone male. There was a positive relationship between the cumulative quantity of food intake until the first brood and the first clutch size. Thereafter, the females successively produced several broods. No significant relationship between clutch size after the second brood and the cumulative food intake during each inter-clutch interval was found. The quantity of food intake during the pre-oviposition period was critical for reproduction of the beetle.

Bioethical issues and Human-Elephant Conflicts in the Nilgiri Biosphere Reserve, Southern Western Ghats, India

Globally bioethics requires that fair consideration is given equally to three areas of moral concern such as human well being (rights and interests), non-human well being (rights and interests) and environmental well being (biodiversity and ecosystem integrity). Bioethical concerns, however, are not only restricted to issues directly related to human life but also to general issues related to every living being. Elephant’s are known its co-existence with human as God, cultural and economical for more than centuries but then, there were fewer humans and more land fulfilled all ecological needs for elephants without conflict. During the past few years the reputed terrestrial giant is being considered as menace with special reference to Human-Elephant Conflict (HEC) issues and now the HEC became a challenging task. The Nilgiri Biosphere Reserve (NBR) was the first biosphere reserve by UNESCO, harbouring Asian elephant. The bioethical violations such as destruction of their habitat due to encroachments, legal violations, habitat fragmentation by loss of corridors, implication of developmental activities, unbalanced biotic threats by the local people, man made fire incidences, tapping natural and ground water and inferior quality of mitigating measures led loss of habitat and life of elephants and human beings resulted intolerance of HEC in all elephant ranges were assessed based on four bioethical principles - Autonomy, beneficence, Justice and non-maleficence are presented here.
Implementation of a model for the amphibian conservation: A case study at the Eastern Andes of Colombia

According to the Global Amphibian Assessment, Colombia is the second-highest country in amphibian diversity, but also is the country with the highest number of threatened species (209 species 30% of the total species in this country), demonstrating the need to conserve this important vertebrate group in this mega-diverse country. Over two years with the Supatá golden frog project has been implemented a conservation model that has combined the biological research, the community involvement and the environmental education to achieve not only the conservation of the amphibian species in the municipality of Supatá, but of all the wildlife of the region. This model has as main purpose integrating the Supatá’s people in decisions making about environmental problems that are facing the amphibians of their region and that it is affecting them also, through the involving local community in diverse activities that have allowed creating a high degree of environmental awareness and ownership. To achieve this purpose we have used the amphibians, especially the Supatá golden frog as flagship species to promote the conservation of the wildlife through sustainable use and management of natural resources particularly the Andean forest relicts still surviving. We expect to carry on with this model to achieve long-impact outputs that contribute to the conservation and preservation of natural heritage of the region.

Threats and prospects for Canada’s Atlantic Maritime Ecozone

Threats and prospects for Canada’s Atlantic Maritime Ecozone will be considered in light of its current status and future scenarios for change.

Genetic Diversity, Gene Flow, and Subspecific Designations of two Eastern Pacific Booby Species

Increasingly, seabird populations are experiencing declines due to anthropogenic factors (competition with fisheries, habitat degradation, etc.) and potentially due to climate change (e.g. more severe and frequent El Niño Southern Oscillation, ENSO, events). Knowledge of genetic diversity, gene flow, and taxonomy are important for informing management of declining and harvested populations and for future management of species at risk of decline. Using a 540 base pair segment of the mitochondrial control region and eight microsatellite loci we characterized genetic diversity and intraspecific gene flow in blue-footed (Sula nebouxii) and Peruvian (S. variegata) boobies, and examined blue-footed booby subspecific designations. Both species rely on cold upwelling systems during breeding and are heavily impacted by ENSO events and competition with fisheries. Further, Peruvian booby guano is commercially harvested in Peru and appropriate management of their colonies is necessary for continued success of the guano industry. We found evidence of high genetic diversity despite historical and recent declines, high gene flow throughout the range of each species, and only weak population genetic structure. These results are encouraging and indicate that, while both species have undergone population fluctuations (especially Peruvian boobies) and continue to experience competition with fisheries, their high dispersal propensity may reduce loss of genetic diversity.

Application of ecological niche models for estimating the potential invasion of two mammals non-native in the ecoregion of Bolivia: Lepus europaeus y Sus scrofa

Invasive alien species (IAS) are the second cause for the loss of biodiversity and ecosystem change worldwide. The establishment, expansion and success in the new habitat was accidental or deliberate introduction of these species by human activities. Two species, Lepus europaeus (hare) and Sus scrofa (wild boar), were introduced to raise them and take their skin and meat for use, currently this are considered major threats to biodiversity in South America. For this have been created tools like the “ecological niche models of species”, the which predict through the native range of distribution, the invasion of IAS in their new habitat. Because of concern that represents the expansion of these two species, this study aims estimate and analyze the ecoregions that could be invaded in Bolivia. For this I used to the algorithm of maximum entropy “Maxent”, resulting in invasion models in fragile ecoregions identified in Bolivia as the Puna and Yungas in the case of L. europaeus; Chaco and Pantanal for S. scrofa. These models represent important inputs basics for the application of legislation for to control and eradicate these species in these ecosystems.
Is G matrix a strong constraint in rapid evolution?
Global environmental change represents a major threat to biodiversity today. The habitats of species are being modified at a fast rate, raising an important question: will populations manage to adapt to the new conditions? Here we aim to quantify constraints on evolution in reproductive traits in terms of genetic correlations between traits. This requires assessing (1) how frequently evolutionary responses are constrained by genetic correlations, i.e. what is the angle between the optimal response to selection and the response actually achievable because of genetic constraints and (2) how stable these constraints are, i.e. if genetic correlations are changing rapidly, the G matrix should not represent a strong constraint on evolutionary response. These questions will be answered using animal models (MCMCglmm software) on long term data sets of wild bird populations for which detailed pedigrees are available. Ultimately, we seek for general patterns of genetic constraints on responses to global change among species.

Comparing survey methods for populations of the western painted turtle, Chrysemys picta.
The number of species at risk in Canada is increasing, and the funds available for the management and monitoring of individual species are decreasing. It is important that survey and monitoring techniques provide maximum information for minimal person-hours and total cost. This study compares visual surveys with mark-recapture surveys of the western painted turtle, Chrysemys picta, and compares the results from three common trapping methods. Using the capture histories of 1109 turtles from 12 ponds, representing over 4000 capture events, a multi-strata model was created to determine the likelihood of turtles transitioning between trap types in a single trapping period. Our results indicate that visual surveys are not a suitable proxy for mark-recapture surveys, and that hatching turtles were under-represented in all trap types. We recommend a combination of basking traps and baited hoop nets to achieve a reasonable estimate of abundance while minimizing sex and size biases, required person-hours, and total cost.

Forecasts of land use scenarios and consequences for ecological systems in the US
Conservation biologists are increasingly concerned over the loss and endangerment of ecological systems due to land use change. We provide an assessment of the conservation status of ecological systems and how past, current, and likely future land use change has affected these systems in the conterminous US. To do this, we combined spatial data on over 500 current ecological systems from NatureServe, biophysical settings ("potential natural vegetation") from LANDFIRE, land use patterns for 2000 and 2050 from the Integrated Climate Land Use System/Spatially Explicit Regional Growth Model (US EPA), and detailed land use data interpreted from high-resolution aerial photography at over 3,000 locations. The direct human modification of land cover was measured from the detailed land use dataset, and a functional relationship between housing density and land cover modification was estimated. This model was then extrapolated for the US and overlaid with the "potential" and current ecological systems data to measure the extent of habitat loss historically and in the future, for each system. Two aspects of our approach offer important information for county and state land use planning: (1) the historical extent of ecological systems provides a benchmark for current conservation efforts, and (2) a consistent, seamless dataset transcends state and county boundaries, enabling conservation priorities to be relevant to ecological systems. That is, we measured the approximate historical extent and the approximate proportion of each ecological system within a given state.
Boreal Shield and Newfoundland Boreal Ecozones - conservation issues into the 21st Century

This paper reviews conservation and management challenges in the boreal shield and Newfoundland boreal ecozones. These zones cover most of eastern Canada, to as far west as Saskatchewan. The southern Shield is characterized by transition forests, distinct from the conifer and mixedwood dominated north. Much of the Boreal Shield has been managed for forests, but northern areas have had relatively little activity. Resource management issues in the south and central portions include forestry, mining, and hydroelectric development. Ecosystem resilience following harvesting has been a concern especially on areas logged from 1800-1990, when scant attention was paid to biodiversity. In the transition forest, old growth forests and some invasive species are major issues. Continued road development and mining developments present a major threat to the ecology of northern areas due to segregation of animal populations, increased hunting, and changes in groundwater resources. There are few threatened species, some key species such as caribou and wolverine are listed. Invasive species in true boreal forests are rare and unlikely to be a major disturbance. Climate change is a major concern, especially to the north where soils are poorer, often paludified and tree growth is stunted and scattered; here future tree growth is not assured. A rise in temperature and a reduction in moisture, as predicted, will cause ecosystems to shift states as important processes such as wildfire and herbivory become more common. Protected areas cover

Broad-Scale Genetic Structure of Woodland Caribou in the North American Boreal Forest

The boreal population of woodland caribou has declined substantially in recent decades, particularly in a south-north direction. Consequently, an understanding of the genetic connectivity among population groups will have important conservation implications. DNA extracted from over 1000 fecal samples of forest-dwelling caribou from the boreal forest regions of Ontario, Manitoba, and Saskatchewan (a geographic extent of 18,000 km) was genotyped at 11 microsatellite loci. We used both model-based (STRUCTURE, GENELAND) and non-model based (e.g. FST, PCA) structuring analyses to delineate genetic populations. Additionally, population graphs (a network of nodes connected by gene flow) and Bayesian MIGRATE analyses were used to assess genetic connectivity and directionality of gene flow between those populations. Our results provided a historical and contemporary comparison of gene flow, as well as a predictive model of core and sensitive nodes (populations) within the connected genetic network. Superimposing that network on landscape variables allowed for a broad-scale assessment of the individual and cumulative roles of natural (e.g., forest fires and rivers) and anthropogenic (e.g., road density) influences on the genetic diversity and connectivity of boreal caribou populations in central Canada.

 Evaluating the Relative Influence of Habitat Loss and Fragmentation: Do Tropical Mammals Meet the Temperate Paradigm?

The relative influence of habitat loss vs. habitat fragmentation per se (the breaking apart of habitat) on species distribution and abundance is currently an area of intense debate. Although some theoretical studies predict a strong negative effect of fragmentation, consensus from empirical work is that fragmentation has weak effects compared with habitat loss and that this effect is as likely to be positive as negative. However, few investigations of this issue have been conducted on tropical or wide-ranging species, which may be strongly influenced by changes in patch size and edge that occur with increasing fragmentation. We tested the relative influence of habitat loss and fragmentation on patch occupancy patterns of 20 mid- and large-sized neotropical mammals in Guatemala. We related patch occupancy to measures of habitat loss and fragmentation in the landscape and compared the influence of these two factors while controlling for patch-scale variables. A larger number of species responded significantly to habitat fragmentation than to habitat loss, and this response generally was negative. Our results point to the need for management efforts to go beyond habitat preservation and restoration and also consider prevention of habitat fragmentation per se or manipulation of landscape pattern, at least for tropical mammals. Whether our findings apply more generally to other tropical species or wide-ranging temperate species should be the focus of continued empirical work.

The relative influence of habitat loss vs. habitat fragmentation per se (the breaking apart of habitat) on species distribution and abundance is currently an area of intense debate. Although some theoretical studies predict a strong negative effect of fragmentation, consensus from empirical work is that fragmentation has weak effects compared with habitat loss and that this effect is as likely to be positive as negative. However, few investigations of this issue have been conducted on tropical or wide-ranging species, which may be strongly influenced by changes in patch size and edge that occur with increasing fragmentation. We tested the relative influence of habitat loss and fragmentation on patch occupancy patterns of 20 mid- and large-sized neotropical mammals in Guatemala. We related patch occupancy to measures of habitat loss and fragmentation in the landscape and compared the influence of these two factors while controlling for patch-scale variables. A larger number of species responded significantly to habitat fragmentation than to habitat loss, and this response generally was negative. Our results point to the need for management efforts to go beyond habitat preservation and restoration and also consider prevention of habitat fragmentation per se or manipulation of landscape pattern, at least for tropical mammals. Whether our findings apply more generally to other tropical species or wide-ranging temperate species should be the focus of continued empirical work.
Strathcona County recognizes wetlands as important municipal infrastructure components for environmental, economic and social sustainability and has committed to conserving their value for present and future generations. As part of this commitment, a new Wetland Conservation Policy has been approved with the intent to conserve wetlands by requiring mitigation during land use planning and development. The policy requires specific procedures for landowners to realize the goal of No Net Loss of wetlands. No Net Loss requires proponents to work through a strict series of mitigation activities - avoidance, minimization, and compensation - with clear criteria and defined outcomes, as set out by the Provincial and Federal policy and legislation. Development of the Wetland Conservation Policy was driven by inconsistent wetland conservation at the planning stage of development across Strathcona County, with significant discrepancies between urban and rural development. Implementation will aim for consistent municipal land use planning in context of science-based conservation. The policy requires wetland delineation, classification, mitigation, and consistent compensation ratios. The result is a streamlined approval process, avoiding duplication of assessments and reports for multiple levels of government. The policy provides clear direction on what the municipality requires, parallel to provincial and federal regulations.

Extinction risk varies across species and space owing to the combined effects of a broad array of factors. As such, integrative models are needed to quantify the relative importance of potential factors and separate dynamic (geographic) from mostly static (life history) extinction risk drivers to make predictions into the future. Here, we integrate and map in space our understanding of the effects of key correlates of IUCN-assessed extinction risk for extant terrestrial birds. We find that species endangerment increases most strongly with decreasing range size but is also affected by environmental niche factors and life-history and ecological traits (e.g., body size and primary diet). Simple quantification of past human encroachment across species’ distribution emerges as a key predictor, suggesting that projected land-use change may offer reliable estimates of future extinction risk. Using species-based model results, we generate grid-assemble predictions that correlate well with the known spatial threat distribution in birds worldwide, particularly on islands and in speciose regions. Our findings underscore the need to appreciate the intricacies of the structure of global extinction risk in species and across space by adopting a species-level approach and to develop measures of future extinction risk thereby making conservation efforts more effective over time.

Energy sector activity is booming across Canada’s northwestern boreal forest. Massive development is on the horizon raising concerns regarding how energy resources can be recovered in an economically-viable yet ecologically-sustainable manner. Many stakeholder groups agree this balance is best met using management thresholds, or limits to the density of the industrial disturbance footprint. Seen as a win-win management tool, strict regulatory controls are enforced only when the impacts of additional development outweigh benefits. Unfortunately, it is unknown how most ecosystem components respond to energy sector development. This lack of understanding has led to disagreements over which disturbances to include in threshold calculations and where thresholds should be set to achieve desired results. Seismic lines cut by industry to explore potential resource deposits are the largest component of the energy sector’s disturbance footprint and possible impacts on wildlife are of great concern. Cumulative line density is often a suggested threshold metric to protect wildlife resources. Here we use remote cameras to show how martens (Martes americana) respond to different line types and how their occupancy rates change relative to increasing line density. We illustrate how thresholds can be identified using actual species response patterns to line density and how an ecologically-based weighting system can properly account for different line types within a threshold framework.
Developing ecologically-based criteria for assessing seismic line impact and recovery in the northwestern boreal forests of Canada

Energy sector activity is booming across Canada’s northwestern boreal forest. Concern over the impacts of massive energy development on wildlife in the region has led to discussions regarding how to best manage this land use. Stakeholders agree this is accomplished by limiting the density of the physical disturbance footprint before impacts to wildlife are unacceptable. Seismic lines are narrow linear corridors used by the energy sector to explore for resource deposits. They are the largest component of the sector’s disturbance footprint, and many northern jurisdictions have implemented limits to line density as a result. These limits are highly contentious and challenged by industry because seismic lines exist across a range of width and recovery states, and there is no concrete data to suggest how most species respond to these line types. Thus, it is impossible to develop a defensible management strategy for seismic lines or line density. We used a paired design of remote cameras to assess behavioral response patterns of several boreal mammals to seismic lines relative to forest interior locations. Species’ avoidance or use of lines was significantly influenced by line width and amounts of woody vegetation present on the line. For many species there are line width and recovery thresholds below and beyond which lines do not function as disturbances, respectively. The first of their kind, these data facilitate informed decision making and management of seismic lines.

How Far Do Andean Bears Range to Consume Ground Bromeliads in the Ecuadorian Páramo?

Throughout the South American Andes, Spectacled bears enter páramo grasslands to consume plant tissue of the giant puya. The goal of this study was to determine if bears use the puya resource equally throughout the páramo or if they limit travel into the open, more exposed habitat. The study was conducted in Sangay National Park, Ecuador (May-July 2009). Two categories of puya were identified; 80 randomly selected plants and 80 consumed plants discovered after dedicated searches within the reserve. Data collected at each plant included: distance to forest (DTF), slope, aspect and horizontal visual cover. Of the measured variables, two were significant. Average DTF within the random puya group was 124.7 meters while average DTF in the consumed group was significantly less (39.3 meters). Horizontal visual cover data were significantly different between the two groups. There were no significant differences between plant categories for slope and aspect. Based on these results, bears appear to limit travel from cover to consume puya resource and horizontal cover has a role in plant selection. Why? Since bears take human agricultural products, they are shot by members of local communities (historically and currently). Bears may limit their travel from cover to reduce the probability of conflict. Therefore actual availability of this food resource may be much less than expected if travel limitations are not considered in management strategies for this charismatic, flagship species.

Reducing wolf-livestock conflicts in the mountain West: What's missing?

Abstract Wolves depredate repeatedly on livestock in areas where wolf behavior and learning combine with traditional grazing practice to exacerbate livestock vulnerability and largely explain chronic patterns of wolf conflicts in the Rocky Mountains. We contend that preventing and reducing wolf-livestock conflicts may be best achieved by manipulating prey vulnerability via adjusting grazing practice than sole reliance on lethally removing their predators. We review more than a decade of wolf-livestock conflict data on cattle that conform to this hypothesis in the Rocky Mountain U.S. and Canada. Data show that: 1) grazing practices that emphasize widely dispersed cow-calf pairs and yearlings are similar throughout public land grazing allotments where vigilance is intermittent or low relative to carnivore presence; 2) wolf predation is selective for behaviorally naïve and anxiety-prone calf and yearling cattle; and 3) regardless of origin and turnover, wolf occupancy of home ranges similarly grazed by cattle are characterized by chronic livestock loss in near identical patterns, suggesting a combination of behavior, biological and human-related factors that predispose vulnerable age cattle to being pursued by wolves and killed. We report results and recommend practical steps to improve vigilance, sustain working ranches and public land grazing while reducing wolf-livestock conflicts.
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Can we improve the Red List assessment with habitat suitability models?

The IUCN Red List of Threatened Species is the most comprehensive global assessment of the conservation status of species. During the assessments, species are assigned to one of a series of categories of extinction risk by applying quantitative criteria based on population size, rate of decline, and area of distribution. The latter is usually based on estimations of either the extent of occurrence (EEO) or area of occupancy (AOO) of the species. However, maps of EEO usually overestimate species’ true occurrence as it may contain unsuitable or unoccupied habitat. Habitat suitability models provide a good alternative to eliminate false presences and a better estimation of the current distribution of a species. Consequently, this may have important implications for species listed in the Red List based solely on the area of presences and a better estimation of the current distribution of a species. Here, we use deductive global mammal models and inductive local mammal models to compare them to the area thresholds used in the Red List. Given the widespread use of habitat suitability models in the last decade, they may become an important tool in the estimation of species distribution for the assessment of their conservation status.

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How Do We Increase Restoration Success? Socio-economic Barriers to Maintenance and Monitoring of Cloud Forest Reforestation Programs

To increase restoration success, we need firsthand knowledge of both ecological and socio-economic bottlenecks. This study seeks to identify socio-economic barriers to cloud forest restoration success in Monteverde, Costa Rica. Restoration practitioners put a lot of effort into germinating native tree seeds and planting the seedlings, usually with the help of volunteers. Although ~ 1 million trees have been planted in the past 20 years, no monitoring data have been taken to evaluate restoration success. How do we turn this enormous tree planting program, which is critical for regional conservation goals, into one that incorporates the practice of restoration science? We conducted interviews with 23 reforestation practitioners and landowners. Our goal was to find how reforestation on a large scale could be improved. Questions focused on the problems people encounter in maintaining planted trees and monitoring the trees survival and growth. Lack of time, money and knowledge were found to be common constraints. One potential solution, which is the focus on our on-going research, is assistance from local educators and students of semester-long sustainability or topical biology courses in providing both knowledge and labor for restoration practitioners.

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Impacts of community forest management on plant diversity in Nepal’s Middle Hills: identifying opportunities for adaptive management and conservation

Community forest management has been the primary form of management practiced in the Middle Hills region of Nepal for more than three decades, with over 14,000 active community forest user groups (CFUGs) documented to date. Although extensive attention has been devoted to case studies of the short-term effects of community forest management practices in Nepal, relatively little attention has been devoted to understanding the longer-term impacts of community forest management on forest diversity and regeneration. We evaluated the long-term impact of community forest management in 12 mixed Schima-Castanopsis forests stratified across three different forest management units (rangeposts), and “ages” (defined as years since incorporation) and compared them with a control group, government forests, in order to determine the effect of CFUG management on species diversity and regeneration. The study sought to tease out factors influencing diversity and regeneration within the existing management approach in order to identify opportunities for application of adaptive management to future community forest management decision-making. We conclude that adaptive management of community forests is a critically important tool for community forest user groups working to ensure the successful regeneration of forest parcels, and identify key variables informing successful management in the Middle Hills region.
Movement costs and local habitat features determine the abundance and distribution of native birds in an urban landscape

Urbanization is viewed by many ecologists as a major threat to global biodiversity because cities tend to overlap with some of the most biologically diverse areas on the planet. We surveyed 183 sites located across a gradient of urbanization from intensively developed sites to near-natural forest stands in Calgary, Alberta, Canada. Using multiple regression and GIS-based cost-distance modelling, we then examined the role of land cover type, local vegetation characteristics, and landscape composition and configuration on avian community composition and the occurrence of individual focal species. Of the 55 species detected during our surveys, 39 (71%) were primarily associated with natural areas and of these, 21 (38%) were exclusively found in these areas. Moreover, in 13 of 16 species-specific models, cost distance to natural features explained more variation in the probability of occurrence than straight-line distance, suggesting that barriers to movement affected settlement patterns, presumably by constraining dispersal flows. These results suggest that conserving avian biodiversity in urban landscapes should begin with the preservation of a network of functionally connected natural areas. Other results from our study suggest that such a network may also be important for sustaining native bird populations both within natural areas and the urban matrix.

Investigating the impact of hunting on Newfoundland caribou using virtual population analysis

Virtual Population Analysis (VPA) was performed using long-term hunter submissions to reconstruct the demographics of the Newfoundland caribou (Rangifer tarandus) population from 1980-2003. During this time the population rapidly increased (1980-1995) and subsequently declined (1997-2003) from and estimated 96,000 in the mid-1990s to about 32,000 in 2008. Our analysis indicated VPA is an accurate and cost-effective tool to reconstruct caribou populations and is strongly correlated with estimates produced from costly census and surveys (r=0.973, p

The effects of past climatic fluctuations and landscape features on the genetics of mongooses endemic to Namibia’s granite inselbergs.

North-western Namibia’s inselbergs support unique ecosystems with high levels of endemism in both vertebrates and plants; however the genetic structures of taxa specific to this area are completely unknown. Past climatic fluctuations and unusual landscape features are likely to have had a significant impact on the patterns of genetic variation within taxa restricted to this highly fragmented habitat. We investigated the genetic population structure of the endemic black mongoose by analyzing mtDNA haplotypes (cytochrome b, 1089bp) and nuclear microsatellite genotypes (15 loci) of 46 individuals from 6 populations. While the distribution of mtDNA haplotypes suggested unexpectedly high levels of genetic connectivity between isolated inselbergs in the past, there was little evidence for recent dispersal across major geographical barriers. The data also suggested the locations of inselbergs that may have supported population refugia during past extreme climatic events. These particular inselbergs supported a higher genetic diversity than others and presumably experienced less extreme micro-climatic fluctuations than did other inselbergs; thus we recommend them as specific areas that should be prioritized for conservation of this valuable ecosystem which, to date, remains unprotected.
Climate Change Adaptation and International Nature Conservation Treaties

To assist adaptation of species and ecosystems to climate change, international cooperation between states is called for, inter alia to facilitate climate-induced dispersal across jurisdictional boundaries and to promote resilience generally. Most existing international nature conservation treaty regimes, however, were concluded without considering the implications of climate change. Legal analysis of four global regimes (Ramsar Wetlands Convention; World Heritage Convention; Migratory Species Convention; Biodiversity Convention) and one regional regime (EU Birds and Habitats Directives) in fact reveals significant shortcomings in this regard. These include the use of static conservation objectives and a lack of attention for habitat connectivity. Other regimes are similarly expected to fall short of what is required to adequately facilitate the adaptation of nature to climate change. To accurately gauge the resultant mismatch and to frame comprehensive proposals for eliminating it, a multidisciplinary research effort is called for, combining conservation biology and international law.

The required law reform is anticipated to be a substantial and unlikely in the short term. In the meanwhile, there is much to be gained by fully exploiting the current legal framework, in particular through interpreting outdated obligations in conformity with treaty objectives and recent decisions of Conferences of the Parties on climate adaptation.

The Endangered Species Act and the next generation of ecological threats: insights from the case of the Bay checkerspot butterfly

The Bay checkerspot butterfly (BCB) reached its threatened status largely as a result of habitat loss through development. The species now benefits from the habitat protection powers of the Endangered Species Act (ESA), yet the biggest new hazard to the survival of remaining BCB populations comes from atmospheric nitrogen (N) deposition. Driven by combustion and fertilizer use, such deposition is an important cause of change in ecosystem structure and function. We use the BCB case to examine whether ESA, as it currently stands, is capable of protecting endangered species from the newly appreciated, remote-origin threat of N deposition. We employ legal analysis that builds on relevant case law to determine whether the limitations on harmful activities as set by Sections 7 & 9 of the Act do, in fact, apply to the emissions that cause N deposition. We also juxtapose our case with a similar case that has become quite salient in recent discussions of conservation law - the case for using ESA to control emissions of greenhouse gases (GHG). Based on this analysis, we find that extending ESA to protect against the harmful impacts of N deposition is both legally and practically more feasible than any attempt to use ESA against GHG emissions and the climate change impacts on listed species. We conclude that Sections 7 & 9 of the ESA could be fruitfully leveraged against existing federal and state air quality and emission control programs to achieve improved ecological outcomes.
A Revision of the Species Structure of the Genera Gobio and Romanogobio in the Eurasian Context

The freshwater fish species of the genera Gobio and Romanogobio continue to be a topical subject for many European ichthyologists. This is because of the changing taxonomy at the species and generic levels, the relatively frequent discovery of new species from various geographical areas and the expansive area of occurrence of some which leads to frequent sympatry and thus to their problematic identification. Very often they are endemic species at various levels of endangerment. Molecular study brings new perspectives on taxonomy, occurrence, hybridization and identification from regions of various countries. The gudgeon species of six European ichthyofaunas and sympatric zones were clearly identified and the level of inter-species hybridization was detected. New localities of the species Gobio sp. 2 were found, which expand the boundaries of its occurrence as far as the Baltic Sea, while also becoming a newly discovered species for seven European countries for the time being.

The success of the diagnostic method "S7indel diagnostics" as a molecular identification key was assessed for both genera. A histologic study of epidermal structures with regard to their problematic identification was performed. Very often they are endemic species at various levels of endangerment. Molecular study brings new perspectives on taxonomy, occurrence, hybridization and identification from regions of various countries. The gudgeon species of six European ichthyofaunas and sympatric zones were clearly identified and the level of inter-species hybridization was detected. New localities of the species Gobio sp. 2 were found, which expand the boundaries of its occurrence as far as the Baltic Sea, while also becoming a newly discovered species for seven European countries for the time being.

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A Paradigm Shift in Managing Free-Ranging African Elephants

Many managers of elephant populations neglect conservation of a key ecological process—population fluctuation in response to temporal and spatial variation of resources. We examined a database of population time series and fecundity and survival estimates for selected populations to ask 1) if elephant populations limited, 2) do resources limit numbers and activate regulatory mechanisms, 3) do regulatory mechanisms operate through density, and 4) do management actions disrupt limitation and regulation? We found evidence of population limitation and a dependence of asymptotic densities on resources. We also observed decreased fecundity at high densities relative to resources and increased mortality of weaned calves as breeding herds roamed further when resources were more limited. Resource limitation thus activates density related regulatory feedback mechanisms that reduce reproduction and survival rates. Case studies illustrate that management actions that alter survival and reproduction deactivate natural regulatory mechanisms and population limitation. This warrants a paradigm shift in management towards responsible megapark design—clusters of interconnected conservation areas that transcend international boundaries—to maintain natural regulatory mechanisms including dispersal and metadynamics. This systemic approach emphasizes the population as a spatial entity and embraces dynamic management that allows spatial and temporal population responses to resource variability.

How to use domestic large herbivores in restoring Europe’s threatened woodpasture landscapes on former intensively used agricultural land.

Till the end of the nineteenth century woodpasture landscapes were the dominant landscape type in large parts of Europe. Now, only remnants are left of these small scaled mosaic landscapes with high conservation value. The decline was mainly due to the intensification of agricultural use. On the other hand, the abandonment of nutrient poor or poorly accessible areas resulted in spontaneous forest recovery. Our main questions were: (1) what processes, interacting with large herbivore grazing, enable establishment of tree seedlings? (2) what patterns develop on former pastures and arable land? (3) what grazing pressures and strategies should be used by managers to initiate and steer developing woodpasture landscapes? Using exclusion experiments, tree emergence experiments and survey studies in 20 grazed nature reserves in Belgium (W-Europe), we studied establishment, survival and growth patterns of tree species under different grazing regimes interacting with different structural vegetation types. Our results showed that woodlands regenerate below grazing pressure thresholds of 125 and 180 grazing days ha-1year-1 on grassland and former arable land, respectively. Lower grazing pressures allow the development of a variety of half open to closed forests within 100 years, given natural disturbances temporarly initiate tree regeneration and protective vegetation types provide safe sites for tree seedlings and saplings.

Remote sensing using Near Infrared Reflectance Spectroscopy (NIRS) for monitoring wild giant panda populations: part one - gender discrimination

We are developing a new remote sensing approach to the study of wild populations of giant pandas using NIRS to discriminate between gender, individuals and reproductive state by rapidly scanning fecals in the field. The objectives of the current study were to develop NIRS pattern recognition libraries for prediction of panda gender and compare the technology’s resolution on fecal samples from wild and captive animals. Leaf fecals from Memphis Zoo’s male (n=26) and female panda (n=35) were dried whole and evaluated with a portable ASD FieldSpec®3 and contact probe for spectral surface analysis. Similarly, leaf fecals from two female (n=25 total fecals) and two male GPS-collared giant pandas (n=62 total fecals) from the Foping Nature Reserve in China, were evaluated. For chemometrics analysis, we used GRAMS/AI software to build our discriminant algorithms and one-out CV analysis using Savitsky-Golay 7-point first derivative mean center processing. Prediction of panda gender discrimination correctly identified 91% of female and 81% of male samples from the captive pandas. For wild pandas, gender predictions identified 100% of female and 95% of male samples correctly. NIRS has the potential to collect, non-invasively and remotely, physiological information about a species for population survey estimates. As the calibration libraries are expanded we will begin to test other applications for this technology with respect to reproductive state and individual identification.

Wildlife diseases are an increasing concern for endangered species, but their patterns and cause are often unknown. We analyzed 3,939 stranded turtles over 28 years to understand fibropapillomatosis, a tumor-forming disease in Hawaiian green sea turtles (Chelonia mydas) that is caused by a herpesvirus. Demographics are a consistent risk factor and models that characterize disease rates locally are highest ranked, revealing a variety of patterns. Some regions in the Hawaiian Islands reached peak disease rates in the 1990s and then declined, others remained constant, and in some regions disease rates increase - implying a local cause. Elevated disease rates are clustered in watersheds with high N footprints; a measure of natural and anthropogenic factors that influence coastal eutrophication. Further spatial analysis shows strong epidemiological links between disease rates, N footprints, and nuisance algal blooms. A postulated mechanism for these links involves a dietary shift to nonnative and invasive macroalgae, which sequester excess environmental N in the amino acid arginine. Arginine is known to regulate immune activity, promote herpesviruses, and contribute to tumor formation. These results taken collectively have implications for understanding diseases of aquatic organisms, eutrophication, herpesvirus, and tumor formation.
Conservation research and planning frequently does not lead to conservation action. Closer collaborations between conservation biologists and empowered stakeholders is one factor that might contribute to greater implementation success. But who are the stakeholders in a planning region, how can conservation biologists build partnerships with them, and is there anything planners can do to facilitate a shift from ‘informed’ to ‘empowered’ stakeholders? Social network analysis was first developed in the 1930s, has been applied to a great variety of contexts, and has begun to be applied to study natural resources management questions. Researchers report the value of greater understanding of relationships among participants in natural resource networks, but don’t describe a process for applying that understanding to address conservation issues. Projects to ‘map’ the social network of people and organizations (from academia, government, business, NGOs, fishers, ranchers, foresters, church groups, etc.) working on sustainable natural resource issues (terrestrial, freshwater, estuarine, and marine) on the Oregon coast and elsewhere suggest opportunities for conservation planners to engage others in new, mutually-beneficial collaborations. A process of ‘network weaving’ can take social network analysis to the next level by using it as a basis for facilitating conservation network participants working together in new ways to find better solutions to the problems they face.

Importance of estimating dispersal for endangered bird management

Endangered species recovery plans are frustrated by small, spatially structured populations where understanding the influence of birth, death, and dispersal is difficult. Here we use a spatially explicit, long-term study to describe dispersal in the Cape Sable seaside sparrow (Ammodramus maritimus mirabilis). Since 1990, this species declined > 50%. It occurs as several geographically isolated sub-populations across the Florida Everglades. We characterize dispersal, recognizing that our sampling, as well as the species’ distribution, is spatially heterogeneous. The annual movements of juveniles and adults are statistically heavy-tailed. That is, while most individuals are recaptured locally, a significant portion exhibit long-distance dispersal. Individuals move between sub-populations to distances > 30 km. Not accounting for the spatial heterogeneity of sampling or the species range itself underestimates dispersal and can lead to ineffective management decisions. Recovery focused on translocation will be less successful than strategies that protect habitat and increase breeding. (147 words)
The Effects of Human Disturbance on an Alpine Plant Community in the Canadian Rockies

Alpine tundra is notorious for its fragility and slow recovery following disturbance. In recent years tourism in alpine areas has increased, and effective management of the impact of recreational activities will require a better understanding of the nature of these impacts. The objective of this study is to examine the effects of hiking on an alpine plant community, and to determine whether they differ from the effects of natural disturbance. In order to do this we censused plant community data in 0.5x1m plots on a hiking trail, on the adjacent, intact, tundra meadows as well as on gravel patches formed by frost disturbance. The three treatments were compared in terms of vascular plant cover, richness, diversity, non-vascular and abiotic cover composition, species composition and species morphological attributes. As predicted, the trail was found to be significantly different from the surrounding tundra. However, it was also quite unlike the community found on natural gravel patches, despite the superficial resemblance of the two treatments. Human activities appear to lead to the establishment of a community type that is unique in the context of the surrounding ecosystem; in order to minimise such community changes, managers may consider minimizing the number and the size of trails in alpine areas.

Importance of historical land use in the spatial distribution of evergreen broadleaved species at their northern limit in Japan

At their northern and southern distribution limits, plant species subsist under climatic stress and are considered as regionally endangered due to bio-geographical importance. Also, land use change over time increases the environmental stress and influences modern vegetation composition. Such effect could affect marginal plant populations more significantly and cause their reduction. In this research, the factors explaining the current distribution of 20 evergreen broadleaved species (5 at their northern limit) were studied at the Tokyo University Forest (2171 ha) from topographic, geographical and historical stand points. 7185 plots of 10m by 10m were surveyed along the census line recording presence and absence of individuals. Current distribution was modeled by multivariate logistic regression with factors derived from a 10m mesh digital elevation model (elevation, slope, solar radiation, topographic wetness index, surface curvature), a 1 km mesh climatic data set, and land use maps: current (2005) and historical (1900). Unlike the case of the rest of the studied species, for northern limit species the historic land use landscape was always a more important factor than the current land use landscape in explaining their current distribution. Surface curvature and winter minimum temperature were also very common significant factors. We concluded that for northern limit species, the historical land use has a relatively stronger influence over their population distribution.

Demographically Sustainable Recovery Targets in the Face of Random Catastrophes: Canadian Freshwater Fishes at Risk

Population recovery targets are a pressing need for the conservation and management of freshwater fishes at risk. However, fish populations have generally been under-represented in considerations of demographically sustainable population thresholds. The small number of population viability analyses conducted on freshwater fishes is too limited for cross-species study or meta-analysis of minimum viable population size (MVP). Here, we conduct a population viability analysis of stage-structured populations to determine MVPs for freshwater fishes listed as Threatened and Endangered in Canada. Here MVP is defined as the number of adults necessary for a 5\% risk of extinction (a 95\% chance of persistence) over 250 years. In addition to explicitly incorporating demographic and environmental stochasticity, density-dependent population processes, and vital rate covariation, computer simulations are repeated at various probabilities of random catastrophes within the range observed in vertebrate populations. Catastrophes emerged as the main determinant of MVP for any given species, seemingly overwhelming the influence of environmental stochasticity and density-dependence. However, the influence of catastrophes decreased with body size and age at maturity. Our results represent the first indication of life history correlates of MVP, showing that in spite of their higher return rates smaller, short-lived, early maturing species require larger populations.

Threats Of Uncontrolled Tourism To Protected Area : A Bhimashankar Wildlife Sanctuary Case Study

Biodiversity hotspots around the world continue to face human population pressure due to overexploitation of natural resources. Protected area managers here, face the dilemma of whether to prioritize conservation or meet human needs. Bhimashankar wildlife sanctuary in north Western Ghats is no exception to this, where religious tourism is being given priority over conservation. We studied the extent of damage done by unmanaged tourism to the sanctuary. Spatio-temporal variations in direct and indirect impacts were assessed by noting frequency of occurrence of impacting factors on transects. We also monitored the tourist influx by point counts of people and vehicles in the sanctuary. Awareness among the people about the sanctuary was studied using questionnaires. Opportunistic observations of destructive tourist behaviours were also documented. It was found that the direct impact of tourism like improper solid waste disposal and tourist activity were more localized near the tourism zone while indirect impacts such as grazing, lopping, fire, etc. were more widespread. It was also found that tourists were aware of the negative effects caused by improper solid waste disposal and the necessity for conserving protected areas. However, due to the religious sentiments attached to the Bhimashankar temple, they were more tolerant about them.
Predictions of climate change effects on distribution of rare and endangered species in the Andes of Colombia

Are species’ responses to climate change idiosyncratic or is there a general rule in the response of each species in a particular region? We explored how the current distribution for some restricted and endangered species in the Andes of Colombia could be affected by climatic changing conditions, attempting to identify if there are general patterns for the Andean species under climate change. Our aim was to identify whether is possible predict patterns in contraction/expansion of geographic ranges in Andean species in several climate change scenarios or in other terms why some species are more threatened by climate change effects than others in the Andean region. We used environmental niche models approaches to predict changes in distribution of eight Andean species in Colombia with several climatic future scenarios. We predicted the future potential distribution using three climatic scenarios models in three different times. Species with a narrow distribution in the Andes region would suffer contractions in the geographic range in the future. Our results show a general rule that species with narrow distributions in the Andean region probably will suffer more impacts by climate change than species with distributions in lowlands or inter-valley Andean.

Managing urban meadows for biodiversity

Communities of forbs and insects have adapted to habitats managed for agricultural purposes over several centuries in Europe. Urban regions often encapsulate remnants of semi-natural habitats that, with appropriate management, provide potentially suitable habitat for threatened species. Municipalities, such as Helsinki, are committed to policies for maintenance of biodiversity. However, little is known about the influences of urbanization factors (e.g. nutrient deposition, landscape composition) on meadow assemblages. In the Helsinki Meadows project, we investigate plant, carabid beetle, spider and ant assemblages of dry and fresh meadow habitats in and around Helsinki. The effects of management regime, environmental and spatial factors on these taxa are evaluated. This information is being applied to refine the planning and management of networks of meadow habitats for the enhancement of biodiversity. The carabid and spider assemblages were species rich and included a number of regionally rare species. A number of carabid species were sensitive to management intensity and less intensive management resulted in more even carabid assemblages. There were also clear responses to site characteristics. Habitat heterogeneity and the presence of deadwood were important factors for ant species richness. These results suggest that management should comprise of mowing and brush clearing, to keep meadows open, but to retain dead wood and heterogeneity.
Towards a systematic approach to the flagship concept in conservation

Flagship species have traditionally played a pivotal role in our ability to fundraise, lobby or raise awareness for biodiversity conservation. However, procedures for selecting flags generally lack empirical evidence or an objective methodology. This has resulted in confusion over what flagship species are and what they are supposed to achieve, which in turn has undermined their effectiveness. In this paper we describe a systematic framework to support the selection of conservation flags, drawing on insights from other cognate disciplines including economics and business, and concepts such as social marketing. Our model highlights the need for flagship selection to be driven not only by the specified conservation goal, but also by the wider values and attitudes of the target audience towards that goal. Thus, the need to be tailored to fit the social, cultural and economic reality of the key stakeholders and based on an understanding of the relationship of this audience with the conservation goal. Furthermore, it reinforces the need for a rigorous evaluation process for any flagship based strategy, as the only means to measure success and determine the scope for improving the use of flagship species in conservation. This conceptual framework should help conservationists develop more effective flags with wider support from a range of key stakeholders, such as donors, local communities or government officials.

P1.20 VerÃ–ssimo, Diogo*; MacMillan, Douglas; Smith, Robert J; Durrell Institute of Conservation and Ecology, University of Kent, UK; dv38@kent.ac.uk
Towards a systematic approach to the flagship concept in conservation

SY67 Verbeek, P. Miyazaki International College; pverbeek@miyazaki-mic.ac.jp
The Primate Relationship with Nature

Around the globe people are feeling the impact of anthropogenic extinctions and climate change. Studies from multiple disciplines identify threats to our health posed by biodiversity loss. Once the essence of our existence, our relationship with nature has become dysfunctional. Psychology has been slow in waking up to the realities of our dysfunctional relationship with nature. The emerging area of conservation psychology focuses on the bidirectional relationship between humans and nature. Here I draw on our primate heritage to describe psychological bases of our relationship with nature. It makes evolutionary sense to take a look at our endangered primate cousins to better understand our own place in nature. Extant primates and human beings have walked the evolutionary road together for a long time and, along the way, faced similar problems in finding their way in nature. In particular, direct perception of what nature affords, and the way that emotions of investigation and discovery mediate rapid learning about and from nature, are psychological particularities that are most likely shared by human and nonhuman primates alike. In this talk I discuss research on how nonhuman primates perceive, explore, and exploit their natural habitat, and on how these behaviors are mediated by social interaction and emotion. I link these findings to our own perceptions and actions to show that a better understanding of the primate relationship with nature can help humanize conservation.
Human adaptation to climate change: Using conservation strategies to increase resilience

Climate change is happening, and recent projections indicate that changes are likely to be greater and happen faster than we anticipated only a few years ago. The resulting changes are going to be significant, with sea levels potentially rising over a meter in the next century, storms increasing in intensity and frequency, and changes in precipitation patterns bringing drought and flooding. We not only need to be reducing carbon emissions, but also planning for how people and ecosystems are going to adapt to the changes. Adaptation to these changes may take many forms, but the tendency is to focus on structural options such as seawalls and dams. We propose that using conservation based adaptation to respond to expected impacts to climate change can provide a less expensive alternative that results in additional benefits to people and ecosystems. Conservation based adaptation strategies include conserving and restoring habitats such as mangroves and salt marshes that can directly protect communities from threats like rising seas and storm surges, as well as maintaining the resilience of ecosystems that provide crucial services, such as fisheries or forestry, to people. In this presentation we will introduce the concept of ecosystem based adaptation and lay out some guiding principles to frame the presentations and discussions that will follow.

Livestock Density Alters Vigilance Behavior of Wild Prey in a Dangerous Grazed Ecosystem

Large and vulnerable livestock that occupy protected areas in developing countries often become preferred prey for large carnivores. Livestock can thus alter interactions between predators and native prey species, but there are few empirical examples. We address this shortcoming by assessing whether predation risk from Asiatic lions (Panthera leo persica) on spotted deer (Axis axis) varies with the density of large domestic prey. We assessed prey vigilance between areas with low and high density of domesticated cattle and buffalo in Acacia-Zizyphus forests in the Gir Protected Area, Western India. Vigilance was significantly greater where livestock density was low, than where it was high. This finding, together with the fact that lion predation rates on livestock are twice as great where livestock are more abundant, implies a form of prey commensalism. Conservation managers must anticipate a variety of non-linear indirect interactions in large prey-predator systems.

Forest succession and amphibian migration: implications for landscape connectivity

Long-term persistence of pond-breeding amphibian populations is contingent upon the successful dispersal of individuals between breeding sites. We investigated the influence of timber harvesting practices on the movements of the juvenile (dispersing) stage of a forest-dependent amphibian, the wood frog (Lithobates sylvaticus) in central Maine, USA using two experimental approaches. Following large scale habitat manipulation (2 ha treatments), newly metamorphosed L. sylvaticus showed a strong preference for closed-canopy habitat and avoided recent clearcuts. Despite substantial vegetative succession there was no increasing trend in the use of clearcuts up to six years post harvesting. A mesoscale field experiment (50 x 3 m terrestrial enclosures) that involved releases in four treatments (recent clearcut, mature forest, 11-year-old conifers, and 20-year-old natural regeneration) revealed that recent clearcuts and young coniferous stands were significant barriers to movements and were three times less permeable to movement compared to the mature forest and 20-year-old regeneration. Because extinction and recolonization processes are common in amphibian populations, forestry practices that involve canopy removal and conversion of natural forest to conifer plantations may affect regional population viability by hindering successful dispersal. However, 20 years of natural succession mitigated the negative effects of clearcutting for dispersing wood frogs.
Effective conservation requires not only academic knowledge, but also hands-on skills that cannot be learned in a traditional classroom, even if supplemented with occasional short-term fieldwork. George Mason University's College of Science and College of Humanities and Social Sciences have collaborated to create the Mason Center for Conservation Studies (MCCS), and have joined forces with the Center for Conservation Education and Sustainability (CCES) of the Smithsonian Conservation Biology Institute (SCBI) to develop and implement residential, hands-on undergraduate, graduate and professional education programs in conservation science. Both undergraduate and graduate/professional training includes courses in conservation theory, field methods and practice, and human dimensions of conservation. Training takes place at SCBI's 3,200 acre facility in Front Royal, VA, USA, home to several endangered species and home base for scientists working at the cutting edge of reproductive science, spatial ecology and international conservation. Course instructors include Mason faculty, CCES-SCBI's scientists, and colleagues at US and international conservation organizations. Program management and administration are shared equally between Mason and the Smithsonian Institution at all levels. This collaboration between an academic institution and a leading research center provides much-needed experiential training for today’s conservation professionals and tomorrow’s conservation leaders.
**SY31 Vors, LS; University of Alberta; vors@ualberta.ca**

**A global perspective on caribou conservation**

Caribou (Rangifer tarandus), an ungulate with a holarctic distribution, is a symbol of the threats and opportunities facing the northern hemisphere. Its widespread population declines have rendered it the subject of much conservation attention due to the species’ ecological, cultural, and economic importance. There is wide agreement that caribou conservation is outdated and requires revision; four extant subspecies, several ecotypes and many discrete populations are recognized across North America. Both natural and anthropogenic pressures witnessed thus far have translated into dramatic declines for populations throughout their global range, although it is not clear whether all of these are inconsistent with historical population fluctuations. In Canada, some caribou have appeared on species at risk lists, while others have not been assessed; indication of any progress on recovery anywhere is non-existent. All have in common the cumulative effects of continued northward encroachment of industrial resource development and the longer-term spectre of climate change. Over-harvesting is also a compounding factor for some migratory tundra caribou populations, which has become a sensitive political issue for aboriginal hunters.

**SAI Vynne, Carly*; Keim, Jonah; Machado, Ricardo B.; Marinho-Filho, Jader; Wasser, Samuel K.; University of Washington, Matrix Solutions, University of Brasília, University of Brasilia; cvynne@uw.edu**

**Agricultural expansion and the plight of the maned wolf in Brazil**

Emas National Park (ENP), Brazil, has historically been considered a stronghold for the survival of the maned wolf (Chrysocyon brachyurus), which is endemic to the grasslands of central South America. Land clearing and agricultural intensification outside of ENP have been rapid and expansive and the Park now stands as a virtual island in a sea of agriculture. This project seeks to assess how land use practices and remnant habitat configuration are likely to affect persistence of this critical population of maned wolves. Specially-trained detection dogs enabled us to non-invasively acquire more than 800 scat samples of maned wolves across a diversity of habitat conditions. Spatial analyses and resource selection functions were applied to understand maned wolf ranging behavior and habitat preferences. Maned wolf pairs make extensive use of the landscape matrix and select agricultural fields for foraging, while strongly avoiding ranchlands and closed-canopy habitat. Results from steroid and thyroid hormone and diet and parasite analyses indicate a cost to making a living in the matrix. Stress hormone profiles, for example, are significantly higher for maned wolves found more than 15 km from the Park border. This information will contribute to conservation and management of maned wolves, simultaneously providing an important model for applications to other free-living, threatened or endangered species.

**SY28 Vucetich, JA*; Hebblewhite, M; Smith, D; Peterson, RO; Michigan Tech University, Univ of Montana, Yellowstone Center for Resources; javuceti@mtu.edu**

**Assessing The Influence Of Wolf Predation On Prey Growth Rates In Isle Royale, Yellowstone, And Banff National Parks**

Attitudes about wolves are strongly shaped by whether wolf predation is an additive or compensatory source of mortality for their prey. We assessed the impact of predation rate on prey growth rate for three systems where predation rate had been estimated for 38 years (Isle Royale), 19 years (Banff), and 12 years (Yellowstone). Prey growth rate declined with increasing predation rate for Isle Royale and Banff, but not Yellowstone. While elk have been declining in Yellowstone, predation appears not to have been an important cause of that decline. Moreover, while wolves and moose have coexisted on Isle Royale for more than six decades, predation had an important destabilizing effect on growth rate of Isle Royale moose. In Banff, increasing predation rate weakly reduced elk population growth rate, but there was no relationship between wolf density and predation rate. We also review how different analytical approaches have given very different impressions about whether wolf predation on Isle Royale has been a strong top-down influence.

**SY42 WA Wall; Alaska Village Initiatives; williamwall11@gmail.com**

**Key Components of Conservation-Hunting Programs and Their Relationship to Wildlife Populations, Ecosystems, and People**

There has been growing recognition from the international conservation community that conservation-hunting programs can provide the basis for successful sustainable use conservation. These programs based in an ecosystem context can be of significant support for community based wildlife management programs. A conservation-hunting program is one that contributes to the short and long-term viability of species populations within an ecosystem context by generating incentives, management regimes, and/or sources of funds for purposes of conservation. However, there is a general lack of understanding of the necessary components for these programs and how interaction of these components provides for success or impediments to conservation. Components of conservation-hunting programs include: a transparent legal basis within the range state including linkage with international regulatory bodies such as CITES; an adequate biological management system based in adaptive management; an adequate economic base which links incentives for local conservation to a local or international market through good business practices; and an appropriate local cultural context. Conservation-hunting programs worldwide have reached varying levels of success. Since different governments, cultures, ecosystems and species populations respond differently, it is critical to fit the program to the local and regional circumstances. This paper presents a framework for organizing and describing key components of conservation-hunting programs and discusses their relationship to wildlife populations, ecosystems, and people. Presented are axioms of biodiversity conservation and conservation-hunting programs to establish common ground from which a series of principles and criteria are derived.
Management strategies for maximizing carbon storage and tree species diversity in cocoa-growing landscapes

Efficient management of land in the tropics that maximizes biodiversity, ecosystem service delivery and agricultural yield is paramount. There are two potential strategies to achieve this: land sparing (high yield per unit area allowing land to be conserved as native habitat) or wildlife friendly farming (greater area to achieve the same yield with better conservation on agricultural land). We examine which would be the optimal strategy in cocoa-growing landscapes to achieve high carbon storage and species diversity in trees. We sampled tree species and size along transects, in addition to interviewing farmers. Increased management intensity explained higher yield and in turn this explained a reduction in carbon storage and species diversity. There were substantial differences in tree species diversity between forest and cocoa farms suggesting land sparing would conserve more species. Based on mean values, there would be little difference between carbon storage under wildlife friendly (131 Mg/ha) and land sparing (112 Mg/ha) management. However, the degree of intensification in wildlife friendly farming alters which management strategy leads to greater carbon storage. In situations where wildlife friendly farming would be preferable, there would be conflict with biodiversity. In conclusion, it can be difficult to identify the optimal strategy to meet agricultural demand whilst retaining high biodiversity and ecosystem services, in part because trade-offs can be dynamic.

Introgression within the red wolf population.

Because this genetic divergence is regarded as an important component for a species’ capability to shift its range and undergo speciation processes the conservation of peripheral populations is likely. Peripherally populations are likely the result of hampered gene flow due to geographic isolation. Because this genetic divergence is regarded as an important component for a species’ capacity to shift its range and undergo speciation processes the conservation of peripheral populations is highly justified from a population genetic perspective.
P2.104 Walters, M*; Smith, G.F.; Crouch, N.R.; South African National Biodiversity Institute; m.walters@sanbi.org.za

Conservation status of South African succulents

South Africa has a remarkable diversity of plant life with more plant species occurring here than in any other region of similar size, making it the world's richest temperate country in terms of floral wealth. A large proportion of this floral wealth is made up of succulents, with an estimated 47% of the world's diversity occurring in southern Africa. Succulents are collected by enthusiasts worldwide and are frequently taken out of habitat and illegally traded, putting pressure on natural populations. In the southern African context, succulents are often used by traditional healers as medicinal plants, putting even more strain on these natural resources. A list of all South African succulents was compiled, and Red List statuses for each of these taxa were obtained from the recently completed Red List of South African natural resources. A list of all South African succulents was compiled, and Red List statuses for each of these taxa were obtained from the recently completed Red List of South African natural resources.

SP11.12 Wang Dajun*; Li Juan; Haxi Zhaxiduojie; Yin Hang; Peking University, The snowland great rivers environmental protection association, Shan Shui Conservation Center; dywang@pku.edu.cn

Study on the Causation and Solution of Human-Wildlife Conflict in Qinghai-Tibetan Plateau, China.

The human-wildlife conflict report has been rapidly increasing in the Qinghai-Tibetan Plateau, China, in recent 5 years. Numbers of wildlife species including brown bear (Ursus arctos), snow leopard (Uncia uncia), wolf (Canis lupus) and Kiang (Equus kiang) are on the conflict list. We initiated a study to understand the causation of the increasing of conflict between human and wildlife, and try to find ways to solve or reduce the conflict, to help the local people with their daily life, and maintain the traditional conservation awareness of local people. The field survey was conducted in Sanjiangyuan area in Qinghai province, interviews to local people and some government officers was also processed to collect data of locations, timings and patterns of conflict, and the economic damage. Remote sensing based GIS analysis was used to map 2 conflict species habitat and human distribution to understand the special pattern of conflict. Historical policy events were also put into analysis to find the conflict causation of wildlife management strategies. We ranked the conflict species, suggested the ecological causation and the policy causation of the increasing of conflict. Suggestion on conservation activities and management policies were made based on information and result of this study.

SP5.8 Wang, O*; Carleglio, M; University of texas at Austin; ophelia.wang@mail.utexas.edu

Conservation area prioritization in the Ecuadorian Amazon using remote sensing and GIS data

Traditional conservation planning relies on gap analysis to overlay maps of land coverage, species distribution, and stewardship status in order to identify conservation “gap” areas that require protection. The Ecuadorian Amazon is one of the world’s high-biodiversity wilderness areas and important ecoregions, but its remote location and little accessibility hinder detailed documentation of species distribution and modeling or land management. In this study we use land cover classification derived from satellite images and GIS data based on local surveys to locate areas that should be prioritized for conservation to ensure biodiversity representation. We use both traditional supervised classification of Landsat images and the software Feature Analyst to extract ten classes of land and vegetation cover that serve as biodiversity representation surrogates in our analysis. GIS data of indigenous community centers, inter-community paths, and flight strips are used as constraints for sites to be excluded from conservation. Distances to the nearest anthropogenic features are used to determining production suitability. With specific targets of biodiversity representation and spatial configuration of shape and connectivity of the conservation areas, we use the software ConsNet to construct area prioritization. This study provides an example to achieve biodiversity conservation, ecosystem function maintenance, and sustainable development through an integration of data sets.

SY33 Waples, Robin; NOAA Fisheries; robin.waples@noaa.gov

Evolution and conservation of Pacific salmon in a changing world

Contemporary evolution of Pacific salmon (Oncorhynchus spp.) in human-altered environments is best viewed in the context of the evolutionary history of the species and the dynamic ecosystems they inhabit. Speciation was complete by the late Miocene, leaving ~6 million years for diversification within each species, and considerable evidence exists for local adaptations. On the other hand, salmon ecosystems remain dynamic on several spatial and temporal scales, and evidence is accumulating that, in some cases at least, salmon evolution can be fairly rapid. This suggests the importance of conserving ecological and evolutionary processes that are capable of producing a mosaic of locally adapted populations, rather than focusing on fine-scale patterns evident at any point in time. Some local human disturbances (e.g., culverts blocking access to areas higher in watersheds) that select against specific life history types are replicated pervasively across the species’ range, creating evolutionary pressures that are perhaps unprecedented in their spatial scale. If anthropogenic changes can be shaped to produce disturbance regimes that more closely mimic those under which the species evolved, Pacific salmon should be well-equipped to deal with future challenges, just as they have throughout their evolutionary history.
Interactions between wetland dependant taxa are important when managing freshwater reserves for endangered species conservation

Globally freshwater ecosystems are threatened by river regulation, water extraction and habitat alteration. Australia's Murray-Darling Basin contains some of the most highly regulated and degraded freshwater ecosystems in the world. Managed environmental flooding is currently the principle mechanism used to maintain wetland habitats and dependant species, including the endangered frog, Litoria raniformis. Since 2001 reductions in environmental flooding has contributed to the large-scale degradation of nationally important wetlands and the near extinction of L. raniformis throughout the basin. In 2007 small amounts of environmental water were released to maintain critical habitats for L. raniformis and associated species. Outcomes of the environmental watering were monitored between 2007 and 2010. Litoria raniformis remained at four out of six watering sites, and recruited successfully at two sites. Waterbirds, introduced and native fish also responded to the environmental flooding and increased levels of competition and predation may have contributed to the poor recruitment outcomes. The exclusion of European carp Cyprinus carpio increased frog recruitment success during subsequent watering. Environmental watering is an essential tool for maintaining endangered wetland species and there are significant follow-on benefits for other wetland taxa, however successful management depends on understanding how these taxa interact under restricted flooding regimes.

Factors affecting conservation of the endangered damselfly, Mortonaigrion hirosei, in an artificially established habitat

In 1998, a tiny habitat of the brackish water damselfly, Mortonaigrion hirosei, which is an endangered species in Japan was discovered in Ise, Mie Pref. It was a dense reed community on the brackish water, from which had been reclaimed under the construction of sewage plant. The local government of Mie Prefecture decided to preserve the local population of the damselfly. Then the mitigation project was started, because the habitat seemed to be too small to maintain the local population, and because surroundings of the habitat would become unavailable vegetation for the damselfly due to the sewage plant development. In those days, however, there were few reports on the biology of the species. Therefore, we had to begin to clarify quantitatively the population parameters of larvae and adults, behaviour, flight habit, body colour change for adults, saline tolerance of larvae as well as to measure abiotic environment, such as saline, water depth, water temperature and relative light intensity in the original habitat. According to the accumulation of information on the quantitative environmental factors, the design for a newly established habitat was proposed. Then, in early spring of 2003, huge number of reed rhizomes were collected near the original habitat, and transplanted for establishing the new habitat. Artificial brackish water was continuously supplied throughout the year. The reed community has developed year after year and nearly completed to the dense community, overcoming a lot of problems appeared. Consequently, the adult population has increased in both the original and the established habitat. The mitigation project has now proved successful.

Ecosystem dynamics after introduced rat eradication

There has been growing evidence that rat eradication generally results in the substantial recovery of native species. However, focus of most previous studies has been restricted to the conspicuous and charismatic species in direct interaction with rat predation. Next challenges could be to assess other native groups, such as invertebrate community, which can have important functions in recipient ecosystems. An important point could be that invertebrate community should be assessed in community-wide perspective, because invertebrate community is likely to be affected not only by direct predation by rat but largely by indirect effects as well. In this regard, we studied the ecosystem of Surprise Island in New Caledonia. We eradicated the invasive rat population in 2005 and compared the community structure including invertebrate community, seabirds, vegetations, and skink between before (2002-2005) and after (2006-2009) rat eradication. Summary of results of this study was that 1) rodents were eradicated from Surprise Island; 2) seabirds and vegetation cover increased; 3) skink (mesopredator) increased; 4) most invertebrates increased or were not affected. These results highlight that mesopredator increase does not always exert negative effects on native ecosystems. In this case, it is likely to depend on the community structure of recipient ecosystems.
Avoid prescribing one-size-fits-all solutions.

General need for conservationists to understand human societies and local culture, and to best accept and most effective way to tackle environmental problems. This highlights a sense of responsibility and felt a limited ability to influence environmental outcomes, even though they perceived the problems to be serious. Indeed, government was widely expected to control environmental problems, in accordance with the collectivist culture fostered by their Soviet past. In Kalmykia, linking environmental messages to Buddhist teachings may influence audiences otherwise uninterested in personally tackling environmental problems. However, as many expect government control and direction, top-down policies may be the best accepted and most effective way to tackle environmental problems. This highlights a general need for conservationists to understand human societies and local culture, and to avoid prescribing one-size-fits-all solutions.

The Republic of Kalmykia is the only Buddhist nation in Europe, and is undergoing cultural resurgence following the break-up of the Soviet Union. Its environmental problems include desertification, water shortage and poaching of its iconic species, the saiga antelope. An intervention which aimed to promote environmentally positive behaviors through pro-ecological Buddhist teachings was evaluated, by thematic analysis of semi-structured interviews. Those who had experienced the teachings were more likely to express pro-environmental attitudes and behaviors, by praying and cleaning their surroundings. The cause was a sense of individual agency fostered by the teachings. Other individuals had little sense of responsibility and felt a limited ability to influence environmental outcomes, even though they perceived the problems to be serious. Indeed, government was widely expected to control environmental problems, in accordance with the collectivist culture fostered by their Soviet past. In Kalmykia, linking environmental messages to Buddhist teachings may influence audiences otherwise uninterested in personally tackling environmental problems. However, as many expect government control and direction, top-down policies may be the best accepted and most effective way to tackle environmental problems. This highlights a general need for conservationists to understand human societies and local culture, and to avoid prescribing one-size-fits-all solutions.

The Alberta BearSmart Program is a province-wide, multi-stakeholder initiative to reduce human-bear conflicts. Led by the Alberta Government, the BearSmart program utilizes public education and management of bear attractants to promote public safety, reduce human-caused bear mortality, and reduce property damage. The program provides educational messaging on bear natural history, proper management of bear attractants, methods to avoid bear encounters, and appropriate responses to close encounters with bears. Education and conflict prevention efforts are focused on communities, outdoor recreationalists, agricultural producers, and industry. Karelian Bear Dogs are used to enhance the investigation of and response to human-bear conflicts and serve as ambassadors to deliver BearSmart messaging. Bear hazard assessments have been completed or are ongoing in several communities, and help to identify the causes of bear-human conflict and recommend solutions. Alberta Government staff and program volunteers work with municipalities and landowners to encourage the proper management of garbage, livestock carcasses, and vegetation. Bear-resistant containers, electric fencing, and aversive conditioning are used to prevent habituation and food-conditioning of bears, and to reduce depredation on livestock. Collaboratively, these efforts promote public stewardship of bears and enhance opportunities for humans and bears to co-exist in Alberta.

Resilience of Cougars and Wolves to Population Management: An Alberta Perspective

Large carnivore populations are often assumed to be highly vulnerable to human-caused mortality. Harvests of these species have been linked to social disruption, poor hunting success, increased rates of sexually selected infanticide, declines in breeding success, and large-scale population declines. Recent research has suggested that human take of some carnivore species is additive and that population persistence is dependent on unharvested source areas. In Alberta, cougars (Puma concolor) and wolves (Canis lupus) have been managed as game animals since the end of bounty programs in the 1960s. For the past 50 years, wolves have been subject to liberal harvest regimes, with long hunting and trapping seasons, no quotas, and no hunting license required for resident hunters. More limited in their distribution, cougars are managed with a strict quota system. Over the past 20 years, we have documented substantial increases in the density of wolves across Alberta, and increases in both the density and distribution of cougars. Wolves are believed to be the proximate cause of declines in woodland caribou across Alberta, and cougars have begun to recolonize their former range in prairie and parkland habitats and appear to be expanding into the boreal forest. Densities of both species are substantially higher on provincial lands than in adjacent National Parks, where they are fully protected. While management of these species may cause temporary, small scale disruptions in social behaviors, our experience suggests that at the population level, cougars and wolves are highly resilient to harvest.

Carbon Offsets and Habitat Conservation - will the goose lay a golden egg?

To what extent can biological carbon markets leverage biodiversity conservation opportunities? This talk will explore the potential externalities (both positive and negative) associated with carbon offset markets within the context of how profitable opportunities for forest carbon sequestration may overlap or conflict with other conservation objectives. The integration of carbon offsets with other conservation markets will be examined with an emphasis on how this issue is handled in other jurisdictions and implications for boreal forest conservation in Canada.
Environmental Mitigation and Stewardship

Construction of roads, railroads, pipelines, powerlines, and other infrastructure fragments and degrades ecosystems and habitat throughout the world. Unfortunately, environmental mitigation of projects such as road or pipeline construction is often opportunistic, misses broader landscape contexts, and has a low benefit-cost ratio. The Conservation Fund developed a "green infrastructure" approach to environmental mitigation and stewardship that: (1) solicits feedback from stakeholders; (2) reviews pertinent literature; (3) identifies species and ecosystems of concern; (4) models habitat of focal species and ecosystems using maximum entropy and other approaches; (5) models and validates a conservation network of high-quality wildlife and plant habitat (core areas), large contiguous natural areas (hubs), and linkages to facilitate wildlife movement and gene flow (corridors); (6) characterizes and ranks elements of this network at multiple scales; (7) identifies high priority areas for conservation and restoration; (8) assesses potential projects in the field; and (9) identifies the best suite of projects with a given budget, using benefit-cost optimization. We will illustrate this process with two examples: (1) identifying and evaluating natural resource stewardship best suite of projects with a given budget, using benefit-cost optimization. We will illustrate this process with two examples: (1) identifying and evaluating natural resource stewardship opportunities in watersheds potentially impacted by construction of a highway bypass; and (2) designing and coordinating endangered species mitigation for maintenance of a 25,000 km gas pipeline network.

The conservation biology of woodland caribou is listed as threatened under the federal Species at Risk Act (SARA). A variety of natural and anthropogenic factors, which may impact caribou populations, act cumulatively in space and time. We employ a computer simulation model as a tool for the assessment of these complex cumulative effects. First, we estimate the natural range of variability for caribou population dynamics and argue that, in natural ecosystems, caribou can coexist with uncontrolled wolf populations. Next, we examine the impacts of cumulative effects of industrial activities and natural disturbances. Based on our analysis, we propose actions that should result in stable caribou populations and allow for industrial activity within caribou ranges. In simulation experiments, we illustrate the importance of key scientific concepts (e.g., functional response curve) as fundamental drivers for wildlife management and successful conservation. We suggest key research areas where future studies should be focused to advance the ecological theory that is critical for successful conservation of threatened species. Our findings shed new light on the current understanding of predator-prey dynamics and the role of predation in limiting or regulating ungulate populations under a spectrum of cumulative effects, concepts critical in conservation biology.
Cardiob reactions to human infrastructure and activity in Newfoundland, Canada:
Potential cumulative and interactive effects
Anthropogenic changes to the landscape have long been known to affect caribou (Rangifer tarandus) populations throughout their range. Since the 1970s, several studies have been conducted in Newfoundland, Canada, to assess the effects of such changes on the insular woodland caribou. Newfoundland caribou show an avoidance of infrastructure and activity associated with resource extraction and direct human disturbance. Resource extraction reduces caribou habitat directly by removing it or altering its composition and displaces caribou 3-9 km beyond the footprint of development and may induce changes to the timing of seasonal migrations. In some cases these effects persist for multiple years after infrastructure construction ceases. Direct disturbance through human encounter induces a flight response; snowmobile disturbance induces a flight of 60-237 m, pedestrian disturbance in summer induces a flight response of 50-135 m. All avoidance and flight responses have energetic consequences for caribou, potentially influencing productivity, survival and recruitment. Cumulative and interactive effects energy expenditures, degradation of habitat and functional habitat loss are expected as Newfoundland's interior resources are subject to increasing interest following the drastic and prolonged reduction in coastal resource industries.

Boreal Opportunities: Expanding conservation prioritization principles to capture forgotten biomes
Prioritizing ecosystems for conservation based on measures like species richness, endemism, rarity, and endangerment have focused global conservation attention on < 10 percent of global terrestrial areas mostly within tropical biomes. While protecting such hotspots is critically important to biodiversity conservation, other regions with highly valuable, important, and irreplaceable conservation values are often not recognized, protected or managed. We apply new ways of assessing conservation value in North America's Boreal Forest region, which covers 1.5 billion acres and contains the world's largest intact original forest. This region supports the most abundant bird populations in North America as well as the world's largest remaining populations of wolf and caribou. Ecosystem services provided by the Boreal Forest region are estimated at $90 billion. The peatland and forest ecosystems of the Canadian Boreal store an estimated 186 billion tons of carbon. The Boreal's vast unfragmented landscapes, meanwhile, will likely be important for adaptation for plants and animals impacted by climate change. A broader accounting of conservation values of ecoregions is vital to implementing conservation actions that maintain a full complement of biodiversity values and healthy ecosystems that support sustainable human communities.

Sea level rise planning in the state of Veracruz, Mexico
The state of Veracruz represents one of the most vulnerable places in the Gulf of Mexico to sea level rise. Veracruz University, with funds from the U.K. Global Opportunities Fund, developed the Veracruz Action Plan on Climate Change with the strong alliance of the National Autonomous University of Mexico (UNAM) and the Ecology Institute (INECOL). This plan includes selected studies to show the vulnerability from the biophysical systems and the impacts on the economy and society. As a result of the vulnerability studies and with public participation, Veracruz University delivered a strategic plan to the Veracruz Government in order to establish a state public policy on adaptation and mitigation for Veracruz. In the strategic plan, sea level rise was examined from a broad perspective; as a regional impact on the productive system and society, as a risk factor to the power industry, and as a driving factor of change on biodiversity. As a result, methodological guidelines have been designed to develop regional action plans on climate change in Mexico. The planning process models in Veracruz were far from ideal; the society, the government, the industry, the producers, and all the stakeholders did not share concerns or an objective that helps to build an accurate action plan to adapt Veracruz to the new reality on climate change.

Local context and forest outcomes: The role of regional heterogeneity in explaining resource management results in Russia
A fundamental challenge in natural resource management is designing appropriate institutions to provide society's desired economic and ecological outcomes. After the collapse of the Soviet Union in 1991, the Russian Federation followed neoclassical economic arguments and decentralized forest management and privatized forest use. At the same time Russia transitioned to a new political system and a market economy. The outcomes of these changes contradicted economic theory: timber production and ecological integrity declined while illegal logging increased. In this research we provide a descriptive understanding on how regional political and economic arrangements mediated institutional change in Russian forest management, resulting in differential outcomes across space. We construct a panel dataset on regional timber utilization and management, timber enterprises, forest agency capacity, and transparency and corruption measures from 1992 to 2005. We use this data to examine forest outcomes and to inform causal hypotheses on the role that regional heterogeneity played in these results. These hypotheses will be used in the future to modify traditional forest management models and tested using remote sensing data on harvesting decisions. Understanding how contextual factors mediate natural resource outcomes is important as countries consider decentralization, market-based incentives, or new property rights arrangements.
Testing hypotheses relating to fire effects on an amphibian community

While amphibian species are generally considered to be behaviourally adapted to avoid post-fire effects, there is evidence that fire frequency may influence amphibian communities. However, studies which quantify the effect of fire at the community level are rare, which is unusual given that fire can impact species already at risk from ongoing declines. We tested whether terrestrial or aquatic habitat, and two fire variables (frequency of fire over 30 years, and burning in a single wildfire) contributed to variation in species occurrence, richness, or assemblage structure. Species richness was not influenced by either fire variable, but assemblage structure was significantly correlated with fire frequency, among other variables. Further analysis showed that this result was due to the response of a single, uncommon species. Aquatic habitat variables were more commonly selected, and explained higher proportions of variation, than fire variables in most models. Our results suggest that large ponds, with long hydroperiods and well developed riparian vegetation, disproportionately contribute to species richness and variation in assemblage structure in this community. Management would be better focussed on conservation of these attributes than on maintenance of particular fire regimes.

Alberta’s Wet Areas Mapping Initiative: a Cost Effective and Innovative Approach to Facilitate Conservation Strategies

Riparian and other wet terrestrial habitats and aquatic systems are significant contributors to biodiversity. However, poor understanding of their precise location and distribution across complex landscapes often constrain implementation of effective conservation strategies. The requirement for these strategies is ever more important in Alberta given the accelerated rate of industrial development. Innovative planning solutions that are economic, timely and ensure positive conservation outcomes are urgently needed by land managers. Accordingly, the Province of Alberta has been working closely with researchers at the University of New Brunswick to refine a depth to water table mapping tool for Alberta’s landscapes. Computer generated maps predict the location of small water bodies such as ephemerals, as small as 10cm in width, and wet areas which are currently not known to resource planners but yet are sensitive to disturbance. The mapping process incorporates newly acquired light and distance ranging (LiDAR) data to produce maps of superior quality with a resolution of 1m. Efforts are underway to map 17 million hectares of primarily forested lands in the foothill and boreal regions of Alberta. These innovative maps, unique to Alberta, are expected to significantly enhance stewardship of Alberta’s landscapes and aid development and implementation of conservation strategies.
Population Viability Analysis of Translocation-Assisted Woodland Caribou Recovery

Caribou in Banff and South Jasper National Parks face an uncertain future given that an avalanche killed most if not all caribou from Banff in 2009 and two of three sub-populations in South Jasper contain less than ten animals. Declining densities of elk and wolves may result in conditions more suitable for caribou persistence. Here we used a population viability analysis to assess the likelihood of caribou persistence in Banff, Brazeau, Maligne, and Tonquin with and without translocation-based management. We used population-specific survival rates and pooled calf-cow ratios to create a female-based projection matrix. We simulated population projections for 20 years using estimated process variance, demographic stochasticity, and three years of post-translocation survival rate depression. Our results suggested the Tonquin caribou are likely to remain viable for the next 20 years without management action. However, almost certain extirpation is predicted for the Brazeau and Maligne. With translocations, the addition of 45 female caribou into Banff, Maligne, and Brazeau resulted in a 50-97%, 22%, and 5% chance respectively of > 8 caribou after 20 years. Thus, Banff may be the preferred destination for caribou translocation. Population persistence depended strongly on estimated survival rates and post-translocation survival rate depression; therefore, prognosis could improve for each sub-population if lower elk and wolf densities result in increased survival rates. Given limited resources and source populations of caribou, caribou recovery efforts should be prioritized from both regional and provincial scales.
**P1.134** Williams, E. R.*; Erskine, P. E.; Mulligan, D. R.; Plowman, K. P.; Centre for Mined Land Rehabilitation, The University of Queensland, Biodiversity Assessment and Management Pty Ltd; e.williams@cmlr.uq.edu.au

### Ants as Bioindicators of Rehabilitation Management Practices on the World’s Second Largest Sand Island, North Stradbroke Island, Australia

North Stradbroke Island, on the east coast of Australia, is the second largest sand island in the world. It has a multitude of vegetation types and a number of nationally threatened ecosystems. Additionally, several rare or vulnerable animal species inhabit the island. Despite this, 70% of the island is under sand mining lease and 20% of the island has been disturbed by mining operations. As required under Australian legislation, mined land is rehabilitated post-operation with remedial procedures to ensure that re-established ecosystems proceed towards specific completion criteria. Typically, biotic recovery is monitored solely by vegetation surveys. In this research, ants were used as bioindicators to assess management practices in mine-site rehabilitation. This research aimed at identifying whether the practices targeted at improving vegetation parameters caused a detrimental impact on another biotic component. Results indicate that the current vegetation management procedures employed on rehabilitated sites may only have a short-term impact on the ant fauna of North Stradbroke Island. It also suggests that these ant communities in the rehabilitation were relatively resilient to fires and clearing despite the overall community being in a recovery phase. Furthermore, ant communities did not precisely reflect vegetation response in this study, demonstrating that more than one biological indicator would be valuable in monitoring studies.

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**P2.189** WILLIAMSON, LP*; Johnson, CJ; Seip, DR; Parker, KL; University of Northern British Columbia, Department of Natural Resources and Environmental Studies, Prince George, BC, V2N 4Z9, Canada; Wildlife Ecologist, British Columbia Ministry of Forests, Prince George, BC, V2L 1R6, Canada; williamse@unbc.ca

### Impacts of Industrial Development on Habitat Selection of Wolves and Woodland Caribou in the South Peace Region of BC

Since the early 1990’s, regions surrounding the Peace River in Northeastern British Columbia have experienced rapid land-use change from resource extraction activities, in addition to large-scale commercial agriculture and forestry developments. Woodland caribou (Rangifer tarandus caribou) in the Peace River region have been negatively influenced by increasing human disturbances and apparent competition. Habitat destruction and loss is one of the main threats to the survival of woodland caribou. The region is of importance to both wolves (Canis lupus) and woodland caribou, and the use of the same habitat by both species is critical for stable populations. Wolves are thought to regulate caribou populations, and caribou are regulated by wolves. The current study focuses on the relative use of woodland caribou habitat in the South Peace River region by wolves and woodland caribou. Resource Selection Functions (RSFs) will be used to describe the habitat selection of wolves and woodland caribou. Additionally, this study will evaluate the effects of industrial development on habitat selection by wolves and woodland caribou, as well as the interactions between the two species. The results of this study will help to identify areas of high-quality habitat for both wolves and woodland caribou, and will provide insights into the effects of industrial development on habitat selection by these species.

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**P2.110** WILLIS, EL*; Kersey, DC; Durrant, BS; Kouba, AJ; Memphis Zoo, Department of Conservation and Research, Western University of Health Sciences; Smithsonian’s National Zoological Park, Conservation and Research Center, San Diego Zoo's Institute for Conservation Research; ewillis@memphiszoo.org

### Development of a non-invasive urinary assay for the determination of pregnancy status in the giant panda (Ailuropoda melanoleuca)

Female giant pandas experience a phenomenon known as pseudopregnancy after ovulation, during which a non-pregnant female exhibits physiological changes similar to those observed during pregnancy. For many mammalian species, reproductive hormone patterns clearly differentiate the pregnant from non-pregnant state. However, pregnancy cannot be diagnosed in the giant panda by hormone monitoring as the patterns are invariable between pregnancy and pseudopregnancy. Among species of Canidae, a family of carnivores that similarly experiences obligate pseudopregnancy, phase proteins have been successfully utilized to differentiate pregnancy from pseudopregnancy. Therefore, in this study we evaluated enzymatically active urinary ceruloplasmin (EAUC), a phase protein, in four adult female giant pandas. Urine was collected (3-7d/wk) throughout 15 reproductive cycles. Results revealed a distinct increase in EAUC during pregnant compared to known pseudopregnant states. Furthermore, among term pregnancies, EAUC was elevated one week following mating/artificial insemination and remained elevated until 20-23 days prior to parturition. This study provided the earliest method to determine pregnancy in captive giant pandas and the first non-invasive physiological assay to diagnose pregnancy. This technique may also be applicable for monitoring the reproductive status of wild populations using ceruloplasmin excreted in feces.
Can predators reduce atmospheric CO2 through trophic cascades?

Top predators, by suppressing herbivores, often have positive indirect effects on plant biomass. Plants utilize CO2 in photosynthesis and store most of the earth’s non-fossilized organic carbon in their living tissues, detritus, and in the tissues of their consumers. This suggests that predators can ultimately increase NPP, thereby decreasing atmospheric carbon. Here we analyze the impacts of sea otters on carbon NPP and sequestration. We find that sea otters, by suppressing herbivorous sea urchins, increase kelp biomass 100-fold, resulting in a 31 to 50 TgCyr-1 increase in NPP and a 10 TgC increase in carbon sequestered by living kelps. These increases represent 34-55% (NPP) and 11.4% (living kelp) of the carbon contained in the atmosphere above the North American sea otter range or 136-220% (NPP) and 44% (living kelp) of the increase in atmospheric carbon since pre-industrial times, and the sea otter-induced increment in just the living kelps has a present day value of over $700 million on the European Carbon Exchange. Populations of large predators have been extensively depleted or lost throughout much of the globe. These losses probably substantially altered the rates of carbon flux through global ecosystems. The conservation and restoration of large predators might thus have indirect ecological effects that will figure prominently in the future trajectories of atmospheric CO2 concentration and global climate change.

Conserving Southern Mountain Caribou in Canadian National Parks

We have identified five threats to the persistence of Southern Mountain Caribou in the national parks of British Columbia and Alberta: habitat destruction, predator-prey dynamics, facilitated predator access, direct human disturbance and small population effects. With the loss of the Banff National Park caribou herd in 2009 during an avalanche, conservation efforts for all southern mountain caribou in national parks have taken on renewed urgency. Current actions include winter trail closures to prevent facilitated access to caribou habitat by wolves, prohibiting domestic dogs on hiking trails in caribou habitat, lowering automobile speed limits in high caribou collision areas and reduction of wolf primary prey to reduce apparent competition with caribou. The effectiveness of these programs in addition to population dynamic monitoring and modeling have suggested that future actions should include continued reduction of wolf (and bear) primary prey (elk and deer) numbers adjacent to caribou habitat and translocation of caribou into the now vacant habitat in Banff National Park. Southern Mountain caribou populations are declining across their range, and we present how we our actions can reverse this trend within the Canadian mountain national parks.

Prioritising conservation investments for mammal species globally

Priorities for conservation need to be set because we cannot do everything, everywhere, at the same time. Our aim is to determine priority areas for investment in threat abatement actions for mammals globally, in both a cost-effective and spatially-explicit manner. We estimate the cost of actions based on the known threats to each mammal. We also evaluate the likelihood of success of these investments, using global indicators of governance and country stability, and factor this into the prioritization analysis. We account for the interactions and dependencies between conservation actions - that is, account for the joint contribution of threat abatement activities to multiple species in the same region, and the fact that some species may require investment in multiple conservation actions to persist. We show that by prioritising investments in this way we deliver more cost-effective investment portfolios then when prioritising each species based on their threat category, by identifying sites for reservation regardless of the threats that the species face, or by assuming that conservation actions act independently. We conclude that information about the threats to species and the locations where they occur is essential for determining the actions required to ensure their persistence, but are not an appropriate basis for prioritising conservation investments.

Considering connectivity in prioritizing reintroduction sites for threatened species

Connectivity enables organisms to disperse among habitat patches. Despite being critical for the persistence of many threatened species, connectivity has been neglected in reintroduction efforts. We propose techniques that consider connectivity in selecting reintroductions sites. Using a graph-theoretical approach in a GIS framework, we analyze regional patch dynamics of the St. Francis’ Satyr Neonympha michellii francisci, a federally endangered species globally restricted to Ft Bragg, NC. We conduct analyses using (a) limited ecological data and (b) species-specific biological information. For each analysis we identify functionally distinct population networks over our study species’ entire range, and those habitat patches that act as critical stepping-stones (i.e. facilitate connectivity) within each population network. We prioritize reintroduction sites based on the relative contribution of unoccupied stepping-stones to each population network’s connectivity. Models suggest that the St. Francis’ Satyr persist as five distinct population networks. We identify the priority reintroduction site as the unoccupied stepping-stone connected to the greatest number (18%) of dispersal routes. By selecting highly connected reintroduction sites, we increase opportunities of reintroduced populations to disperse to unoccupied habitat over the medium term. Over the long term connectivity will enable reintroduced populations to adapt their ranges under changing environment.
P1.170 Wilson, KT*; Lehman, SM; University of Toronto; katty.wilson@utoronto.ca
Quantifying the extent of edge effects on mid-altitude humid forest structure of southeastern Madagascar using spatially explicit techniques.
Modern forest landscapes are characterized by fragments where edges are the norm. This is particularly evident in Madagascar as it has lost 80-90% of its original vegetative cover and the remaining forest is highly fragmented. Edge effects penetrate the forest to varying degrees resulting in ecological boundaries. The composition of boundaries may not resemble that of either the interior or the edge environment, altering the flows of energy and affecting species distributions. Moving split-window and lattice-wombling are spatially explicit techniques that are reliable in their detection of boundaries. These methods were applied to dendrometric data collected from mid-altitude humid forest in southeastern Madagascar. The two methods provided comparable results. The edge influenced the interior forest from 300-m up to 900-m and produced gradual and sharp boundaries. The orientation and type of edge as well as the inclination of the terrain contribute to the depth at which the edge environment penetrates the interior, as well as the resulting type of boundary created. This study has important implications to the management of the remaining forests of Madagascar as conservation efforts may be tailored depending on the structure of the edge environment and the degree to which it penetrates the forest interior.

P1.120 Windels, SK; Voyageurs National Park; steve_windels@nps.gov
Monitoring the Ecological Effects of Lake Level Management on Voyageurs National Park Using Beavers (Castor canadensis)
Water levels and flow regimes of the international waters of Rainy Lake and the Namakan Reservoir on the Minnesota-Ontario border have been controlled by several private dams since the early 1900s. Voyageurs National Park, MN contains more than 27% of these water bodies. In response to documented ecosystem degradation, the International Joint Commission (IJC) issued the 2000 Rule Curves to mimic a more natural water cycle, particularly in reducing the winter drawdown in the Namakan Reservoir. Beavers (Castor canadensis) in lake environments are especially sensitive to fluctuations in water levels, particularly changes that occur after lodge sites have been established in late fall. Therefore, beavers were selected as one of a suite of indicators for assessing the ecological effects of the new hydrologic regimes. Several aspects of beaver ecology were studied from 2004-2009 to compare with similar data collected in 1984-1986 during the previous water level management regime (i.e., the 1970 Rule Curves). Beavers appear to have deeper and more stable access to water during the winter drawdown at present than during the 1970 Rule Curves. Consequently, beavers spent more time inside their lodges versus outside of the lodge during the winter than before the changes in 2000, which has implications for beaver energetics and predation risk. Other aspects of beaver ecology related to water level management, including body condition, reproduction and survival, and availability of aquatic forages will be discussed.

P2.23 Wippich Whiteman, C.*; Saldanha, N.; Oliveira, E.C.; Ramos do Carmo, A.; Brazilian Institute of the Environment and Natural Renewable Resources; whitemanchristina@hotmail.com
Mining activity licensing and wildlife management in the Eastern Brazilian Amazon
In the Eastern Brazilian Amazon, state of Pará, there are important sites of interest for mining. Many, for instance, concentrate in the Carajás region, where there is a mosaic of five very important protected areas, and mining activities may be developed, under the approval of Brazilian government environmental agencies. In the year 2009, the Ibama (Brazilian federal wildlife authority) unit located in Marabá, state of Pará, received 11 requests for fauna impact studies/survey, fauna rescue or monitoring projects related to the licencing of mining activities. An evaluation based on the analysis of such requests was performed. Positive aspects involved the biodiversity data generated through these studies, logistics and equipment offered by mining companies for general wildlife studies and academic/teaching opportunities emerged through the projects. Negative aspects involved a deficiency of knowledge and procedure patterns regarding fauna rescue in this context; lack of patterns between deforestation and fauna rescue procedures, and its field enforcement; and scarce information on the real loss of biodiversity caused by the mining activities. Moreover, a critical problem was the effect of political pressure of large mining companies on the government to utilize conservation zones inside protected areas, as well as to utilize protected areas where such activities are not legally allowed.

P2.41 Wise, Sharon*; Buchanan, Bryant; Dawes, Patrick; Racchumi, Joelte; Rohacek, Alex; Utica College; wise@utica.edu
Impacts of Artificial Night Lighting on the Behavior of Nocturnal Salamanders
Artificial night lighting (ANL) is of increasing concern as human habitation encroaches into natural habitats. The effect of ANL on amphibians has not yet been widely studied. We examined the impact of ANL on the nocturnal activity of terrestrial salamanders (Plethodon cinereus) in the natural habitat and in the laboratory. These salamanders remain under cover objects during daylight hours and emerge above-ground to forage and mate at night. We hypothesized that ANL affects the nocturnal behavior of salamanders by delaying emergence from under cover objects. We tested this hypothesis using forest transects (N= 12) in which half were dimly, artificially lit (10-2 lx) and six were left dark (10-4 lx). Fewer salamanders were active 1 h after dark in the lighted transects, suggesting a delay in time of emergence. In laboratory experiments in which salamanders were exposed to nocturnal light from 10-4 to 100 lx, we found that salamanders were more active at higher than at lower illuminations when no cover was available, but were less active at higher than at lower illuminations when cover objects were available. Results from the laboratory and field provide evidence that salamanders are avoiding higher nocturnal illuminations, resulting in increased activity when cover is absent and delayed emergence from cover under higher illuminations. Thus, ANL has the potential to alter the normal nocturnal foraging and breeding activity of salamanders.
Olympic marmots (Marmota olympus) are endemic to the Olympic National Park, Washington State, and studies in 2002-2006 have documented declines and local extirpations of the species. Predation by non-native coyotes (Canis latrans) was shown to account for 33-90% of the mortality at the intensive study sites. We implemented park-wide carnivore scat analysis to determine the spatial extent of coyote predation on Olympic marmots, and the magnitude of coyote predation relative to other carnivore species. Out of 958 carnivore scats collected, 10.3% contained marmot remains. Predator species identification with mtDNA for scats with marmot shown that 85% arose from coyote, 10% from bobcat (Lynx rufus) and 5% from cougar (Puma concolor). Distribution of scat indicated that coyotes were present and preyed on marmots in all studied regions of the park. With frequency of occurrence >10%, marmot was the fifth most important prey item of coyotes in the Olympic alpine, after snowshoe hare (Lepus americanus), mountain beaver (Aplodontia rufa), voles and cervids. Twelve out of 13 coyote individuals identified with microsatellite markers included marmots in their diet. Overall, occurrence of marmot remains in coyote scats observed could be considered high, especially if relatively low marmot densities are taken into account, supporting the potential for coyote predation to be the main driving factor of the observed marmot declines and extinctions.
A conceptual framework for contributions of the human dimensions research to the climate change debate in protected areas

Human dimensions research is an interdisciplinary field of inquiry in the social sciences with focus on applied research relevant to resource and environmental management issues. As such, its concepts and relevance also bridge to the natural sciences. I will present a conceptual framework that ties several crucial behavioural theories and concepts of the social sciences and economics to the research questions that are crucial in the climate change and adaptation debate. My presentation will relate to the mitigation and adaptation related research needs of protected areas management, and I will provide some case studies.

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Saproxylic Beetle Microhabitats Within Logs

Saproxylic (i.e. deadwood-dependent) beetles are a critical component of forest ecosystems and many species are threatened in managed forests of northern Europe due to the loss of deadwood habitats. To assess relationships between saproxylic beetles and their microhabitats, we hand collected and reared beetles from 150 trembling aspen (Populus tremuloides) logs in mature deciduous forests of NW Alberta. Beetles were recorded from microhabitats within each log: upper surface, lower surface, bark layers, under bark, wood, moss and fungus. We collected 151 species; 51% were found in only one log and 78% occurred in just one log microhabitat. Species assemblages differed significantly among log microhabitats (ANOSIM, p

Deadwood is a critical component of forest ecosystems, particularly as habitat for hyperdiverse saproxylic communities. Many saproxylic beetle species have become threatened in the intensively managed boreal forests of Fennoscandia. However, we know much less about this fauna for other areas, including North America. To assess saproxylic beetle diversity in unmanaged deciduous forests of northwest Alberta, we employed a variety of collection methods on targeted deadwood habitats. We compared saproxylic assemblages across deadwood positions (standing, fallen), decay class and size. We collected 164 beetle species (4 novel, 26 new provincial records) from a wide spectrum of deadwood habitats, ranging from declining, intact trees to nearly humified wood on the forest floor. Assemblages varied greatly between deadwood habitat types and were less than 20% similar between standing and fallen wood. Three species of saproxylic beetles were significant strong indicators of large diameter (>34cm) downed wood (p

The problem of wildlife resources exploitation and subsequent threats to wildlife species survival is a matter of great concern to all conservation minded people across the globe. The African wildlife crisis has received greater attention, research and conservation education awareness in recent years throughout the world but only the negative aspects has been highlighted. In realization of this concern, this paper has proposed to do assessment on the status and economic potential of African civet (Civettictis civetta) in Tigray Region, Ethiopia. Conducting in-situ and ex-situ assessment of African civets in Tigray region where traditional civet farming and musk extraction is uncommon but African civets range freely in the wild. A well structured questionnaire was developed and the response of 350 individuals was collected form five zones of the region namely Southern Zone, Eastern Zone, Central Zone, Western Zone and South Western Zone. Direct observation was also conducted to locate the animal, identify its wild habitat, indicates communal latrine sites and marked areas. The study adopts both random and purposive sampling technique. The Zones have been identified purposively and random sampling is used to identify specific Woradis from the selected Zones. Qualitative and quantitative method of analysis used to achieve the stated objective of the study and SPSS was used to analyze the collected data. Females have (90.91%) better knowledge about African civet than males (84.31%). African civet distribution didn't encompass the eastern zone of Tigray and it was manifested by the knowledge of the people towards the animal in the area. Nobody responded positively for the knowledge of African civet in Eastern zone. Muslim religion followers (94.59%) have a better knowledge of African civet than orthodox religion followers (84.03%). The study result indicates no better farming practice thought-out the region was observed and the respondents fail to measure the actual economic benefit of African civet farming in supporting their livelihood. The perception of the society in all parts of the study area is found positive if this farming practice consider as an opportunity, it will create better interventions for government to change the livelihood of the society. Majority of the respondents clearly indicate African civet has economic value and recommended conservation activities are vital to rescue the animal and to ensure the benefit from such farming practice. Finally this study investigated that African civets are ranging freely in the wild but the farming practice is non existent in the region.

Conducting in-situ and ex-situ assessment of African civets in Tigray region where traditional civet farming and musk extraction is uncommon but African civets range freely in the wild. A well structured questionnaire was developed and the response of 350 individuals was collected form five zones of the region namely Southern Zone, Eastern Zone, Central Zone, Western Zone and South Western Zone. Direct observation was also conducted to locate the animal, identify its wild habitat, indicates communal latrine sites and marked areas. The study adopts both random and purposive sampling technique. The Zones have been identified purposively and random sampling is used to identify specific Woradis from the selected Zones. Qualitative and quantitative method of analysis used to achieve the stated objective of the study and SPSS was used to analyze the collected data. Females have (90.91%) better knowledge about African civet than males (84.31%). African civet distribution didn't encompass the eastern zone of Tigray and it was manifested by the knowledge of the people towards the animal in the area. Nobody responded positively for the knowledge of African civet in Eastern zone. Muslim religion followers (94.59%) have a better knowledge of African civet than orthodox religion followers (84.03%). The study result indicates no better farming practice thought-out the region was observed and the respondents fail to measure the actual economic benefit of African civet farming in supporting their livelihood. The perception of the society in all parts of the study area is found positive if this farming practice consider as an opportunity, it will create better interventions for government to change the livelihood of the society. Majority of the respondents clearly indicate African civet has economic value and recommended conservation activities are vital to rescue the animal and to ensure the benefit from such farming practice. Finally this study investigated that African civets are ranging freely in the wild but the farming practice is non existent in the region.

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Evidence for Karner Blue Butterfly (Lycaeides melissa samuelis) as a Surrogate Species for the Conservation of Oak Savanna Bird Community Assemblages

At Fort McCoy Military Installation in Wisconsin, USA, the federally endangered Karner blue butterfly (Lycaeides melissa samuelis) is the focal species for a conservation plan designed to create and maintain oak savanna, which is critical habitat for the butterfly. Habitat management for the Karner blue butterfly may influence the habitat of other organisms that use oak savanna. We examined whether Karner blue butterflies act as a surrogate species for the conservation of birds using oak savanna. From 2007 through 2009 breeding bird point count and vegetation data were collected at 243 sample points in six vegetation types spanning an open to closed tree canopy gradient, including Karner blue butterfly managed oak savanna. Univariate and multivariate statistical methods were used to compare vegetation and avian community assemblages. We found that vegetation features of the Karner blue butterfly managed oak savanna were similar to remnant oak savanna and significantly different from woodlands. However, our results suggest that management for Karner blue butterfly creates habitat in which both savanna and woodland associated bird species are found. Our findings indicate that the Karner blue butterfly can act as a surrogate species for the conservation of savanna associated breeding birds.
**P1.143 Wyborn, C; Fenner School of Environment and Society, Australian National University; carina.wyborn@anu.edu.au**

**Connecting people, connecting landscapes? Assessing the social agenda of connectivity conservation in Northern America and Australia**

Connectivity conservation is gaining prominence around the world. Originating in response to habitat fragmentation and land use intensification, connectivity is increasingly framed within the discourse of climate change adaptation. These initiatives are shifting the players and perspectives involved in conservation management and show promise for facilitating integrated conservation management. At the heart of these initiatives is the motivation and ability of individuals, agencies and institutions to collaborate across multiple scales, land tenures and land uses. The challenge faced by bringing together players from across the public-private spectrum should not be understated as each organisation is constrained by their unique culture, objectives, values and for government, legislation. This challenge highlights the need for research into the social dimensions of connectivity initiatives. Drawing on existing theory, policy and practice, and recent qualitative social research (interviews and participant observation), this paper will place connectivity conservation within a social context. Areas for investigation include the relevance of initiatives. Drawing on existing theory, policy and practice, and recent qualitative social research (interviews and participant observation), this paper will place connectivity conservation within a social context. Areas for investigation include the relevance of prominent North American initiatives to Australian aspirations for connectivity, and the contested claim that connecting landscapes has both ecological and social benefits. Despite the promise offered by these initiatives, without serious consideration of the social dimensions of connectivity conservation their grand visions may remain an aspiration.

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**SP3.2 Yasue, M.; Nellas, A.; Vincent, A.C.J.; Quest University Canada and Project Seahorse, Project Seahorse Foundation, Project Seahorse; mayasue@gmail.com**

**Seahorses helped drive creation of marine reserves, so what did the reserves do for the seahorses?**

The recovery of a "flagship species" can help maintain local support for a conservation project. In the Danajon Bank, Philippines, seahorses (Hippocampus) were used as flagship species to help engender support for small, community enforced and management marine protected areas (MPAs). Here we conducted seahorse surveys inside and immediately outside eight community-based marine reserves and five distant fishing areas in the Philippines to examine the impacts of reserves on seahorse abundance, reproductive status and size. Mixed-effects models suggested that treatment (inside, immediately outside and distant fished areas) had no effect on the change in seahorse densities over time. Moreover, the number of years of protection had no effect on seahorse densities. However, our analyses suggested that there were consistently higher seahorse densities in and around MPAs compared to distant fished sites. Moreover, seahorses were larger inside than immediately outside MPAs. In summary, although MPAs do not appear to enhance seahorse populations, our study suggests that MPAs protect existing populations despite the rampant and destructive fishing outside of the MPAs. The study also warns against building community support for an MPA based on the recovery or spillover of a single species. Instead, evaluating the success of MPAs on a wider range of species could lead to long-term, stable community commitment towards the MPA.

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**P2.64 Yarish, LE; Root, KV; Michaels, HJ; Bowling Green State University; lyarris@bgusu.ca**

**Assessing Factors that Influence the Success of Butterfly Communities in Oak Savanna**

The federally listed Karner blue butterfly (Lycaeides melissa samuelis) has become a symbol for oak savanna. Efforts to restore and manage oak savanna for the Karner also benefit other species that rely on this rare ecosystem. We characterized 4 oak savanna sites in northwest Ohio focusing on lupine (Lupinus perennis), nectar plants, and light heterogeneity which are important for the Karner and possibly other butterfly species. Transects were established at each site and a 1m² quadrat was placed every 10 meters on the transect. At each quadrat we measured: number of lupine and nectar plant stems (flowering), distance between lupine and nectar plants, canopy cover, vegetation height and density, and leaf litter. Behavioral observations of butterflies were also conducted. Higher butterfly species richness was found at sites with a larger number of lupine and nectar plant stems, smaller lupine-nectar distances, and greater light heterogeneity. Butterfly species richness varied from 4 to 9 among sites. Nectar plant species richness varied from 6 to 9. The site with the highest butterfly species richness also had the highest nectar plant species richness. Butterflies were observed nectaring most often from butterflyweed (Asclepias tuberosa) and scaly blazing star (Liatris squarrosa). These results help inform future land management decisions at these and other oak savanna sites. This type of assessment could be used instead of butterfly counts to monitor populations.

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**P2.10 Yates, Gabriela*a; Boyce, Mark; University of Alberta; gyates@ualberta.ca**

**Flat-lining Canadian lynx in southern Canada**

During the past 30 years lynx (Lynx canadensis) populations across broad regions of southern Canada have declined in abundance with dampened population oscillations. This breakdown in population cycles may be crucially linked to the threatened status of the lynx in the United States, and periodic dispersal from the north might be essential to maintain southern populations. Further north in Canada populations continue the fundamental rhythm of the boreal ecosystem with 10-20 cycles of snowshoe hares (Lepus americanus) and lynx. Recent advances in ecological theory provide insights into alternative mechanisms for these deteriorating population cycles. Data from fur harvest records suggest that the lynx-hare cycle is a plant-herbivore-predator system driven by climatic seasonality. We present evidence that (1) the regional effect of lynx dispersal, or (2) reductions in environmental seasonality are the most probable mechanisms causing flat-lining population cycles. Changing landscapes and changing climates are having widespread consequences in the north.

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A simple and cheap coral restoration method was developed by Association of Marine Biodiversity Conservation and Education (AMBCE), an NGO conservation group led by marine scientists, in collaboration with local administrative officials, volunteer groups and local teachers. The concept of this method was providing additional substrates for coral recruitment and attaching coral fragments found on the coral reefs by using clusters of designed concrete blocks which were made by local people. The coral restoration sites were in shallow water of the west of Koh Kood, Trat Province, in the eastern Gulf of Thailand. It is easy for local students to study on coral biology and ecology at the coral restoration sites. This coral restoration model can raise public awareness on coral reef conservation through students as well as increase survival of natural coral fragments. Moreover, the planning and implementation activities of the project enhanced coordination among local communities, NGOs and government agencies.

SY14 Zangger, Adrian; Biodiversity Monitoring Switzerland, c/o Hintermann & Weber Ltd, Aaubergergasse 61, CH 3011 Bern; zangger@hintermannweber.ch
Focusing on Trends in the Common Landscape-the Swiss Biodiversity Monitoring Program

The primary task of Switzerland’s state-run biodiversity monitoring program (BDM) is to survey changes over extended periods of time. BDM is embedded in a framework combining effectiveness and baseline monitoring programs as well as customised studies. As a baseline monitoring program, BDM has to cover a broad range of possible changes. Because relevant human impacts on biodiversity have different effects at various spatial scales, we collect data within habitats, landscapes, and biogeographical regions. Monitoring only rare species could create a false impression, as in our intensively used landscapes, these are often restricted to small, special patch habitats. For this reason, it is important to survey species typical of our normal landscape. That in turn means monitoring abundant and wide-spread species. Hence, the bulk of our funds is invested here. As our data shows, it is these species that have undergone significant changes in recent years. In order to reveal trends in biodiversity, we propose to collect data on whole taxonomic groups rather than focusing on a selection of predefined target species. This also provides optimum flexibility to adapt to questions emerging in the future, as has recently been shown for several issues. Apart from scientific considerations, it is important to select species groups that also appeal to the general public—an indispensable requirement to maintain interest and, thus, funding.
An Alberta Model of a Conservation/Carbon Offset Co-Benefits Project

Zimmerling, T.N.; Alberta Conservation Association; Todd.Zimmerling@ab-conservation.com

The concept of carbon offsets is relatively new in Alberta, and the linkage of carbon offsets with other co-benefits such as conservation of biodiversity, reduced soil erosion, improved water quality, or increased recreational opportunities for the public has only recently begun to be explored. The Alberta Conservation Association, Alberta Fish and Game Association and The Society for Conservation Biology have entered into an agreement to undertake the first known carbon offset/conservation project in Alberta. This presentation will provide an overview of the Alberta carbon offset market and will provide the details around the Wild Rose Conservation Site. The details will include the proposed management of the site for biodiversity and carbon sequestration, and the carbon offset program which is being used to offset this meeting. While the carbon sequestration measurements for the site may not be as rigorous as some may like, I will provide information showing that for a first time conservation/carbon offset demonstration site the assumptions used are sufficiently conservative to ensure that an appropriate amount of carbon is being sequestered, while 384 ha of grasslands are being protected for conservation purposes. The success of this co-benefits project should lead to much more biodiversity being protected in the future, in Alberta.

Habitat quality assessment based on species rarity: case study of land snails in Hungarian forest reserves

Kemencei, Zita; Salymos, Peter; Hornung, Erzsabet; Vilisics, Ferenc; Department of Ecology, Faculty of Veterinary Science, Szent Istvan University, Budapest, Hungary, Alberta Biodiversity Monitoring Institute, Department of Biological Sciences, CW 405, Biological Sciences Bldg, University of Alberta, Edmonton, Alberta, T6G 2J9, Canada; kemenczi.phd@gmail.com

We studied the performance of 5 different measures of habitat quality. We used the species richness (not sensitive to species rarity), Shannon’s diversity index (sensitive to local scale rarity), mean rarity index (mean of regional rarity scores of species), and two indices that combine the local and regional commonness/rarity of the species (regional rarity scores weighted by relative frequency or reciprocal of it). We surveyed the land snails in 3 Hungarian forest reserves. Local rarity was based on relative frequency of the species calculated from the sample counts, for regional rarity of the species we followed a conservation prioritization scheme developed for the Hungarian mollusc fauna. All indices ranked the 3 reserves similarly except for the one where regional rarity was weighted by local commonness. Range restricted (regionally rare) species tended to be locally rare, although not in each cases. We found that the regionally rare species Macrogastra plicatula was one of the most abundant species in one of the reserves. Our results generally reiterate the positive relationship between rarity measured at different spatial scales, but also provide example where this was not the case. So habitat quality assessment should rely on different and complementary indices. Incongruences of multiple indices can help in identifying potentially idiosyncratic biotas.