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Ordered by surname of first author.

**Abbott, Rachael,** *Victoria University of Wellington;* **Ben Bell**, *Victoria University of Wellington;***Nicky Nelson,** *Victoria University of Wellington*

**Improving conservation management of New Zealand's rarest kiwi (Apteryx rowi): An integrated approach identifies optimal release group size.**

To increase the effectiveness of restocking for conservation, it is necessary to identify any elements of the release protocol which affect post release survival, and modify the procedure accordingly. Rowi are critically endangered flightless ratites which form monogamous, highly territorial pairs. Restocking of the sole remaining rowi population has been underway for over 16 years. To reflect the adult social organisation, releases traditionally took place in pairs or small groups. However, preliminary data analysis led us to hypothesize that individuals in larger groups may have higher survival rate than those in small release groups. We tested this by experimentally manipulating release group size over 3 years, followed by intensive post release monitoring. Modelling reveals that of all variables tested, group size was the only factor with significant influence on post release survival (n=67, p=0.036). Kaplan Meier analysis showed cumulative survival at 90 days post release of small groups (ф 0.545, n=22) was significantly lower than that of large groups (ф 0.911, n=45). This finding has led to a change in release protocol, and also has important theoretical implications for the interpretation of behavioral ecology, life history and demography, and their application to reintroduction biology and restocking as a conservation tool.

**Abrams, Jesse,** *Leibniz Center Tropical Marine Ecol*

**The Carbon Cycle: Where does SCB's habitat trading fit in?**

We need carbon but the need for carbon is also associated with one of the biggest problems of today: global warming. Carbon is exchanged between different reservoirs in what is known as the carbon cycle. The carbon cycle has both fast and slow components, which help regulate the Earth’s temperature on both short and long time scales. Certain components could act as either positive or negative feedbacks on the system. There are certain phases of the global carbon cycle that offer opportunities for reduction of future greenhouse gas impacts, such as preserving and restoring habitats that sequester carbon dioxide. A combination of potential sequestration strategies could help mitigate the problem of rising carbon dioxide levels and the secondary problems, such as ocean acidification, associated with it. Amongst these strategies are improved land management and restoration of degraded lands and cultivated organic soils. Here I will identify where SCB’s habitat trading fits into the climate change mitigation picture.

**Abrams, Ron,** *Dru AssocIates, Inc.*

**SCB at Rooihoek, South Africa: Severe logistics in Baviaanskloof Mega Preserve**

SCB investment in carbon offsets began after the 2007 ICCB in South Africa. The carbon offset contributions collected from 2007 through 2009 are supporting habitat restoration at Rooihoek in the Baviaanskloof Mega Reserve in South Africa. In addition to the carbon credits contracted from this work, SCB’s participation is giving impetus to an experiment in restoration combined with community-based conservation. Drought and herbivory are suppressing the growth of the restored habitat, so experimentation at Rooihoek involves replanting of spekboom along with additional species to enhance the substrate, and the area's biodiversity, as well as trials of herbivore exclusion by temporary electric fence. This collaborative research on restoration across the Eastern Cape region will reveal much about Adaptive Management of carbon sequestration projects. In the meantime, the Department of Environmental Affairs and the Eastern Cape Parks and Tourism Agency have discussed with the National Parks at Addo the designation of land that is already restored for claim by SCB for sufficient credits to meet the carbon target set in the original contract with ECPTA. Decisions remain to be made about how SCB completes its commitment to the Rooihoek project. Once SCB has approved a strategy, members of the Rhodes Restoration Group will aid SCB in revising the calculations in the contract which establish the credits needed from either ECPTA or National Parks.

**Acevedo, Aldemar,** *Ecology and Biogeography Research Group, Universidad de Pamplona;* **Rosmery Franco**, *Ecology and Biogeography Research Group, Universidad de Pamplona;***Karen Silva,** *Ecology and Biogeography Research Group, Universidad de Pamplona*

**Diversity and Conservation Status of Andean Amphibians from the Tama National Natural Park - Colombia**

Anthropogenic disturbances in habitats have led to changes in composition, diversity and abundance patterns of amphibian species, as well as adverse effects on the conservation of these in the Neotropics. To evaluate these processes and determine the amphibian diversity, from August 2010 to April 2011 samplings were made in the Tama park (Colombia) in four Andean mountain areas, between 2000 to 3200 m.a.s.l. In order to determine the impact of threats; we applied the technique of formal concept analysis (AFC) to evaluate the different degrees of threat (habitat fragmentation, animal husbandry, human presence and infection with Batrachochytrium dendrobatidis). We recorded 538 individuals of 17 species of amphibians. 95 samples were analyzed for the diagnosis of chytrid fungus through the conventional PCR technique, 45 were positive in 12 amphibians species, being one of the most alarming registers of infection in the Colombian country. In the AFC results, six of 17 species recorded faced the five threats. This study led to the discovery of a new species (Bolitoglossa tamanese), plus five new records were reported, three new for Colombia: P. gryllus, P. melanoproctus and P. mondolfii and two species to the department of Norte de Santander: Dendropsophus pelidna and P. frater. Finally, we suggest further explorations to the areas of the Massif El Tamá, and evaluate other aspects of threats to which could be subjected amphibian species of high mountain areas.

**Acharya, Bhoj,** *Sikkim Government College, Tadong (Sikkim University);* **Basundhara Chettri**, *Sikkim University*

**Impact of climate change on birds, reptiles, amphibians and butterflies in the Eastern Himalayas and their conservation strategies**

Biodiversity of the tropical mountains including Himalayas are most vulnerable to global climate change. Warming rate, and also the consequences, is higher in the Himalayas than the rest of the world. We analyzed climate change effect on four ecologically sensitive faunal groups (birds, reptiles, amphibians and butterflies) in Sikkim, Eastern Himalayas, India. Situated within the globally significant biodiversity hotspots, Sikkim occupies an important biogeographic location in the entire Himalayan chain. Field based studies collated with historic records shows that studied faunal taxa have extended or shifted their ranges towards higher elevation leading to reduction in their range sizes. We also observed late breeding/breeding failure among birds and early breeding of amphibians. Biased sex ratio towards females (higher temperature favors females) has been observed in snakes. Drying springs and erratic rainfall pattern has affected breeding of amphibians causing decline in their population. Long dry spells have caused the disappearance of turtles from Sikkim. Faunal habitats, especially in the low elevation areas, in Sikkim are fragmented/degraded due to various developmental activities. Consequently, many streams have dried leading to loss of potential habitat for reptiles and amphibians. Hence, conservation of community owned agro-forests and revival of dried streams could mitigate climate change impact and enhances biodiversity conservation in the Eastern Himalayas.

**Ackerly, David,** *University of California, Berkeley*

**Topoclimates and climate change impacts on vegetation in Mediterranean ecosystems of South Africa and California**

Species distribution models have played a central role in projections of climate change impacts on biodiversity. I present two studies examining the influences of topography on climatic heterogeneity and plant distributions at fine spatial scales, to evaluate the potential for species to persist in heterogeneous landscapes with limited dispersal. In the San Francisco Bay Area, summer and winter temperatures are inversely correlated in relation to distance from the coast. Vegetation types that are most responsive to summer temperature are projected to shift downhill and as a result they expand their potential range in lower elevation areas. Vegetation that is more sensitive to winter temperatures shifts uphill, leading to range restrictions as high elevations cover less area. On Table Mt (Cape Town, South Africa) topographic heterogeneity generates up to 3°C variation in minimum and maximum temperatures at a local scale, due to cold air pooling and solar insolation, respectively. For one high elevation fynbos species, this fine-scale variation provides a buffer of an additional 1°C rise in regional temperature before it goes extinct. The two studies together highlight the importance of enhanced spatial resolution in both climate and biodiversity modeling, and the potential importance of landscape heterogeneity for biodiversity conservation in the face of climate change.

**Adams, Keenan,** *USFWS*

**The Land Ethic of African American Forest Landowners in South Carolina**  
African Americans account for a significant proportion of South Carolina's population but reportedly own a disproportionately smaller amount of land. Historically, African Americans in the rural South have held a close relationship to the land and the natural resources (e.g., farming, timber, wildlife). Unfortunately, many African American landowners have sold, lost, or otherwise been divested of the empowerment that natural resource management offers. Studies of Non-industrial Private Forest (NIPF) landowners in the US have been performed, but information regarding minority NIPF landowners is limited. We interviewed 14 NIPF forest landowners in South Carolina to qualify their experiences, values, and perceptions of the forest. Qualitative methods were employed using multiple disciplines to understand the essence and nature of their experiences. This study also includes formal and informal interviews with regional natural resource management professionals. The findings suggest that land is strongly associated with historical/cultural legacy and collective ownership. Furthermore, the landowners felt that they did not receive an adequate amount of technical, informational, or financial resources. Investigating African American NIPF landowners' experiences is critical in understanding their forest stewardship. Understanding perceptions of these NIPF landowners can provide insights that can yield improved forest management and meaningful stakeholder engagement.

**Adams, Vanessa,** *Charles Darwin University*

**Estimating landholders' probability of participating in a stewardship program, and the implications for spatial conservation opportunities**

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, both private and public. We conducted a survey in the Daly Catchment, Northern Territory, to inform the design and implementation of a stewardship payment program. We used a choice model to spatially predict landholders’ probability of participating in the stewardship program at the resolution of individual properties. We then incorporated these predictions into conservation planning software to examine the potential for the stewardship program to meet conservation objectives. We found a tension in our study region between planning for a cost-effective program and planning for a program that targets properties with the highest probability of participation. Underlying this tension was the tendency for properties that were least costly to be the least likely to participate. We present a generalized analysis of how correlations between management costs and probability of participation can affect the potential to achieve spatial conservation objectives. We conclude by discussing the implications of these results for conservation opportunity assessment.

**Adams, Vanessa,** *Charles Darwin University*

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**Adams, Vanessa,** *Charles Darwin University*

**Planning for conservation and development: can a regional strategic plan link to on ground local actions?**

We present a regional planning exercise currently being undertaken in the Daly river catchment, Northern Territory, Australia and the potential opportunities and barriers to implementation. Although the Daly catchment currently has relatively little clearing, there is interest in future development projects including intensifying agricultural and pastoral uses. Therefore, a concurrent development and conservation planning process is being undertaken to allow for objectives to be formulated and trade-offs to be considered explicitly. Both development and conservation of natural resources in the catchment will affect human wellbeing and the long-term provisioning of ecosystem services; therefore the engagement process with residents has focused on quantifying the importance of key factors to their wellbeing. The engagement process uniquely links these factors to spatial features in the catchment and we compare the factors identified as being most important to wellbeing and the plan priorities (objectives) set by the catchment management authority. We discuss how alignment the plan priorities to factors important to resident wellbeing might contribute to the overall acceptance of the plan. Lastly, we discuss the potential for the regional plan to be implemented both at a regional scale as well as linking to local actions.

**Adhikari, Yagya,** *TUM;* **Anton Fischer**, *TUM*

**Conservation and sustainable utilization perspectives for epiphytic orchids in subtropical Himalayas**

Anthropogenic disturbance is a major driver for biodiversity loss. This is especially true for subtropical and tropical forest ecosystems. Epiphytes in these forests fundamentally depend on host trees. We established a 1.5 km grid net including surrounding forest areas and analysed epiphytic orchids (EOs): 156 systematically distributed grid points, 10 trees per point as close as possible to the respective point in Kathmandu Valley, Nepal. Data from remote sensing were used for classification of land use types. We identified the main habitat requirements for the conservation of EOs and outlined keystones of a management approach for their protection. This approach is based from a literature review of existing knowledge and our own research on EOs. It is the first study to include all relevant types of habitat (from natural habitats to single tree habitats) transformation at a single study site and developed conservation perspectives. Keystones for sustainable conservation and utilisation of EOs are: i) the elements that should be protected, ii) the activities that should be carried out, and iii) the socio-economic background of conservation. While remnants of natural habitats are crucial for the conservation of EO communities, groups of native trees in urban settings can still serve as stepping stones. Finally, proposed keystones of a management concept for protection is essential for the long-term conservation of the high epiphytic diversity in Himalayas and elsewhere.

**Agaldo, Jennifer,** *A .P. Leventis Ornithological Research Institute. University of Jos Nigeria*

**Plight of the Nigeria-Cameroon Chimpanzee in Oban division Forest; a reflection of the state of one of Nigeria's most important Biodiversity hotspot**

Little is known about the endangered/endemic Nigeria-Cameroon Chimpanzee in Oban division forest of Cross River National Park. As Nigeria's most important remaining forest blocks, lack of recent research on the status of this forest and its species is ironical. This study aimed to provide data for informed conservation decisions for the protection and conservation of the Chimpanzee from local/global extinction as well as providing recent account on status of the biodiversity rich Oban forest. Guided-reconnaissance walks were used in a stratified random manner where all chimpanzee signs encountered were identified and noted. All signs of anthropogenic activities encountered were also recorded. Interaction with local communities around the area was also carried out aimed at assessing local perspective of the chimpanzees and the Oban Forest. This study confirmed the presence of chimpanzees at very low densities in the Oban forest as no chimpanzee was sighted except nest and calls heard. Hunting, logging and farming were also identified as the greatest of 13 threat identified to the chimpanzees and the forest. It demonstrates the need for urgent steps to eliminate anthropogenic activities which affect the chimpanzees as well as other species of conservation importance in the habitat. It provides data in line with a recent regional IUCN action plan to conserve the Nigeria-Cameroon Chimpanzee.

**Agapito, Melinda,** *Memorial University of Newfoundland;* **Rodolphe Devillers**, *Memorial University of Newfoundland;***Evan Edinger,** *Memorial University of Newfoundland;* **Ratana Chuenpagdee**, *Memorial University of Newfoundland;* **Mariano Koen-Alonso**, *orthwest Atlantic Fisheries Centre Fisheries and Oceans Canada*

**Decision realities: tradeoffs and 'hard' choices in GIS-based marine conservation planning**

Marine conservation planning processes are often characterized by competing stakeholders' objectives where 'hard choices' and tradeoff decisions are inevitable. We implemented a decision-making framework, spatial tier framework (STF), where conservation goal and objectives are identified and delineated through spatially-explicit decision criteria. We then integrated a multicriteria decision-analysis (MCDA) method, ordered weighted averaging (OWA) that allows weighting of stakeholders' values on various decision criteria. We tested this approach in the Newfoundland and Labrador shelf bioregion, Canada, (~1.2x106 km2). We generated 25 spatially-explicit criteria obtained from various biological and human-use datasets such as scientific surveys for ground fish, habitat-forming invertebrates and seabirds, commercial fishing logbooks, transportation and oil and gas activities. Workshop participants generated weights and evaluated the approach. MCDA-OWA identified about 0.5% of the areas as 'easy choices' characterized by high biodiversity and low economic impacts. Inshore high biodiversity regions were prioritized only when fishing 'cost' was sacrificed. Priority areas became restricted towards the shelf edge when higher weights were applied to socio-economic objectives. Our approach, combining STF and OWA, can constrain 'hard' and 'easy' choices and tradeoff decisions using GIS-based decision criteria within an inclusive decision-making framework.

**Aguirre, Alonso,** *George Mason University*

**Conservation Medicine: bridging the gaps to face transdisciplinary challenges and integrative research in ecological health**

Conservation Medicine has emphasized the need to bridge disciplines, thereby linking human health, animal health, and ecosystem health under the paradigm that “health connects all species in the planet” with the urgent need to address the rapid deterioration of the world. The recent convergence of global problems including climate change, biodiversity loss, habitat fragmentation, globalization, and infectious disease emergence demanded integrative approaches breaching disciplinary boundaries. This integration requires commitment not only from government agencies, universities and other organizations but eventually will attempt to generate new international structures. Conservation Medicine needs to orient itself toward research that accounts for these global changes and contextualize it in terms of human development. The challenges faced today and how to overcome them at a pivotal time in the environmental history of humanity require true regionalization of ecological health. Perhaps most importantly, not only research needs expansion to all sciences but also needs to be truly geographically and culturally participatory. The strategies of Conservation Medicine include long-term monitoring, health assessment, and interventions to protect species, ecosystems and humans at risk. We are grappling with finding solutions for today’s most compelling challenges: conserving fragmented ecosystems, addressing threats to biodiversity from climate change, understanding emerging infectious diseases and ecosystem health. Consistent with this philosophy and goals, we need to strive to ensure lasting local conservation impacts with global health solutions with every project by training community leaders, volunteers and school children, in addition to professional, in-country experts. These groups comprise the next generation of planetary doctors.

**Agyekumhene, Andrews,** *Wildlife Division (Forestry Commission);* **James Akwovia**, *Wildlife Division (Forestry Commission);***Cynthia Okine,** *Forest Services Division (Forestry Commission)*

**Community participation in natural resource conservation: Success story from Muni-Pomadze Ramsar site, Ghana**

Anthropogenic activities within the Muni-Pomadze Ramsar Site (MPRS) threaten wildlife species and their habitat. Ghana Wildlife Division uses law enforcement and conservation education programs conserve the resources. However, there has been an immediate need for programs that engage local communities to actively participate in protecting the natural resource. This work examines the impacts of some efforts on resource conservation at the MPRS. A site management committee (SMC) which is made up of staff of WD and selected opinion leaders from the community was established to help in decision making and implementation at the site. Resource protection volunteer groups were formed in the communities to protect the natural resources. Income-generating alternative livelihood activities were introduced. The establishment of a site management committee was helpful in enacting by-laws that protected the resources. Resource Protection Volunteer Groups in the communities has been helpful in reducing the degrading activities to the natural resources as the volunteers doubled as informants to give information to the WD. Introduction of income generating Alternate livelihood activities has reduced greatly the threats to the resources. Of all the programs introduced, alternative livelihood seems to be the most embraced program by the community members.

**Ahmadia, Gabby N. ,** *World Wildlife Fund*

**Making the most of the data: challenges of collaborative NGO data management and analysis for impact evaluation in a remote MPA network in Indonesia**

Extensive collaborative efforts have resulted in a network of MPAs in the vast Bird’s Head Seascape (BHS), Indonesia, which covers over 13,000 square miles. To understand the effectiveness of these conservation interventions, a comprehensive impact evaluation needs to be conducted. Three separate NGOs have been conducting ecological monitoring, which presents three major challenges in synthesizing the data and setting the framework for impact evaluation. First, to address biological and technical issues associated with the current coral reef monitoring protocol we analyzed the variability in the data to select short term and long term ecological indicators for coral reef health. Second, we made several efforts to improve data management, including creation of a database for the BHS, creation of an online storage database, and exploration into using mobile phones as a means of data collection. Finally, we addressed a lack of control sites outside of the MPAs by recently conducting an expedition to monitor potential control reef sites. We further analyzed these data in order to develop criteria for matching control sites with MPAs based on similarity of certain reef attributes. This has ultimately led to baseline ecological data to use in combination with social data for future impact evaluation in the BHS.

**Ahumada, Jorge,** *Conservation International;* **Johanna Hurtado**, *Organizacion de Estudios Tropicales;***Diego Lizcano,** *Universidad de Pamplona*

**Estimating status and trends of terrestrial mammals from camera trap data: a tool for conservation.**

The Convention on Biological Diversity, proposed a plan in 2010 to reduce the rate of biodiversity loss by 2020 by monitoring progress of 20 targets (Aichi Biodiversity Targets). Measuring progress towards these targets depends on the availability of data to be synthesized under several dozen indicators. The simple question of whether a species is increasing, decreasing or stable, a vital component of many of these indicators, can be hindered by quality and consistency problems in the data that goes into them. We demonstrate the use of annual camera trap deployments as a cost-effective way to monitor terrestrial mammal species and community diversity that can feed directly into indicators for many Aichi targets. As part of a global monitoring system for tropical forests, 60 camera trap points were deployed annually along the Volcan Barva transect, Costa Rica between 2008-12. From these data we estimated annual occupancy rates for 14 species of mammals of interest. Four of these species showed declines in occupancy that were statistically significant. We calculated trends in species richness and the Wildlife Picture Index -a synthetic indicator of community diversity, developed specifically for camera trap data. Both showed a modest decline through time. We discuss the possible causes for this decline, and ways this information can feed back into park management authorities to enhance effectiveness in conservation and help reach biodiversity conservation targets.

**Aikens, Ellen,** *Smithsonian Conservation Biology Institute;* **Kate Jenks**, *Minnesota Zoo;***Naris Bhumpakphan,** *Kasetsart University;* **Nucharin Songsasen**, *Smithsonian Conservation Biology Institute;* **Sawai Wanghongsa**, *Thailand Department of National Parks, Wildlife and Plant Conservation;* **Budsabong Kanchanasaka,** *Thailand Department of National Parks, Wildlife and Plant Conservation;***Peter Leimgruber**, *Smithsonian Conservation Biology Institute*

**People and Wild Canids - Lessons Learnt from Comparative Studies of Dhole and Jackal Movements**

We integrated social-science interviews on people's perceptions of wild canids with comparative ecological research on canid movement behavior to better understand how canid ecology influences perception by local people. Villagers living in proximity of Thailand's protected areas generally see wild canids as pests threatening their livestock. However, in interview surveys they frequently confuse photographs of endangered dholes (Cuon alpinus) with sympatric golden jackals (Canis aureus). We used GPS tracking and advanced statistical tools to analyze the movement ecology of both species to assess how they use habitats in and around protected areas, and to determine how frequently they may come into contact with local people. Our research demonstrates that dholes are forest specialists with relatively restricted territories and home ranges, while golden jackals are habitat generalists living mostly in agricultural landscape mosaics with occasional forays into forests. Based on habitat choice and movement characteristics, jackal are more likely to be encountered by people and probably also represent a greater threat to livestock. Data from this research is being used for environmental education to raise awareness for dhole conservation in and around Thailand's protected areas.

**Airoldi, Laura,** *University of Bologna;* **Filippo Ferrario**, *University of Bologna;***Ljiljana Ivesa,** *Center for Marine Research, Institute Rudjer Boskovic;* **Shimrit Perkol-Finkel**, *SeArc Ecological Marine Consulting;* **Elisabeth Strain**, *University of Bologna*

**Combining Ecological Principles to the Design of Marine Infrastructures to Preserve Native Biodiversity in Marine Urban Seascapes**

Urbanization and management of coastal erosion has resulted in the proliferation of marine infrastructures, such as breakwaters, ports, seawalls and offshore installations. These artificial habitats tend to be very poor compared to natural habitats, and are one of the leading causes for biodiversity loss in coastal waters. This calls for new strategies aimed at elevating the ecological value of coastal infrastructures. We explored the feasibility of preserving native biodiversity in marine urban environments by promoting the growth of ecologically valuable, canopy-forming algae on coastal artificial structures. Canopy algae form diverse, structurally complex and highly productive habitats along many temperate rocky coasts, but are rapidly retracting in urban areas. We demonstrated experimentally that canopy algae could be transplanted, survive and grow on purpose designed artificial surfaces. However, recruitment was limited by biotic disturbance (primarily grazing), which was greater on coastal structures compared to natural reefs. The observed different ecological functioning of artificial vs natural habitats was consistent across urban catchments hundreds of km apart, possibly providing an additional explanation to the ongoing global retraction of canopy forming habitats. We conclude that to preserve native biodiversity in urban areas it is necessary that the unique functioning of artificial habitats is understood and incorporated into green infrastrutture design

**Akasaka, Munemitsu,** *Tokyo University of Agriculture and Techinology;* **Taku Kadoya**, *National Institute for Environmental Studies;***Fumiko Ishihama,** *National Institute for Environmental Studies;* **Taku Fujita**, *The nature conservation society of Japan*

**Reinforcing need for conserving narrow-range species: positive feedback of being gap species and high local extinction rate in non-conserved areas**

Whether a species' distribution is included in protected areas (PAs) is an important criterion for species prioritization. Particularly, species of which distribution area is not conserved (gap species) often receives high priority when planning new PAs. The gap between distribution of PAs and that of species can be minimized when PAs are allocated based on complementarity analysis. However, due to practical limitations, such allocation is often unavailable, and PAs are located rather randomly regarding areas that should be conserved. In such case, narrow-range species might become gap species easily than wide-range species. Using distribution records of 1889 red-listed vascular plant taxa in Japan, we empirically examined whether conservation priority should be set to narrow-range species. Narrow-range species were more likely to become gap species than wide-range species. Furthermore, proportion of species of which red-list category had deteriorated between 2007 and 2012 was twice as high as in the gap species than conserved ones. This trend is supported by double in the rate of local extinction in non-conserved mesh than in conserved mesh. Our results suggest a positive feedback -that is, narrow range species is prone to become gap species, which accelerates the local extinction of the species, and which further narrows the range of the species. Therefore these species should be conserved preferentially.

**Akcakaya, H. Resit,** *Stony Brook University;* **Jessica Stanton**, *Stony Brook University;***Matthew Aiello-Lammens,** *Stony Brook University;* **Kevin Shoemaker**, *Stony Brook University;* **Richard Pearson**, *American Museum of Natural History*

**Extinction risk assessment and red-listing of species threatened with climate change**

How current methods of categorizing threatened species (such as IUCN Red List) will perform in identifying species threatened with climate change has been an unresolved debate. Addressing this question requires analyzing extinction risks under climate change, but most methods used for this are inadequate. Inferring species vulnerability to climate change from projected shifts in their habitat--based on predictions of ecological niche models, ENM-- ignores the effect of demographic or life history traits. Correlative approaches to determine the effect of life history traits on vulnerability to extinction often leads to circularity in analysis when the data on extinction risk is based in part on these life history traits. To address these shortcomings, we developed a novel modeling approach, linking downscaled climate model ensembles, ENMs, and generic life history models that predict extinction probability. Analysis of simulation results reveals interacting effects of life history traits and range shifts on the vulnerability of species to climate change. The results also allow calculating the time between red-listing of a species and its extinction (assuming no conservation action), giving an estimate of the time that would be available for conservation measures to prevent the extinction of climate-impacted species. This approach is demonstrated by using distributional and demographic data on 36 species of North American herps to analyze their vulnerability to climate change.

**Akeredolu, Excellence,** *Department of zoology Faculty of Science,University of Lagos,Nigeria;* **Omopeluola Akinfeleye**, *Department of zoology Faculty of Science,University of Lagos,Nigeria;***FELA AKINSE,** *UNIVERSITY OF LAGOS,DEPARTMENT OF ZOOLOGY*

**SWIMMING CRAB (Callinectes amnicola) : AN ECOLOGICAL INDICATOR OF HEAVY METAL POLLUTION IN THE WESTERN SIDE OF LAGOS LAGOON, NIGERIA**

Heavy metal pollution from the industrial sector constitutes a threat to aquatic biodiversity in the western side of Lagos Lagoon in the south western Nigeria. A survey was carried out at three stations: UNILAG front, Iddo and Oko Baba on the Lagoon between the wet and dry season of 2011 to determine heavy metal pollution using the crab Callinectes amnicola (De Rochebourne) as a bioindicator . Five priority heavy metals namely Nickel (Ni), Chromium (Cr), Copper (Cu), Lead (Pb) and Zinc (Zn) were analysed in water and crab tissues(muscle and hepatopancreas) The mean concentration of heavy metals (mg/kg) in water and crab tissues varied significantly (p Pb > Cr, > Zn > Cu across the study sites. The metal level in water samples from these stations also increased in the order Ni> Cr> Pb> Cu>Zn. The study concluded that western side of Lagos lagoon is highly polluted with these heavy metals, thus recommending ways by which further pollution can be averted. Keywords: Heavy metals, bio-accumulation, bio-concentration, swimming crab

**Akintunde, Oluyinka,** *Federal University of Agriculture, Abeokuta, Nigeria.;* **Segun Olakunle**, *Federal University of Agriculture, Abeokuta, Nigeria.*

**Valuation of Ecotourism Potentials of Olumo Rock, Abeokuta, Nigeria Using Travel-Cost Model Approach.**

ABSTRACT This paper investigated the monetary value placed on ecotourism potentials of Olumo Rock, Abeokuta, Nigeria as perceived by visiting tourists. Questionnaires were administered to collect primary data. Information harnessed includes, mode and cost incurred for transportation and visitation, purpose of visitation, perception about the recreational status, staff-visitors' relationship and problem encountered during visit. Descriptive statistics, multiple regression analysis and travel-cost model were parts of the statistical tools used for data analysis. The result showed that the majority of the visitors were male (54%); residents of Lagos State, Nigeria (60%); students (38%); having tertiary education (44%); visiting for recreational purposes (72%); encountered hill climbing as a problem (26%); fairly satisfied with staff-visitor relationship (74%) but satisfied with the site resources and facilities and wishing to call again (90%); come mostly with their private vehicles (68%) . With respect to travel cost analysis, it was discovered that visitors using private transportation incurred more expensive than those using public transport. The reduced model of the multiple linear regression revealed that the following variables: income, distance to site, and travel cost significantly influenced the visitation rate to Olumo rock site. Effective management of park resources and facilities with improvement in staff welfare packages were parts of suggested recommendations.

**Alamu, Olabisi,** *National Centre for Genetic Resources and Biotechnology;* **Olusegun Olajide Kupoluyi**, *Department of Agronomy*

**Evaluation of Sweetpotato (Ipomoea batatas) conservation status and genetic diversity in Nigeria**

Sweetpotato is an economic and food security crop in Nigeria. Non availability of healthy and high yielding planting materials at the beginning of the growing season has been noted to be major constraints to cultivation of the crop by many household in Nigeria with the consequence of genetic erosion of landraces and cultivars. Germplasm collection of the sweetpotato vines and roots were carried across the production zones of the Nigeria, with the county divided into six zones .Vines cuttings of 164 accessions were transferred to the Research Plot of NACGRAB Ibadan (7o 22'N, 3 o50E') and planted on ridges at 3m x I m ,3 replicate per accession . Roots were harvested at the age of 5-6 months. Morphological data and yield data were taken and analyzed appropriately. There was high variability in the yield and vegetative data thus indicating genetic diversity of the crop in Nigeria There was increase in the number of accession conserved and it also arrest the genetic erosion of the crop in Nigeria. The study recommends increase in the accessibility of farmers to materials of important traits eg. high yielding, pro - vitamin A contents , disease and pest resistance. While information and knowledge sharing through interactions among farmers and Scientists should be sustained towards conservation of plant genetic resources

**Alavi, Ayub,** *Wildlife Conservation Society (WCS)*

**Bamyan Plateau corridor habitat: An anchor for landscape scale conservation in central highlands of 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 conservation planning, wildlife and range surveys, environmental legislation and community involvement in the area. Findings from surveys conducted in safe portion of in-conflict Afghanistan suggests the 7000 km2 high altitude plateau to the north of Bamyan province continues to harbour significant populations of urial (Ovis orientalis) and Siberian ibex (Capra siberica) and recent camera trap images have revealed a surprise: a Persian leopard, an apex predator long thought to have disappeared from the region. This pocket of rich biodiversity, also a natural corridor for wildlife seasonal movements between western Hindukosh to the south and northern plains of Afghanistan, extended northward from the only national park of Afghanistan; is proposed for a diverse, community-based, landscape scale conservation program. Currently 16 local game guards from the 4 community clusters distributed geographically around the plateau game the area and dependent on funding, providing assistance to the government and local communities in developing and training Community Conservation Councils (CCCs) and based on advice from the CCCs, a spectrum of protection measures to be employed to protect natural values while enhancing the livelihoods of local people.

**Albright, Whitney,** *California Department of Fish and Game;* **Natalie Dubois**, *Defenders of Wildlife;***Judy Boshoven,** *Founders of Success;* **Amber Pairis**, *California Department of Fish and Wildlife;* **Armand Gonzales**, *California Department and Fish and Wildlife*

**Incorporating Climate Change into the California Wildlife Action Plan**

The California Department of Fish and Wildlife (CDFW) has begun the process of revising the California Wildlife Action Plan with a goal of better integrating the impacts of climate change. The CDFW recognizes that climate change is a major challenge to the conservation of California's natural resources and is taking an active role in planning for and responding to the challenges posed by a changing climate. As part of this effort, CDFW worked with partners to develop a methodology that explicitly integrates climate change into the threat assessment and ratings described in the Open Standards for the Practice of Conservation and will be using this framework to update the California Wildlife Action Plan. This integrated threat assessment provides a basis for identifying climate adaptation strategies that minimize the impacts of climate change on wildlife and habitat. The process has been conducted by teams at the ecoregional level and will be rolled up into a state-wide strategy. A separate climate stakeholder group was convened to help gather the necessary climate data for this exercise and to support the ecoregional teams as they worked through this process. Stakeholder involvement will be discussed in addition to describing how the Open Standards integrated threat assessment is being utilized in the context of the California State Wildlife Action Plan revision.

**Alexander, Steven,** *Environmental Change & Governance Group, University of Waterloo;* **Derek Armitage**, *Environmental Change & Governance Group, University of Waterloo*

**Expanding the Network Perspective: Understanding Social Networks and the Implications for MPA Effectiveness**

Ecologically linked MPA networks are required to effectively address the impacts of marine resource exploitation and climate change. However, recognizing MPAs as social networks is also crucial to understanding their success and potential for conservation effectiveness. Formal and informal social networks are central to multi-actor governance arrangements (e.g., co-managed MPAs) and have been repeatedly cited as a key attribute in the broader natural resource management literature. However, not all networks are structurally equal with research suggesting that different patterns of social relations contribute to different conservation outcomes. Here, we outline the opportunity and need to further develop and apply a social network perspective to MPAs and MPA systems. Drawing upon concepts from relational sociology and social network analysis we outline the theoretical assumptions that serve as a foundation for a social-relational network perspective, including the role of social structure and individual agency. We then draw on cases from the Caribbean, Pacific and Indian Ocean to illustrate the analytical utility and application of a social-relational network perspective for examining attributes and processes (e.g., trust, knowledge exchange) already identified as central to the design, planning and management of MPAs and MPA networks. Future research directions are highlighted, including the need to better understand multi-level and temporal dynamics of social networks.

**Alexander, Michael,** *NOAA ESRL*

**Uncertainty in Climate Change Projections: Myths, Misconceptions and Malleable Guidelines**

Concern about climate change and its implications for human and natural systems have motivated many efforts to assess climate impacts and develop conservation and adaptation strategies. Scientists, resource managers and decision makers are increasingly expected to use climate information in assessment and planning, but may struggle with the uncertainty associated with this information. Much of the uncertainty stems from how to best use output from global climate models. There are three major sources of uncertainty in climate projections: i) model error, ii) how anthropogenic greenhouse gas emissions will change in the future, often addressed by different "scenarios" and iii) natural variability. The latter, as identified by a large ensemble of simulations with slightly different initial conditions, can have a surprisingly large impact on short term variability and long-term trends on physical quantities, including temperature, precipitation and winds. Here, we identify and address a number of common misperceptions about the ability of climate models to project future conditions relevant to ecological systems. We focus on how natural climate variability can complicate using climate projections in understanding and projecting changes in marine ecosystems. We discuss how climate projections can be useful in ecological applications including providing strategic management advice despite these uncertainties.

**Allan, Crawford,** *WWF-TRAFFIC, North America*

**Dismantling conservation crime: leveraging integrated and innovative responses across related sectors of security, technology and enforcement**

Poaching for the illegal wildlife trade is a criminal industry that has increased in frequency and sophistication with devastating impacts to wildlife populations, ecosystem health and function and local community stability. Patrols on the ground may detect and deter poaching incidents, but patrols that lack intelligence on illegal incursions and poaching activity are expensive, dangerous, and increasingly insufficient to combat the rapidly advancing skills, technology and intensity of perpetrators servicing illicit global markets. WWF has been awarded a Google Global Impact Award to implement an innovative project that incorporates integrated technology for anti-poaching efforts in Africa and Asia. This project integrates three core technologies: aerial surveillance systems; SMART, a wildlife law enforcement efficiency and monitoring system; and new affordable GSM-based wildlife tags as animal tracking units. These technologies will help enforcement units respond more rapidly and effectively to detect poaching activity and identify animal location information so as to improve patrolling systems when integrated into SMART. This project will be implemented in pilot geographies over a three-year period, and is expected to yield essential lessons and technological advancements that will inform conservation practitioners around the world. The talk will explore the challenges and opportunities this project has presented to-date, and the need for collaborative approaches.

**Aluri, Jacob Solomon,** *Andhra University;* **RANGAIAH KONE**, *Andhra University*

**Reproductive ecology of Boswellia ovalifoliolata (Burseraceae), an endemic and endangered keystone medicinal tree species in the Southern Eastern Ghat**

Boswellia ovalifoliolata Bal. & Henry (Burseraceae) occurring in the Southern Eastern Ghats Forest Ecosystem of Andhra Pradesh, India, is a narrow endemic and globally endangered deciduous tree species. The tree is a source of gum and resin; it is used for treating different human ailments such as ulcers, scorpion sting, amoebic dysentery, hydrocele and rheumatic pains. It is a prominent dry season bloomer and provides forage to an array of animals. The flowers are small, bisexual, mildly odoriferous and strictly self-incompatible. Insects and sunbirds use the flowers for forage during which they effect pollination. Bud and flower feeding by a weevil and flower and fruit feeding by the Palm Squirrel greatly affect the success of sexual reproduction. The garden lizard is a predator of pollinating insects. Fruit set in open-pollination is

**Alvarez, Silvia,** *University of Maryland;* **Diego Gutierrez**, *ICOMVIS - Universidad Nacional de Costa Rica;***Ruben Pacheco,** *Grupo de Investigación en Ecología y Biogeografía*

**Comparing animal groups as surrogates for conservation planning of a tropical dry forest**

Tropical dry forest (TDF) is poorly represented in protected areas of Colombia. Our study aimed to evaluate the effectiveness of different animal taxa as surrogates to identify priority areas for conservation of this forest in north-eastern Colombia. We compared priority areas obtained from using butterflies, birds, bats, and terrestrial mammals as TDF surrogates, respectively. We considered all registered species as conservation objectives, but set higher targets for threatened, endemic and TDF-specialist species. We developed a fifth scenario by setting conservation targets only for tropical dry forest and shrub (vegetation scenario). We estimated effectiveness in terms of species representativity, land cover representativity, complementarity, and costs. Representativity varied between 89% for bats and 100% for mammals, butterflies and vegetation scenarios. Selected areas for butterflies, birds and mammals corresponded mostly to undisturbed forest, while bats resulted in the selection of a higher percentage of disturbed forests. Shrubs were poorly represented in all animal based portfolios. Costs were highest for the vegetation scenario, while the butterfly scenario resulted in higher costs than any other animal based scenario. Based on our results, birds were the most effective animal group to identify priority areas for conservation of tropical dry forest. Priorization using species as surrogates resulted in lower costs than when only targeting forest and shrub.

**Alves, Maria Alice,** *Universidade do Estado do Rio de Janeiro;* **Mariana Zannon**, *Pós-Graduação em Ecologia e Evolução, IBRAG, UERJ. Rua São Francisco Xavier 524;***Mariana Vale,** *Pós-Graduação em Ecologia e Evolução, IBRAG, UERJ. Rua São Francisco Xavier 524*

**Missing for the last twenty years: the case of the southernmost populations of the Tropical Mockingbird, Mimus gilvus, in Rio de Janeiro, Brazil**

The Tropical Mockingbird (Mimus gilvus) ranges from Mexico to Brazil. The Brazilian populations, however, only occur on restinga (an open shrubby vegetation in sandy coastal plains, associated to the Atlantic forest). These populations likely belong to an undescribed species that is regionally threatened by habitat loss and capture of nestlings for illegal trade. We conducted field surveys in 21 restinga remnants in Rio de Janeiro State, the southernmost portion of the species' range. The bird has already disappeared in most of them. We estimated a current Area of Occupancy (AOO) of 256 km2, which combined with the estimated average population density (52 individuals km-2) and occurrence probability (20%), translated into an estimated population size from 2,662 to 13,312 individuals in Rio de Janeiro. From the original AOO (652 km2), we estimated an original population size of 33,904 individuals in Rio de Janeiro, and a population reduction of 61% to 92% in the last 20 years. The species, therefore, is regionally "Endangered" under IUCN Criteria. The Tropical Mockingbird needs a taxonomic review in order to confirm whether the Brazilian populations belong to a different species. We also recommend the enforcement of the Brazilian Forest Code, that formally protects restingas, together with environmental education that could reduce illegal trade, in order to mitigate the pressures over the species and avoid more local extinctions.

**Amaya-Espinel, Juan,** *Fauna Australis Laboratory - Pontificia Universidad Catolica de Chile;* **Cristian Bonacic**, *Fauna Australis Laboratory - Pontificia Universidad Catolica de Chile;***Laura Agudelo-Álvarez,** *Asociación Bogotana de Ornitologia;* **Andrea Morales-Rozo**, *Asociación Bogotana de Ornitología*

**Crossing the cities: opportunities and challenges for the conservation of bird communities in urban areas in the Neotropics**

There is a significant concern about the negative effects that expansive growth of urban areas worldwide may cause on the biodiversity. In response, is evident an increase of the efforts to identify, protect and recover conservation opportunities at urban level. However, little is known about the potential role that different green urban spaces play in the maintenance of the wildlife, mainly in developing tropical countries. We conducted a study to assess a biological indicator group such as birds, in various green elements present at Bogota, the largest city of Colombia and part of the Tropical Andes Hotspot. It was evaluated in 4 contrasting geographical areas (12806 ha) within the city where 940 points were characterized by birding in point counts. 153 species of birds were recorded, included 121 residents, 32 migratory and 6 endangered species. The results show a city dominated by a few species with about 70% of all registered individuals and a large number of rare species. The natural green areas as well as those in regeneration, show an important role as reservoirs of these rare birds. Urban parks, cemeteries and corridors, showed interesting options such as sinks or stepping-stones. However, these trends were not uniform throughout the city. This study presents an accurate picture of the current state of the community of birds present in a highly transformed area in the neotropics as well as the opportunities and challenges offered for the conservation on urban spaces.

**Amick, Kari,** *University of Saskatchewan;* **Douglas Clark**, *University of Saskatchewan;***Ryan Brook,** *University of Saskatchewan*

**Stakeholder perspectives on Chronic Wasting Disease**

Chronic wasting disease (CWD) is an emergent prion disease of cervids and a burgeoning wildlife management issue in the North American west. Past management efforts have incorporated hunter participation; however, this has not been effective in the long term, apparently due to lack of hunter and stakeholder interest. This research looks at community perspectives on CWD management in the Canadian provinces of Saskatchewan and Manitoba. The goal of this project is to understand how stakeholders frame CWD as a risk, what their preferences for management are, and whether adaptive governance can be used for wildlife disease management. A mixed methods approach incorporating Q-methodology to identify participants' perspectives was used to survey hunters, First Nations, landowners, wildlife managers and other stakeholders. Preliminary results indicate that the knowledge of CWD varies between individuals, and personal understanding of CWD as a risk can impact preferences for management. These results are considered in relation to Canada's current national CWD management plan, as well as to assess the future viability of adaptive governance in addressing CWD and other emergent wildlife diseases.

**Anand, Anupam,** *Global Land Cover Facility, University of Maryland;* **Jyoteshwar Nagol**, *Global Land Cover Facility;***Joseph Sexton,** *Global Land Cover Facility;* **Saurabh Channan**, *Global Land Cover Facility;* **Praveen Noojipady**, *Global Land Cover Facility*

**Isolation of a tiger landscape- An analysis of change in forest habitat of India's oldest protected area**

Protected areas cannot serve their purpose as 'islands'. Using the case of Jim Corbett National Park, our research highlights why protected areas should not be managed based on rigidly delineated boundaries. Research has shown that, in general, forest cover within the administrative boundaries of protected areas remains stable as conservation and habitat management efforts are often confined to these boundaries. This constricted approach, however has some serious impact on forest habitats in the surrounding areas. At this interface of protected areas with human settlements, habitat fragmentation and degradation, blockage of animal corridors, transmission of diseases between, wildlife, people and domestic animals and increased frequency of human-animal conflict have become commonplace. Based on our analysis of global Landsat resolution forest change map, we estimate the extent of forest habitat loss within the park and the surrounding ecologically sensitive areas. We demonstrate how remotely sensed products can help park managers assess the extent of forest habitat change and identify habitat change hotspots. This study allows policy and decision makers understand and situate the processes and drivers of forest change within larger political, economic and social contexts of land use dynamics where forest habitat loss in the periphery is very critical for defining the proposed Eco sensitive buffer zones around highly protected areas, the national parks and sanctuaries in India.

**Anderson, Mark,** *The Nature Conservancy*

**Conserving all the stages: using a geophysical approach to identify a network of climate-resilient sites**

Conservationists need a method to conserve the maximum amount of biological diversity while allowing species and communities to rearrange in response to a continually changing climate. Here, we develop and test such an approach for northeastern North America. First we identified the geophysical factors most correlated with species diversity patterns and subdivided the region into 30 distinct geophysical settings. Next, within each geophysical setting we located sites that were connected by natural cover, and that had complex topography and large elevation ranges increasing their micro-climatic buffering. We hypothesized that these sites had the highest resilience to climate change. We compared these against the current network of secured lands, and against sites identified for their high quality biodiversity features. Results showed a robust correspondence between the biodiversity sites and the high scoring geophysical sites; with universally high average resilience scores across every natural community and species group. Troublingly, low elevation areas on calcareous bedrock or surficial substrates scored markedly low for estimated resilience and securement, and had higher densities of rare species than other geophysical settings. We identified sites for each geophysical setting that are likely to have the highest possible resilience, revealing and correcting for substantial bias in current conservation.

**Andrade Silva, Pedro,** *Federal University of Bahia/ Botanical Garden of Salvador;* **Erivaldo Queiroz**, *Botanical Garden of Salvador;***Maria Lenise Guedes,** *Federal University of Bahia;* **Luciano Santos**, *Botanical Garden of Salvador;* **Henrique Chagas**, *Botanical Garden of Salvador;* **Lucineide Teixeira,** *Botanical Garden of Salvador*

**Phytosociology of Atlantic Forest in Botanical Garden of Salvador, Brazil**

The present study features a plant community of a great relevant fragment from Atlantic Forest, located in Botanical Garden of Salvador (BGS), Brazil, in order to know the floristic composition and tree structure, contributing for further conservation studies. BGS has an area of c.a. 18ha, known as Mata-dos-Oitis, due to the occurrence of an edible and endemic species Licania salzmannii. Thirty 20x10m-plots were used, distributed in four transects, covering a total of 0.6ha. Individuals were selected with circumference ≥ 10cm to 1.30m from soil. 1.237 individuals, 136 species and 41 families were sampled. Shannon diversity index and evenness (J) were 4.276 nats/individuals and 0.870. The absolute dominance (Abs. Dom) was 53.086m²/ha. Fabaceae family had the highest species richness and higher number of individuals. The most important families in relation to Abs. Dom. were Fabaceae, Elaeocarpaceae, Chrysobalanaceae and Moraceae, respectively. The species with the highest importance value index was Parkia pendula, followed by Brosimum lactescens, Sloanea guianensis, and L. salzmannii. Brosimum lactescens had the greatest number of individuals. The average height was 9.043m and DBH of 10,219cm. The tallest tree reached 42m and larger girth was 5.5m, in different individuals of P. pendula. Mata-dos-Oitis is the best preserved remnants of Salvador, comparing their diversity and dominance to the forests of Bahia (S) and Espirito Santo (N), regions of greater diversity of planet.

**Anwana, EnoAbasi,** *Regional Institute for Population Studies, University of Ghana;* **Samuel Codjoe**, *Regional Institute for Population Studies, University of Ghana*

**Life on the Edge: Livelihoods, Impact and Adaptation to Climate Change in Urban Coastal Areas in Ghana**

Urbanisation in Ghana is upward trending, with a quarter of current population living along the coast; where global climate changes are expected to cause various socio-economic impacts. Yet, the country still lacks a comprehensive communication framework to address knowledge gaps on climate compatible planning for coastal environments. Using Focus Group Discussions and In-Depth interviews in consonance with a livelihood framework tool, we assessed the impact and coping strategies to sea level rise, flooding amongst three dominant economic groups (i.e. fishermen, fishmongers and non-fish traders) within six communities in Greater Accra Region. Results obtained show negative impacts on natural ecosystem goods and services. Importantly is the effect on fisheries and other aquatic biodiversity; deemed important for the dominant fishery occupation and tourism of the area. Differentiated impacts amongst socioeconomic groups have far-reaching implications for their collective responses to the effects of climate change. Thus, building resilience amongst and within groups will demand an integrative coastal zone management (ICZM), which takes cognizance of current climate change vulnerabilities of the coastal area and bridging gaps in climate change knowledge within the area. Such ICZM should be reflective of local ecological knowledge and equally embrace the adaptive strategies of the people to future climate change scenarios.

**Apeverga, Tersoo,** *A.P. Leventis Ornithological Research Institute, Jos Nigeria*

**The role of bridge species in the transmission of Highly Pathogenic Avian Influenza (HPAI) and Newcastle Disease (ND) viruses in Jos, Nigeria**

Avian Influenza (AI) and Newcastle Disease (ND) are the two most important diseases of poultry and other birds. This is not only because of its ability to cause serious threat to the welfare of wild bird populations, but also its effects on agriculture and human health. However, not much is understood on the route of recurrent outbreaks of these diseases. Wild resident birds (bridge species) have been implicated with harbouring these viruses and capable of transmitting it to poultry. This study sort to understand the role of these bridge species in the transmission of AI and ND. A total of fifty eight (58) bridge species were caught using mist nets. All cloacal and tracheal samples collected tested negative for AI, but 53% showed positive result for ND. Although no positive case of AI was recorded, it was possible that infected birds died quickly after infection. The presence of ND virus is a great threat to wild birds and poultry farms, and could lead to great economic loss. This study suggests that poultry farms should be located away from streams and open waters to minimize contact with wild birds, and if possible they should be reared in bird-proof concealments.

**Arengo, Felicity,** *American Museum of Natural History;* **Juan Cornejo**, *Wildlife Conservation Society*

**Population status and threats to Chilean Flamingos in known areas of their distribution in South America**

Three species of flamingo are found in southern South America. The Chilean Flamingo (Phoenicopteruschilensis) has the broadest distribution from the Pacific coast of Peru and Chile, lakes in the Central Dry Puna, to lowland and coastal lakes in Paraguay, Argentina, Uruguay, and Brazil. The Puna (P. jamesi) and Andean Flamingos (P. andinus) are primarily in the altiplano, although they use lowland wetlands of central Argentina, particularly in winter. The population status of Puna and Andean Flamingos is known and conservation strategies are being implemented. However, less is known about the population and conservation status of Chilean Flamingos. During a workshop with experts from the region, we identified breeding and non-breeding wetlands, threats at these sites, and knowledge gaps. The global population of Chilean Flamingos was estimated at 290,000. Priority sites holding 1% or more of the population or where breeding activity had been recorded were identified, generating a list of 8 priority sites in lowland wetlands and 13 in the high Andes. Excluding the global threat of climate change, top threats in lowland wetlands were water extraction for commercial agriculture and contamination with agrochemicals. In Andean wetlands top threats were habitat loss and degradation due to mining, road development and domestic contamination. We also identified information gaps and evaluated areas of overlap between priority areas for conservation forthe 3 flamingo species.

**Arias, Mauricio,** *University of Canterbury*

**Optimizing conservation efforts by modeling the spatial impact of hydrological changes on wetland fauna habitat: a case study of the Tonle Sap**

The Tonle Sap is the largest wetland in Southeast Asia, a UNESCO Biosphere Reserve with great value to regional biodiversity and migratory endangered fishes and birds. The Tonle Sap’s productivity and diversity are driven by the Mekong river flood pulse, which is facing disruptions due to hydropower development and climate change. Conservation efforts are underway to mitigate changes, and a better understanding of the impacts of hydrological disruptions on the future spatial distribution of fauna of the Tonle Sap is necessary to optimize these efforts. We developed a spatial modeling framework to simulate changes in fauna habitat. We analyzed the preferred habitats of 63 animal species with nutritional, conservation, and ecological value. We found that gallery forests provide habitat to the greatest number of species. We estimated that changes in flooding regime by the end of the 2030s could alter habitats in 19% of the 15,000 km2 floodplain. The most affected animals will be those that use gallery forests exclusively. The strong synchronicity between biota’s life history and the flood pulse seasonality implies that ongoing disruptions will alter ecosystem dynamics, imposing further conservation challenges. Protecting areas feasible for future gallery forests and shrublands is critical to maintain a diverse ecosystem. This modeling framework can be applied to other floodplains along the Mekong and elsewhere there are known links between seasonal flooding and habitat.

**Armsworth, Paul,** *University of Tennessee;* **Szvetlana Acs**, *European Commission - Joint Research Center;***Martin Dallimer,** *University of Copenhagen;* **Kevin Gaston**, *University of Exeter;* **Nick Hanley**, *University of Stirling;* **Paul Wilson,** *University of Nottingham*

**Designing Cost Effective Conservation Payment Programs**

Incentive payment programs to private landowners provide a center-piece of conservation strategies in many parts of the world. We examine how payment programs can be designed to provide cost effective improvements in biodiversity, using 44 extensive livestock farms in northern England as a case study and bird species as an indicator of biodiversity. We first estimate the "true" supply price to farmers of producing improvements in different biodiversity targets. We then derive the optimal (i.e. most cost effective) program design for each target. This provides a benchmark against which to compare the cost effectiveness of simpler, more readily implemented, payment programs. Existing payment schemes appear cost ineffective and primarily act to subsidize farm profits. The optimal policy exploits variation in costs of producing biodiversity enhancements within and among farms. However such a policy would be prohibitively complex to administer. By comparing alternative, simpler policies to the optimal policy, we show that common simplifications in payment scheme design can result in 49-100% of promised biodiversity gains being given up. Moreover, we are able to identify which policy simplifications are most problematic. Spatially differentiating pricing for biodiversity improvements is critical to the success of such programs, a finding that is robust to idiosyncratic responses of different biodiversity targets to management actions.

**Arnold, Heather,** *Nature Conservancy of Canada;* **Marie Tremblay**,

**Marrying research and practice: the role of conservation practitioners in the 'happily ever after' of a high-impact research agenda**

The field of conservation science has grown exponentially in the past several decades, as evidenced by the proliferation of dedicated university programs and scientific publications. However, the achievement of on-the-ground conservation results has been impeded by significant barriers to the application of research by conservation practitioners. Such barriers can lead to the application of suboptimal or ineffectual conservation actions and the misuse of limited conservation dollars, which in turn can undermine socio-political and financial support for conservation work. Moreover, the lack of rigorous assessment of current practices precludes adaptive management, the cornerstone of accountability and improvement in conservation practice. To overcome these challenges, we advocate for a much tighter working relationship between academic researchers and practitioners with an aim to increase the impact of research beyond the typical ‘management implications’ paragraph in peer-reviewed articles and ensure a more direct contribution toward solving specific real-world problems. Drawing on examples from private and public land management organizations in Canada, we explore how practitioners can play a stronger role in influencing the research agenda and

**Arowosoge, Oluwayemisi,** *Ekiti State University;* **Folaranmi Babalola**, *University of Pretoria*

**Strategies for Integrating Private Stakeholders in Plantation Forest and Conservation: Public and Private Forest Practices in Ekiti State, Nigeria.**

Increasing pressure on forest with rapid decrease in biological diversities justifies the need for integrating private stakeholders in restoration and conservation strategies. This study therefore evaluates integrated approach of private stakeholders in plantation forest and biodiversity conservation in Ekiti State, Nigeria. Primary data were collected through administration of structured questionnaire and interview of 49 private tree growers. Secondary data were obtained from classified documents of the State Forestry Department. Data were analyzed using descriptive statistics. The study reveals that between 2007 and 2012, wood cut in the public forest within the State ranged from 42,216m3 to 88,642m3. Out of the 581 ha of plantations established within the five years' period, only 160 ha of Tectona grandis and Gmelina arborea was established by the State while the private tree growers established 421 ha (72.5%) on their owned lands. Top three constraints to increasing private plantation size include non-availability of land, lack of incentives and lack of technical advice. Identified strategies for effective integration approach of private stakeholders include transfer of degraded public forest to private stakeholders, stakeholders' empowerment for the sales of carbon credits and planting of mixed species. Participation of private tree growers in public forest plantation and conservation of biological diversities in the State is crucial.

**Arsensis, Kriton,** *European Parliment member*

**Increasing momentum for the protection of Roadless Areas**

In times when funding for biodiversity conservation is scarce, identifying and protecting the world's remaining Roadless Areas arises as a cost efficient option to meet the Aichi biodiversity targets and mitigate climate changeA new initiative towards the protection of the world's Roadless Areas was presented during the Rio+20 Summit and during the COP11 of the 2012 Convention on Biological Diversity (CBD) where was showcased the first global mapping of the world's remaining Roadless Areas. Partners such as the United Nations Environment Programme (UNEP), IUCN, the European Parliament's Rapporteur on Forests, MEP Kriton Arsenis, the Society for Conservation Biology (SCB), the Global Canopy Programme (GCP), Conservation International and the Indigenous Peoples' International Centre for Policy Research and Education, Tebtebba have gathered and joined forces during these events in order to promote Roadless Areas as a cost efficient and effective way to protect biodiversity. How to generate incentives for the protection of Roadless Areas, avoid the financing of destructive roads, and provide international policy makers with useful instruments for effective biodiversity conservation regulation will be at the core of European Parliament's Rapporteur on Forests, MEP Kriton Arsenis' presentation during this 2013 ICCB.

**Artelle, Kyle,** *Simon Fraser University and Raincoast Conservation Foundation;* **Sean Anderson**, *Simon Fraser University;***Andrew Cooper,** *Simon Fraser University;* **Paul Paquet**, *Raincoast Conservation Foundation;* **John Reynolds**, *Simon Fraser University;* **Chris Darimont,** *University of Victoria and Raincoast Conservation Foundation*

**Confronting uncertainty in wildlife management: performance of grizzly bear management in British Columbia, Canada**

Addressing uncertainty is an important element of effective wildlife management. Failure to properly account for uncertainty in some systems has been implicated in management errors with disastrous consequences. We used the hunt management of grizzly bears (Ursus arctos horribilis) in British Columbia, Canada, as a model system to empirically assess potential impacts of uncertainty on management. In particular, we examined outcome uncertainty (the discrepancy between expected and actual mortality levels) and components of biological uncertainty. We found that unaddressed uncertainty compromised management performance repeatedly, and throughout the province, from 2001-2011. Outcome uncertainty alone led to excess mortality in 19% of cases (population-years) examined. Accounting for uncertainty around estimated biological parameters revealed excess mortality might have occurred in up to 70% of cases. We describe a method that uses empirical assessments of uncertainty to identify targets that maintain the probability of exceeding mortality limits below specified thresholds. At thresholds of 25% and 5%, this method identifies average target mortality reductions of 47% and 81%, respectively. Application of our transparent and generalizable framework to this or other systems could improve management performance in the face of uncertainty.

**Asah, Stanley,** *University of Washington;* **Miku Lenentine**, *University of Washington;***Dale Blahna,** *USDA Forest Service*

**What Really Motivates Voluntary Urban Conservation Stewardship: Why and How It Matters for Conservation Practice**

Advocates for conservation in urban areas are growing amidst mounting financial challenges and inadequate stakeholder involvement. Conservation psychology can mitigate some of these challenges through conservation volunteerism, if we attend to and capitalize on volunteers' motivations. We present results from three studies of volunteers' motivations. In the first two, we assessed volunteers' motivations, attitudinal commitment, and frequency of volunteering for urban conservation. In the third, we coded volunteers' motivations, expressed in their own words and frames of references. We conducted frequency analysis of expressed motivations. Predictive models showed that volunteers' participation and commitment are motivated by personal and social benefits, not environment-related reasons. Environmental motivations more saliently influence participation and commitment only when personal and social benefits are met. Additionally, volunteers expressed social-psychological motivations 20+ times as often as environmental motivations. Ecologically focused participation appeals, planning and management of volunteer-dependent events are likely to be less effective motivators of voluntary conservation stewardship than efforts that focus on personal and social benefits of urban conservation. We discuss implications for urban conservation stewardship initiatives, suggesting practical ways to harness volunteers' personal and social motivations to meet urban conservation goals.

**Aslan, Clare,** *Arizona-Sonora Desert Museum;* **Erika Zavaleta**, *University of California, Santa Cruz;***Bernie Tershy,** *University of California, Santa Cruz;* **Don Croll**, *University of California, Santa Cruz*

**Large flower size may facilitate pollination disruption in Hawaiian lobeliads**

Large flower size may be a specialization for large-bodied pollinators. By excluding some potential pollinators, such specialization could create risk of mutualism disruption. We examined ongoing pollination and conservation status of species in the genus Clermontia, a taxon of bird-pollinated Hawaiian lobeliads varying widely in flower size. We employed a combination of field observations, pollination treatments, and museum specimen measurements. Field results indicated that small and mid-sized flowers are now pollinated largely by an introduced bird species, while large flowers receive no evident pollination. A comparison of museum specimen floral tube lengths and conservation threat rate revealed that larger-flowered species in the genus are more likely to be threatened with extinction than are smaller-flowered species (ANOVA; p = 0.047). We speculate that pollination disruption may be one factor contributing to this pattern: not only are large-bodied native pollinators largely extinct, but introduced bird pollinators are generalist, small-bodied species. Pollination disruption carries risks of inbreeding and decreased reproductive output. Conservation threats to both large-bodied animals and large-seeded plants are broadly recognized, but the vulnerability of large-flowered plants to pollination disruption has not been widely discussed in conservation circles.

**Asmyhr, Maria,** *Department of Biological sciences, Macquarie University;* **Simon Linke**, *Griffith University;***Grant Hose,** *Macquarie University;* **David Nipperess**, *Macquarie University*

**Conserving poorly described ecosystems by integrating Phylogenetic Diversity (PD) into systematic conservation planning**

Complementarity-based algorithms are increasingly being used for selecting and prioritizing nature reserve networks. However these methods require taxonomic and distributional information- data currently missing for the majority of the world's taxa. Phylogenetic diversity (PD) is a measure of biodiversity that incorporates information on evolutionary divergences between taxa by summing the branch lengths of a phylogenetic tree. The tips on the tree can be species, populations, individual organisms or genetic sequences making PD suitable for estimating biodiversity in poorly known ecosystems. Australian subterranean fauna potentially represent a vast amount of the continent's biodiversity, with > 80 % as yet undescribed. We used molecular methods to estimate PD for stygofauna from New South Wales. Designating the branches of the phylogenetic tree as conservation features weighted by their length, we evaluated the conservation value of different sites using endemism and complementarity-based algorithms including Rebelo and the software MARXAN. The different approaches resulted in similar ranking of sites however MARXAN incorporates the cost and shape of the final reserve system resulting in slightly different conservation priorities. We demonstrate that by using molecular methods and PD, largely unknown ecosystems can be effectively included in conservation planning. Future work will focus on identifying environmental surrogates for predicting phylogenetic β-diversity.

**Asmyhr, Maria Gulbrandsen,** *Macquarie University*

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**Atuo, Fidelis,** *Oklahoma State University;* **Timothy O'Connell**, *Oklahoma State University;***Samual Ivande,** *A. P. Leventis Ornithological Research Institute (APLORI);* **Zingfa Wala**, *A. P. Leventis Ornithological Research Institute (APLORI)*

**Use of caves and overhanging rocks as hunting camps: consequences for breeding Grey-necked Picathartes in southeastern Nigeria.**

The overdependence on bushmeat as a source of protein and income among forest communities constitutes a major challenge to wildlife conservation in Sub-Saharan Africa. In this study, we investigated the use of caves and overhanging rocks as hunting camps and its consequences on breeding Grey-necked Picathartes (Picathartes oreas). P. oreas is one of the only two species in the family Picathartidae. Both species are listed as Vulnerable by the IUCN, and are endemic to tropical African forests, where they build mud nests in caves and on rock overhangs. We found 85 nesting locations for P. oreas in southeastern Nigeria, of which 14 (21%) had been used as hunting camps. Predominant camping evidence included fire stands, sleeping spots, cooking utensils, and drying rakes. Fire stands were the most frequently recorded camping evidence and were found in 79% (11) of the camps. At the 14 breeding sites, only two nesting attempts were made by the P. oreas during the survey. Of nests recorded within hunting camps, 95% (37) were empty and showed no evidence of breeding activity, suggesting that they had been abandoned. Camping hunters also affected breeding success through direct removal of eggs and fledglings from nests. We carried out conservation enlightenment campaigns for P. oreas that includes community meetings and television talk shows. A sustained conservation education scheme will assist in improving the conservation status of P. oreas and other threatened species in the region

**Auerbach, Nancy,** *University of Queensland;* **Ayesha Tulloch**, *University of Queensland;***Hugh Possingham,** *University of Queensland*

**Where should I do what to cost-effectively manage threats to species?**

When conservation funding is constrained, natural resource managers need simple, transparent, and logical decision-support for choosing between multiple management actions to abate threats to multiple species. We show how cost-effectiveness directs efficient investment in conservation action. Our case study examines the relationship between the benefits and costs of abating two threats (habitat degradation from cattle grazing and predation by foxes, an invasive, introduced species) to priority species in a biodiverse region of Eastern Australia. We demonstrate that benefits to species are four times higher if we use cost-effectiveness to select for threat management in species-rich sites than if we randomly invest $10M. If we also prioritize restricted habitats in species-rich areas, the contrast between arbitrary and cost-effective management is even greater. Our research further determines that for the same amount of money, it is almost twice as effective to simultaneously manage two threats as compared to treating each threat separately. Importantly, we find that the return on investment in threat abatement diminishes rapidly. Greater than 50% of the total possible benefit of managing two threats can be delivered with $5M, but doubling the budget results in a benefit increase of only 12%. Our analysis shows how to accountably locate where to efficiently use limited resources to act on abating multiple threats to multiple species by delivering great benefit for little cost.

**Augustine, Lauren,** *Smithsonian National Zoological Park;* **Kimberly Terrell**, *Smithsonian Conservation Biology Institute;***Christina Petzinger,** *Smithsonian?s National Zoological Park;* **Michael Maslanka**, *Smithsonian?s National Zoological Park;* **Bradley Nissen**, *Center for Animal Care Sciences, Smithsonian's National Zoological Park*

**Nutritional comparison of larval hellbender (Cryptobranchus alleganiensis) diets in captivity and in the wild**

Hellbender (Cryptobrachus alleganiensis) populations are declining in the wild; an increasing number of institutions are maintaining this species in captivity for conservation purposes. Yet providing captive animals with nutritionally complete diets can be a challenge. Commercially-sourced diets can contribute to nutritional deficiencies in captive amphibians (e.g., metabolic bone disease), and wild-sourced food items carry the risk of disease introduction. We investigated the nutritional content of a commercially-sourced diet (i.e., worms, shrimp, krill, and crayfish) for captive juvenile hellbenders compared to prey available to wild counterparts. Invertebrates were collected from seven streams known to contain hellbenders in the eastern United States. The samples were assayed for dry matter, fiber, fat, protein, chitin, ash and gross energy. Nutritional content of commercial versus wild crayfish was similar, except for dry matter, which was greater (P < 0.05) in wild-caught individuals. Macroinvertebrates available to wild hellbenders contained more (P < 0.05) dry matter, ash, fiber, and chitin, but less (P < 0.05) energy and protein compared to the captive diet. The findings suggest the importance of continued nutrient evaluation of commercially available prey sources for hellbenders, and it appears the current best practice is to provide as much diversity in prey items as reasonable and practical, rather than focusing on any single commercially available item.

**Austen, Douglas J. ,** *USFWS, Landscape Conserv. Coops.*

**A national structure for collaborative science and conservation planning at the landscape scale - the Landscape Conservation Cooperatives**

The need for intensively collaborative approaches to address conservation challenges has never been greater and will be increasingly necessary in the future. Clearly, successful approaches exist but have been focused on species groups or geographically limited areas. In 2010, a wide variety of conservation partners established the Landscape Conservation Cooperatives (LCC). The existing network of 22 LCC’s, includes all diverse set of federal agencies, state fish and wildlife agencies, non-governmental organizations, tribes and tribal groups and others entities. The LCC’s are a conservation-science partnership that: (1) develop and provide integrated science-based information about the implications of climate change and other stressors; (2) develop shared, landscape-level, conservation objectives and inform conservation strategies that are based on a shared scientific understanding about the landscape, including the implications of current and future environmental stressors; (3) Facilitate the exchange of applied science in the implementation of conservation strategies and products developed by the Cooperative or their partners; (4) Monitor and evaluate the effectiveness of LCC conservation strategies in meeting shared objectives; and (5) Develop appropriate linkages that connect LCCs to ensure an effective network. The role, function, governance, and limitation of LCC’s will be discussed and explored in light the challenges facing our conservation community.

**Avila, Alexandra**, *Universidad San Francisco de Quito*

**Genetic Diversity and Conservation of the Misty Grouper (*Hyporthodus mystacinus*) in the Galapagos Islands, Ecuador**

More than 90% of marine fisheries worldwide are now either overexploited or nearing this point. In the past, overfishing was widely recognized as impacting species diversity and abundance; however, its effects on marine fish genetic diversity have been largely ignored. The groupers (Serranidae) are a commercially important family of fish in many parts of the world as well as in the Galapagos Islands. Recent assessments of the family suggest that the group might be particularly vulnerable to fishing (GWSG 2007), and it has also been suggest that their genetic diversity may be threatened due to overfishing (GWSG 2007). High genetic diversity and high gene flow for H. mystacinus was found among the localities in the Galapagos Islands. High genetic diversity has traditionally been associated with good health of populations, and would signal a good future for traditional fishing of H. mystacinus. Therefore, for fishing of H. mystacinus to continue at a sustainable level, it is imperative to maintain a high genetic diversity through a good management plan. It is important to conserve genetic diversity since it provides the raw material for the maintenance of species over longer evolutionary time-scales, and is also of particular relevance at present in terms of providing the basis for responses to rapid environmental change (e.g. climate), since reduced genetic diversity has been correlated with decreased fitness (Hoelzel et al. 2002, Bell and Okamura 2005).

**Awoyemi, Stephen M. ,** *RCRC, RCBWG, SCB*

**The Animal Release Project: An Overview**

In response to concerns from the international conservation community, the Religion and Conservation Research Collaborative of the Religion and Conservation Biology Working Group of the Society for Conservation Biology crafted a policy statement on the religious practice of releasing captive wildlife for merit in July, 2012. As an offshoot of RCRC policy, an email forum involving more than 40 scientists and scholars from around the world culminated in the creation of the Animal Release Project with a goal of bringing the release practice in line with the principles of conservation biology so negative effects on biodiversity are diminished and eventually cease. This symposium is part of the project’s objectives--to arrive at a consensual and collaborative strategy between religious leaders, animal release practitioners, and conservation biologists to address animal release in Asia. Another major part on which we are working concurrently is the development of an educational strategy aimed at demonstrating the importance of ‘biodiversity friendly’ animal release in Taiwan, Hong Kong, and China.

**Backs, Janet,** *University of Illinois at Chicago;* **Mary Ashley**, *University of Illinois at Chicago*

**The story of a tough little West Texas oak, the threatened Quercus hinckleyi C.H. Mull.**

Quercus hinckleyi C.H. Mull. is listed as a threatened species under the U.S. Endangered Species Act and by the state of Texas and is identified as 'critically threatened' on the IUCN Red List. Its known range in the United States is limited to one county in West Texas. Among immediate threats are low number of populations combined with few individuals, asexual reproduction, wildlife herbivory and insect predation, and possible hybridization with other oak species. We used DNA microsatellite analysis of eight loci to assess the genetic status of Q. hinckleyi. Our findings are based on examination of over 200 samples from three separated locations. To assess the threat of hybrid swamping, we analyzed over 40 samples of putative hybridizing species. Within Q. hinckleyi samples analyzed from the three known locations in Texas, clonal reproduction was prevalent; among 70 ramets genotyped from two of the locations only ten genets existed and genets were not shared across these sites. While we did find a relatively high level of genetic diversity there is limited gene flow between the locations. The high level of asexual reproduction combined with the low levels of gene flow and evidence of hybridization make long-term survival a challenge. Extreme conservation strategies, including hand pollination, translocation of genets among remaining populations, and ex-situ methods such as in vitro propagation and cryopreservation may be necessary if this species is to be conserved.

**Bailey, Helen,** *University of Maryland Center for Environmental Science;* **Bruce Mate**, *Oregon State University;***Ladd Irvine,** *Oregon State University;* **Elliott Hazen**, *NOAA/NMFS Southwest Fisheries Science Center;* **Daniel Palacios**, *NOAA/NMFS Southwest Fisheries Science Center;* **Steven Bograd,** *NOAA/NMFS Southwest Fisheries Science Center;***Karin Forney**, *NOAA/NMFS Southwest Fisheries Science Center;* **Evan Howell,**

*NOAA/NMFS Pacific Islands Fisheries Science Center*

**Integration of endangered blue whale satellite telemetry and oceanographic data to develop habitat models for conservation management**

Management of protected species requires spatially explicit information on their distribution and abundance, and how this varies over time. Satellite telemetry provides time-series information on individual movements, but these "presence-only" data have generally been ranked lower on management's data hierarchy than density estimates, which have mainly been derived from survey observations. Here, we demonstrate the development of absolute density estimates from satellite telemetry of endangered blue whales, and the increased utility of telemetry data for marine conservation and management. A state-space model was applied to 104 blue whale satellite tracks from 1994 to 2008 to account for errors in the locations. We output daily positions and integrated these with remotely sensed environmental data as a proxy for prey availability. A generalized additive mixed model was applied to determine the probability of occurrence, and then scaled by the population abundance to estimate absolute densities. These densities were comparable to those derived from survey modeled densities. We were additionally able to increase the time period and resolution of density predictions from that currently available, which will allow management to more accurately examine the overlap with potentially harmful human activities. Our approach could be applied to other protected populations and species for which telemetry data is available, and further inform policies to reduce human impacts.

**Bailey, Megan,** *Wageningen University and Research Centre;* **Simon Bush**, *Wageningen University and Research Centre;***Paul van Zwieten,** *Wageningen University and Research Centre;* **Arthur Mol**, *Wageningen University and Research Centre*

**Connecting the dots through information innovation: The case of western and central Pacific tuna**

Rising consumer demand for fish and seafood, coupled with improvements in gear efficiency has led to increasing pressure on the ocean's resources. Nowhere is this truer than in the western and central Pacific Ocean (WCPO), home to the world's largest tuna supplies. Conservation concerns over two species particularly, yellowfin and bigeye, have been voiced by a range of stakeholders, such as nature conservation groups, national management bodies, domestic and foreign businesses and international regulatory groups. Barriers to effective tuna governance in the WCPO include the quality of national-level data and reporting, and the limited flow of information between stakeholders. In this study, we investigate innovative information platforms, and discuss in what ways such innovations can improve governance regimes for WCPO tuna. Existing data systems, innovative smart phone applications, and real-time information platforms are analyzed. Our work suggests that information innovation, often led by private actors, can improve state-based management. These improvements are often local, however, and the flow of information across stakeholders can be limited, even when innovation exists. Linking existing information platforms, connecting investors with local businesses and communities, and increasing the availability of private data to public entities are all ways to connect stakeholders and contribute to effective conservation of WCPO tuna.

**Bailey, Natalie,** *Africa Biodiversity Collaborative G*

**Developing Broader Solutions for Conflicting Land Use: Lessons from ABCG Approaches**

The Africa Biodiversity Collaborative Group (ABCG) engages in various approaches to address emerging and high-priority conservation issues affecting biodiversity in Africa, many of which are represented by the previous presentations in this symposium. Our work is guided in part by the Dar Vision for the Future of Biodiversity in Africa, which foresees that “By 2025, environmental degradation and biodiversity loss in Africa have been significantly slowed, people and nature are adapting to climate change, and species and ecosystem services are providing a foundation for human welfare in a society committed to sustainable economic development and equitable sharing of natural resource benefits.” The approaches shared in this symposium range from legal rights to scenario planning, sustainability frameworks and community leadership in land use planning. Tradeoffs are inherently a part of each approach. This final presentation will address the benefits and challenges of the above approaches and will preface a discussion on competing interests, development needs and preservation and protection of biodiversity.

**Bain, Raoul,** *Div Vert Zool (Herpetology) and Center for Biodiversity and Conservation, AMNH;* **Martha Hurley**, *Center for Biodiversity and Conservation, AMNH and Global Wildlife Conservation;***Eleanor Sterling,** *Center for Biodiversity and Conservation, American Museum of Natural History*

**Conservation Biogeography of Vietnam: Insights from Novel Biodiversity**

Clear demarcation of biogeographic patterns of endemism and species richness, including detecting novel biodiversity, is required to incorporate evolutionary processes into conservation planning. Key to this is the reliable identification of inventoried species and phylogeographic analyses, both of which are increasingly reliant on molecular techniques. We use results from multi-taxa inventories in Vietnam (Indo-Burma Biodiversity Hotspot), 1999-2004, to examine the relevance of specimen collections to delineating evolutionary patterns and prioritizing areas of evolutionary novelty for conservation. Results from surveys at six sites for small mammals, birds, amphibians, and reptiles include 17 new taxa described based on morphology and eight new country records and a minimum of 40 published phylogenetic analyses using vouchered tissue samples. Results support: (1) regional trends for high levels of new species descriptions over new country records; (2) importance of novel species in providing evolutionary insights; and (3) deep divergence among morphologically similar species in areas of known endemism. All depend on referenced collections to support accurate field identifications and provide comparative data for continued phylogeographic research refining ecological and evolutionary patterns. Lag in reporting survey result results from the process of species description and publication; however, tissues collected will continue to be used in molecular analyses.

**Baisero, Daniele,** *Sapienza Università di Roma;* **Piero Visconti**, *Microsoft Research - Computational Ecology;***Stuart Butchart,** *Birdlife International;* **Luigi Boitani**, *Sapienza Università di Roma;* **Lucilla Francucci**, *Sapienza Università di Roma;* **Carlo Rondinini,** *Sapienza Università di Roma*

**Effect of data uncertainty on extinction risk projections to 2050**

The IUCN Red List is the global standard for categorising species according to their risk of extinction and underpins efforts to prioritize species for conservation intervention. The Red List Index (RLI) is an indicator showing trends over time in aggregated extinction risk for sets of species. The RLI can also be projected to assess the potential impact of different policy scenarios on biodiversity. Methods to project the RLI have already been used to evaluate the implications of future development scenarios on the status of the world's mammals. This involved using habitat suitability and bioclimatic niche models to estimate species future extent of occurrence, area of occupancy and population size, which were applied to the Red List criteria to assess future status. Modelling potential impacts of large-scale strategic choices is, however, currently limited by a lack of understanding of how uncertainty in input data influences the RLI. We ran a series of sensitivity analyses on the RLI projections for mammals. Models were developed for three Rio+20 strategic scenarios from 2000 to 2050 and input data was varied to simulate uncertainty in generation length, dispersal, population growth rate, occupancy and maximum density. The uncertainty in RLI projections was then assessed. Our results highlight the impact that investments in data compilation and sharing could have on scenario-based biodiversity projections.

**Baker, Ariele,** *Rutgers, the State University of New Jersey;* **Patricia Pinto da Silva**, *Northeast Fisheries Science Center Social Science Branch;***George Lapointe,** *George LaPointe Consulting*

**Measuring success of Regional Fisheries Management Goals and Objectives: A Retrospective Analysis**

In the United States most of the regional Fishery Management Councils (FMC) have not yet crafted a clear vision―or set of objectives―for measuring management success in their regions. A clear vision is an important step towards forming a coherent fisheries management policy. To inform these emerging processes and to illustrate the main stated goals of each FMC, we conducted a retrospective analysis of the principal regulatory documents of each Council since 1977 when the Magnuson-Stevens Act was implemented. For each of the eight management councils, we identified all of their fishery management plans [FMPs] and associated amendments and coded and analyzed the goals and objectives in selected fisheries for each region with particular emphasis on social and economic goals and objectives. Key fisheries in each region were selected based on the number of participants and ex-vessel revenue and selected through a series of informal interviews with Council staffs, NOAA science and policy personnel, and other experts. Using Atlas Ti qualitative data analysis software, we created hierarchical trees of each fishery to enable analysis and comparison. Our initial results indicate that a core set of goals exist throughout the US. These include: preventing overfishing, rebuilding stocks, controlling effort and participation in the fishery, and ensuring economic stability. However, in many cases, fisheries goals and objectives conflict both within and among fisheries in the region.

**Baker, Liv,** *University of British Columbia*

**Understanding the Individual and Their Welfare in Wildlife Conservation: How Personality Type Affects Translocation Success**

Translocations, movement of wild-captured animals to other natural locations, are a key management practice for many at-risk species. Most translocation attempts, however, have been unsuccessful in establishing self-sustaining populations. Historically, post-translocation mortality is high and highest during the initial days to weeks after release as animals confront their novel environments. Such a mortality rate is likely because the stressors characteristic of typical translocations strain the coping mechanisms an animal uses to survive in the wild. Current theory suggests that these stressors differentially affect individuals in a population because of personality type; the few studies that have explored physiological and behavioral effects bear this out. To this end, I investigated personality composition in a translocated population of the endangered kangaroo rat, Dipodomys stephensi. D. stephensi is a nocturnal, granivorous heteromyid rodent; it is a keystone species native to open grasslands of southern California. The U.S. Fish and Wildlife Service federally listed this species as endangered in 1988. Until 2008, no confirmed populations of D. stephensi had been successfully established via translocation. Principal components analysis indicates a range of personality types along an axis of behavioural plasticity. These types are predictive of cortisol levels during translocation. Moreover, kangaroo rats that survived one-year post-release exhibited greater adaptive behaviours and smaller changes in cortisol during temporary holding, prior to translocation. Thus, knowledge of how certain personality types respond to potential stressors should help increase survival as we are able to anticipate and reduce the negative impact of stressors on individuals.

**Baker, Sandra,** *University of Oxford*

**Humane wildlife management; an integrated approach**

People and wildlife often come into conflict in residential or leisure areas. To combat such conflict, people have devised various wildlife management methods, often involving culling. However, even where a desire exists to manage conflict humanely, little information is available on the humaneness of methods. Using moles as a case study, we applied a matrix-based model (devised by Australian Government scientists with input from animal welfare, veterinary and pest control organisations), to examine the relative humaneness of mole management methods. The model uses published scientific information from a range of disciplines, together with informed judgement, to produce a score reflecting the welfare impact of each method. Of all the methods, the overall welfare impact (excluding suffering specifically associated with the killing part of lethal methods) was greatest for live-trapping and relocation of moles, followed by harrowing and rolling molehills, phosphine gassing, spring trapping and removing molehills by hand. The killing aspects of both lethal methods were also associated with potentially severe suffering. In addition, the model allowed identification of specific gaps in scientific knowledge regarding mole control methods. This integrated approach potentially provides a tool for: reaching consensus among stakeholders regarding the relative humaneness of wildlife management methods; improving the humaneness of management methods; and influencing policy and practice.

**Balachowski, Jennifer,** *University of California, Davis;* **Jennifer Balachowski**, *University of California, Davis*

**Mix It Up! Multi-Ecotype Blends for Conservation and Restoration in the Face of Global Change**

Managing ecosystems in the face of global change will require novel, proactive approaches that encourage both population persistence and ongoing evolutionary change. Composite provenancing is a novel approach to conservation and restoration that involves augmenting local ecotypic diversity via the introduction of plants from geographically distant locations. Though it has been suggested as a practical and effective future-oriented planting strategy for restoration and conservation, few studies have considered how early inter-ecotype interactions may influence its long-term success. I have established a multi-year field experiment to test the short-term consequences of composite provenancing, and to predict its long-term efficacy. I use ecotypes of a perennial grass species, Elymus glaucus, collected from along a natural drought intensity gradient planted in mono-and polycultures to simulate the practice of composite provenancing under different climate regimes. Results from the first year of research suggest that ecological interactions between ecotypes will influence the long-term genetic composition of "composite" populations, and that populations differ in their abilities to tolerate extended drought conditions. They also suggest that variation in drought adaptation in the face of variable summer drought stress may be an important driver of ecotypic differences.

**Baldi, Andras,** *MTA Centre for Ecological Research;* **Julie Shapiro**

**The need for accurate locations for conservation studies**

One of the basic principles of conducting sound science is that experiments and observations be repeatable. Because of this, published studies should include all the details necessary for someone to repeat their experiment. Location is a key detail in ecology and conservation biology, e.g. to find earlier sampling sites, to repeat sampling in monitoring or restoration programs, etc. In spite of this, many papers do not provide accurate location information. This is partly due to difficulties in giving exact coordinates for hundreds of field sites or for irregular or patchy areas etc. However, emerging technologies now provide free and easy tools for providing accurate location information. For example, using Google Earth, point, transect or polygon sample areas can be stored in KML format, and used by others. In this way, studies are repeatable and readers can gain more information on landscape context or even landscape views from uploaded photos. We argue that providing KML location information should be requested from papers reporting field studies, except if protection or other reasons prohibit the open access of data.

**Baral, Nabin,** *Virginia Tech;* **Chris Nagy**, *American Museum of Natural History;***Benjamin Crain,** *University of Puerto Rico-Rio Piedras;* **Ramji Gautam**, *Prithvi Narayan Campus*

**Population Viability Analysis of Critically Endangered White-rumped Vultures Gyps bengalensis in Nepal**

More than a decade has passed since the catastrophic population decline in Gyps species in South Asia, but much uncertainty remains about quantifying their short-term extinction risk. To estimate the extinction risk of White-rumped Vultures (Gyps bengalensis) in Nepal, we conducted counts at seven nesting colonies between 2002 and 2012. We compared three methods of estimating abundance and calculated mean population growth rates () and cumulative probabilities of extinction given the abundance estimates from each method. The first two methods were traditional indices: average of all counts and the highest of all counts. The third method was a mixture modeling approach that corrected raw counts by a detection parameter. All three methods yielded mean 's < 1 and median times to quasi-extinction (≤ 20 vultures) of 22, 32 and 13 years as predicted by abundances based on mean count, highest count, and mixture modeling, respectively. All methods indicated that extinction of these populations is possible in as soon as 10-25 years. Overall, the mixture modeling method provided more precise predictions than the other two methods while requiring minimal additional effort. Accordingly, population biologists using count data are encouraged to employ such model-based estimators. All estimates suggested that White-rumped Vultures in Rampur are in danger of disappearing within a decade or two. Consequently, conservation efforts should be expedited to prevent the loss of this species.

**Barker, Jennifer,** *FHI 360;* **Roberto Martin**, *FHI 360;***Patrick Christie,** *University of Washington;* **Barbara Best**, *USAID*

**Global FISH Alliance: Progress toward sustainable harvest of spiny lobster in Honduras**

Implemented by FHI 360 and funded by the U.S. Government (USAID), Global FISH Alliance (G-FISH) brings together government, private sector, and civil society to promote sustainable fisheries and aquaculture around the world. The spiny lobster (Panulirus argus) fishery of Honduras has long been environmentally unsustainable and dangerous for lobster divers, who dive with compressed air to depths beyond safe diving limits. More than 5,000 lobster divers work in this fishery and approximately 1,800 Honduran divers have been injured from unsafe diving practices in pursuit of spiny lobster on the Caribbean coast. G-FISH, with partners including The Nature Conservancy, the Honduran government, fishermen associations, and Darden Restaurants, Inc., has employed a social change process based on increased interaction and communication among system stakeholders, regular system-wide events, targeted social ecological monitoring of the fisheries system, and policy advocacy. Interview results and social network analysis of hundreds of informants demonstrate that connections between key stakeholder groups have been strengthened and that policy makers and resource users are willing to make profound policy changes improve lobster fishery sustainability when all key actors agree to common goals, act in synchrony and create mutually beneficial outcomes.

**Barord, Gregory,** *CUNY Graduate Center and Brooklyn College;* **Andrew Dunstan**, *Queensland University;***Anthony Ilano,** *University of San Carlos;* **Peter Ward**, *University of Washington*

**Population assessments of a living fossil, the chambered nautilus, in the Indo-Pacific using baited remote underwater video systems (BRUVS)**

The chambered nautilus is part of an ancient lineage that has existed in the Earth's oceans for 500 million years. Resembling its ancestors and referred to as "living fossils", extant nautiluses inhabit coral reef slopes in the Indo-Pacific at depths to 700m. In the 1970's, nautilus fisheries formed to supply a new world-wide demand for its ornamental shell. These fisheries are unregulated and anecdotal reports have suggested declines in nautilus populations. However, no scientific data has been collected to substantiate these claims until recently, stymying any conservation efforts and regulations. To support conservation initiatives, population data has been collected from three critical habitats to compare fished populations (Philippines) to un-fished populations (Australia and Fiji). The last two countries have not supported historical fisheries and are used as a natural population size to compare to populations in the Philippines, where nautilus fisheries exist. Baited remote underwater video systems (BRUVS) are used to collect population density information by recording the number of nautiluses attracted to the BRUVS over a 6-12 hour period per night. Based upon the BRUVS data, the nautilus populations in the Philippines are significantly smaller than the two un-fished habitats. This data suggests that the Philippines has been affected by unregulated fisheries. Conservation and management plans should be developed to ensure sustainable populations of nautiluses.

**Barrett, Heather,** *Belize Foundation for Research and Environmental Education (BFREE);* **James Rotenberg**, *University of North Carolina Wilmington;***Jacob Marlin,** *Belize Foundation for Research and Environmental Education (BFREE)*

**Integrated Community-Based Avian Conservation Program**

Significant conservation challenges in Belize include the absence of a research culture and infrastructure to support in-country scholarship. Historically, foreign scientists have conducted research on flora and fauna while locals participate as guides or field hands. Much of the research carried out is unavailable to community stakeholders, leaving local conservation practitioners without data to make sound, science-based management decisions. Community members remain largely unaware of and unconcerned by conservation efforts because they do not equate conservation with income generation and a secure livelihood. The result is a dearth in long-term studies and disconnect between conservation initiatives and the local people. BFREE and UNC Wilmington have sought to address these challenges by offering Parabiologist training to local people from buffer-zone villages surrounding the Bladen Nature Reserve protected area, and within close proximity to the BFREE field station. Eleven trainees have graduated from this program and three individuals are currently in training. Three graduates are employed by BFREE and are now highly trained avian field technicians dedicated to their work and to providing environmental education to their communities. These technicians are considered avian and conservation experts in their country and are receiving opportunities and recognition abroad. Their success is shifting the existing paradigm and serves as a model for other countries.

**Barrett, James,** *Consultant and Visiting Fellow, American Council for an Energy Efficient Economy*

**Climate Change - The Environmental and Economic Synergies of Taxes and Investments**

Climate change may be the most profound challenge facing humanity today. A changing and less stable climate will have profound impacts on ecosystems across the globe, putting plant and animal species and human civilizations at risk. Addressing climate policy is not being pursued with a level of urgency that problem demands. The United States is among the more intransigent industrialized nations in implementing effective climate policy to reduce greenhouse gas emissions and slow climate change. That intransigence is born primarily from a fear that effective climate policy will entail unacceptably high economic costs. This, in turn, is based on the misperception that pricing emissions and reducing the consumption of fossil fuels must necessarily reduce economic growth and competitiveness. In truth, while a policy of pricing carbon emissions, if poorly designed, could indeed have profound negative impacts, a well-designed emissions pricing policy can have positive economic effects, accelerating economic growth while cutting emissions. The principle determinant of which type of effect a policy will have is the set of tax and investment policies that accompany an emissions pricing scheme. This talk will discuss various approaches and their likely implications for climate policy in the U.S.

**Bart, David,** *University of Wisconsin-Madison;* **Austin Yantes**, *University of Wisconsin-Madison;***Tara Davenport,** *University of Wisconsin-Madison;* **Quentin Carpenter**, *University of Wisconsin-Madison*

**Interacting Legacies and Stress Predict Rare-Species Occurence in Wisconsin Fens**

Land-use legacy influence on rare- or indicator-plants is understudied. We argue that in high stress systems these plants will be less likely found when legacies remove them from the pool or alleviate stress. We used the occurrence of a land-use legacy (a history of plowing), two non-resource stresses (waterlogging (as measured through root-zone volumetric water content) and high conductivity) and a resource stress (low nutrient availability (as measured through plant-available Nitrogen and Phosphorus)) to predict: 1) rare- and indicator-species richness and, 2) individual species frequency in 11 calcareous fens. Partial Least Squares Regression (PLS) revealed that regardless of stress, no study species were found in plowed fens. In never-plowed fens rare- and indicator-species richness increased with conductivity and waterlogging stress and decreased with nutrient availability. The richness model was highly predictive. PLS models of frequency counts were less predictive of individual species, but invariably showed that no history of plowing, high conductivity, high waterlogging stress, and low nutrient availability were important predictors. We suggest that plowing removed most fen specialists and rare species from the local pool, and lack of dispersal to these fens limits recovery of these species. However, efforts to return these species to fens may meet limited success if abiotic stress is low.

**Bartuska, Ann,** *USDA*

**Policy Formulation using "Best Available Science": Is there Room for Citizen Science?**

In the world of policy making, the phrases “science based” and “best available science” are frequently used. Traditionally, this has been the domain of peer-reviewed, published findings, thus ensuring credibility and quality. For the most part, this has been a safe assumption. Change has been happening in the manner in which data are produced that is challenging this convention. The emergence of participatory research, where the users and stakeholders of the research, actively participate in defining the problem, designing the project, and actively participating in the analysis, is leading to a change in how science is actually practiced. This approach is particularly effective when the problem to be solved involves a controversial policy. Similarly, smart-phone apps are increasing the opportunity for non-scientists to collect and analyze data, substantially increasing the number of data points for measures of biodiversity, presence of invasive weeds, and patterns of food consumption. Citizen science opens the laboratory door and in many ways is democratizing the practice of research. From a policy perspective, can data and information gathered through citizen science constitute “best available science”? We should explore new ways of validating the information thus generated so it can be used effectively in policy decisions.

**Bateman, Brooke,** *University of Wisconsin-Madison;* **Jessica Gorzo**, *University of Wisconsin-Madison;***Anna Pidgeon,** *University of Wisconsin-Madison;* **Volker Radeloff**, *University of Wisconsin-Madison;* **H. Akcakaya**, *Stony Brook University;* **Curtis Flather,** *USDA, Forest Service;***Thomas Albright**, *University of Nevada, Reno;* **Stephen Vavrus,**

*Center for Climatic Research;* **Wayne Thogmartin,** *United States Geological Survey;* **Patricia Heglund,** *United States Fish and Wildlife Service*

**Identifying drivers of abundance of an irruptive species, the Dickcissel (Spiza americana)**

Increasing pressure from anthropogenic and climatic change will make it more difficult to identify and maintain key habitats for species. This may be particularly so for species that naturally exhibit high variability in abundance and distribution like the Dickcissel (Spiza americana), a grassland bird. It is thought that the irruptive nature of the Dickcissel is linked with drought conditions within the core breeding range, causing populations to move in search of more suitable conditions. We aim to identify the effect that weather has on regulating the spatial abundance of this species. We generated a temporally-fine-scale species distribution model for the Dickcissel using weather data (1950-2011). To examine the effect of extreme weather on Dickcissels, we used remote sensing products to quantify droughts and heat waves (2001-2011). We found that the Dickcissel habitat, as determined by weather, varied greatly through time, although the core of its range had the most consistent weather across all years. Our results show that low weather suitability is always accompanied by low Dickcissel abundance, suggesting that weather plays a role in limiting its distribution. When weather is unsuitable at one location this species moves to more suitable areas, which may be well outside of its core distribution. In a changing climate with weather becoming more erratic how will we ensure adequate conservation strategies for such weather-sensitive species?

**Bax, Nicholas,** *CSIRO;* **Marcus Haward**;*University of Tasmania,* **Piers Dunstan**;*CSIRO,* **Tony Smith,** *CSIRO,*

**Answering the hard questions: Sustainable Ocean Policy and Implementation**  
The last three decades have seen increasing attention to the institutional arrangements and policy outcomes affecting management of the world's seas and oceans. Increased attention has occurred at national, regional and international levels, initially driven by problems with marine pollution, inadequate controls over unregulated fishing, and degradation of the marine environment. We consider the history, successes and failures of four different international and national policy sectors, pollution/dumping, biodiversity, fisheries, and seabed mining. We identify four aspects of competent governance that are displayed to varying degrees by each of these sectors: 1. Strong national governance structures & frameworks; 2. Effective science policy interface; 3. Governance effectiveness and complexity; and 4. Multilevel governance leading to creative tension in policy. Instruments addressing the marine resources and marine biodiversity conservation sectors provide an interesting case study on the operation of international regimes, including their spatial and functional overlap. We describe how these sectors intersect and how the different approaches can (or do) complement each other. We suggest the circumstances where institutional cooperation could enhance or constrain management effectiveness for high seas marine resources and biodiversity and propose a framework that future agreements might follow to improve integration of the management of multiple sectors.

**Beard, Karen,** *Utah State University;* **Rodrigo Ferreira**, *Utah State University*

**Matrix-habitat and edge effects on amphibian communities in the Brazilian Atlantic rainforest**

Brazil's Atlantic rainforest has been reduced to 10% of its historical range but still harbors a tremendous amount of endemism and diversity. This is particularly true for amphibians, which are represented by over 300 endemic species. As primary forest is lost and replaced with plantations, the effects of these new matrix types on amphibians are critical to understand. We investigated the effects of the dominant matrix types (coffee plantations, Eucalyptus plantation, and secondary forests) and their edge effects on bromeligenous and leaf litter frogs along a reserve in the mountainous regions of Espírito Santo in southeastern Brazil. Both species diversity and the total abundance of frogs were lower in coffee plantations, Eucalyptus plantations, and secondary forests than in the interior of the reserve. In addition, species diversity in edge habitats was lower than in interior forest for coffee plantations and Eucalyptus plantations matrix types. All bromeliad-dwelling frogs were found only in the forest interior. Results suggest that, in general, 1) species prefer primary forest, 2) matrix habitat types will only be used by some species, and 3) edge effects are greater for matrix types that represent the largest contrast with primary forest. We will discuss the role of the local community in habitat loss and bromeliad collections. We will also discuss our involvement in the local community, including interviews, discussions and education programs.

**Becker, Matthew,** *Virginia Tech*

**Using probiotics to develop new tools that will allow us to control chytridiomycosis.**

Probiotics (beneficial bacteria) have been used to prevent and treat disease in agriculture, aquaculture, and humans for many decades. Only recently has this treatment method been used to control disease in a wildlife setting. Current research has shown that a high diversity of bacteria inhabit the skin of amphibians and provide protection to their host against the fungal pathogen Batrachochytrium dendrobatidis (Bd). This pathogen causes the disease chytridiomycosis and is responsible for many amphibian declines worldwide. Experiments have demonstrated that treatments of North American amphibians with locally-derived antifungal bacteria have successfully prevented chytridiomycosis in both laboratory and field settings. In this presentation, I will review the current understanding of amphibian skin bacteria and their use as probiotics to identify new tools that will allow us to control chytridiomycosis. In addition, I will discuss characteristics of effective probiotics and techniques to implement a probiotic strategy for at-risk species.

**Bednarczyk, Daria,** *School for Field Studies;* **Ellen Splain**, *The School for Field Studies;***Edward Hind,** *The School for Field Studies*

**The devil is not in the detail: Using rapid social science assessments to identify socioeconomic baselines in 'data-poor' conservation situations**

Rather than seeing 'data-poor' environmental management problems as a barrier to good conservation this paper explains a scenario where the use of an easy to administer field methodology can prevent the policy stagnation that has traditionally been associated with such problems. Environmental managers are increasingly recognizing that it can be impossible to collect the detailed data which they desire to inform their decision making. Indeed, where long time series of ecological data are absent both academics and bureaucrats are now advocating data-poor decision making in line with the precautionary principle, and even data-less management. However, few have suggested a similar approach in cases where the data that is 'poor' is socioeconomic in nature. This paper, using the case-study of fisheries management in the Turks and Caicos Islands, shows that quick and simple applied social science techniques can be used to discover wide ranging socioeconomic baselines, identify complex stakeholder networks, and map out potential policies for successful conservation management. Stakeholder feedback for this study was almost uniformly positive with little of the data or findings being questioned. These social science techniques, accessible to all, can be adopted in any environmental management situation where there are human stakeholders and are especially useful in cases where there is little existing information.

**Behe, Carolina,** *Inuit Circumpolar Council-Alaska*

**Arctic Food Security: Building a Conceptual Framework on How to Assess Food Security from an Inuit Perspective**

The Arctic is changing at an unprecedented rate, with changes in storm surge, surface temperatures, sea ice, and species distribution. Climate change is opening new economic opportunities for tourism, oil/gas extraction, shipping, and commercial fishing. The coupled effects of climate change and the industrialization of the Arctic are causing increasing concern over potential threats to marine life; which ultimately affect Arctic food security. Industries, academic institutions, and governments are conducting assessments to understand how far this unique environment can be pushed before reaching a tipping point. From an Inuit perspective, this must occur through a food security lens to see where the interconnections between systems lie. The understanding of these connections is critical when considering threats to marine mammals. For example, when considering threats to beluga whales one must also consider effects on surrounding cultures to gain a holistic understanding. In response to the need to address food security of traditional food resources, the Inuit Circumpolar-Council Alaska is building a conceptual framework for how to assess food security from an Inuit perspective. The final product, to be shared with state and federal agencies and the Arctic Council, will provide an understanding for elected leaders and policy makers of the concept of food security in the Arctic, what the drivers are, and what will need to be monitored in order to create action plans.

**Beier, Paul,** *Northern Arizona University*

**SCB's Carbon Sequestration/Offset projects: a review**

In 2007 SCB became the first professional organization related to natural resources to take responsibility for greenhouse gas emissions from its meetings, publications, and other activities. Our effort has 4 steps (which should be used by any responsible individual, industry, or nation): (1) Estimate emissions. SCB’s annual ecological footprint assessments show that > 95% of our emissions derive from jet fuel burned to take people to our Congresses. (2) Reduce emissions. SCB cut emissions 40% by changing from annual to biennial International Congresses. (3) Replace dirty energy sources with cleaner ones. By itself, SCB cannot replace jet fuel with a cleaner fuel. (4) Offset remaining emissions by storing an equivalent amount of carbon. SCB has invested in 2 projects that have offset about 90% of our impacts since 2007. Moreover, these projects directly benefit biodiversity (by restoring native ecosystems) and improve human livelihoods in the project area. But the direct impact of our efforts is small. Real progress requires global action to reduce emissions and replace polluting energy sources, because no offset project stores carbon as securely as leaving fossil fuels in the ground. Climate change policy is at the top of SCB’s policy agenda. For example, SCB promotes cap-and-trade legislation and opposes development of tar sands which emit more carbon per unit energy than other fuels.

**Beier, Paul,** *Northern Arizona University;* **Malcolm L. Hunter**, *University of Maine*

**Conserving the stage: using geophysical units as coarse-filter targets in conservation planning for climate change**

A land facet is a recurring landscape unit defined by topographic, soil, and other abiotic attributes. A reserve design that conserves the stage (diversity of land facets) should also conserve biodiversity (defined as species plus the eco-evolutionary processes that maintain & generate biodiversity), and should do so under any climate regime. The other talks in this symposium articulate the assumptions and evidence for the land-facet approach, and illustrate its use in conservation planning. In this talk we argue that (1) This coarse-filter approach is grounded in the state-factor model of ecosystems. (2) Broader acceptance of the land facet approach depends crucially on demonstrating that a reserve design based on land facets represents biodiversity under at least some facet classification schemes (where a scheme is a combination of abiotic variables, pixel size, and algorithm), and does so better than an equal-sized reserve area composed of randomly-selected units. (3) This demonstration (that land facets are good surrogates) has not occurred because (a) we lack “truth” (accurate maps of biodiversity), (b) there are countless facet classification schemes, and (c) each analysis of surrogacy is specific to one study region and classification scheme and thus cannot support a general inference about surrogacy. (4) The alternative to a land facet approach (designing a climate-robust reserve based on focal species) is fraught with even more uncertainty.

**Bekoff, Marc,** *University of Colorado, Boulder*

**Compassionate Conservation as a Unifying and Integrative Movement: Who Lives, Who Lives, and Why**

The principles and goals of the relatively new and rapidly growing interdisciplinary field called Compassionate Conservation fit in nicely with the theme of this SCB gathering, namely, "Connecting Systems, Disciplines, and Stakeholders". Compassionate conservation asks us to consider seriously the well-being of individual animals as we make decisions about the health and integrity of larger entities including species, populations, and ecosystems in our attempts to slow and reverse wide-ranging losses of biodiversity. It also asks us to consider the well-being of human as well as nonhuman stakeholders. Almost daily we are forced to make very difficult decisions about "who lives and who dies" and because of limited time, money, person-power, and ever-growing problems, we may have to choose not to pursue certain projects and "let some species or habitats go" or to terminate those programs that are not producing useful results. Some conservation scientists already agree with these possibilities. These sorts of decisions are singularly daunting, but it is clear we cannot continue redecorating nature without paying the price for our unrelenting and destructive ways that result in significant and often irreversible damage. At best we can make decisions that have positive effects on as many nonhuman and human animals as possible and their homes, but it is naive to think that we can actually re-store or re-create ecosystems as they were in the past. Compassionate conservation demands that we no longer ignore nature and that we rewild our hearts and pay close attention to what we have done and where we need to head in the future. We also need to focus on what has worked and not less pessimism and negativity get us down. A guiding principle with which we might choose to begin is "first do no harm".

**Belachew, Samson,** *Saikrishna Hitech Agri Consultancy PLC;* **Makuria Argaw**, *Addis Ababa University;***Anouska Kinahan,** *Frankfurt Zoological Society -Bale Mountains Conservation Project (FZS-BMCP)*

**Assessment and Mapping of Soil Organic Carbon Sequestration Potential for Harenna forest, Ethiopia**

Soil carbon sequestration is an important link between global warming and soil rehabilitation. This study quantifies the soil organic carbon sequestration potential and the amount of total Nitrogen of Harenna forest (39034'-39052'E, 6027-6054N') with the possibility of carbon trade with 80 samples. It also examines relationship between other environmental variables. Soil carbon analysis used Walkley-Black method and nitrogen used Kjeldahiahl method. Habitat type showed significant effect on soil organic carbon while, overall, that was not the case for soil type, rainfall and temperature. Altitude showed positive correlation with soil organic carbon. Montane forest soils had 315.1 tC/ha and glades 215 tC/ha. Total nitrogen in montane forest was 30.9 tN/ha and 21.5 tN/ha in glades. The only carbon stock, which has got market value, is the additional carbon that is stored in the montane forest over the glade. But this will require preventing deforestation of 1505 ha/yr. The current market value of carbon is between $4 and $8 per ton. The soil organic carbon stoke worth annually, between 801.1$ and 4,415,110 $. Recent result of land use change is of great concern as it has put the deforestation rate at 1500 ha/yr. This will ignore conservation efforts and significantly deplete the soil carbon. Sound sequestration strategy matching the deforestation rate is a priority while putting the available soil organic carbon for voluntary carbon market which has multidimensional benefit.

**Bellemare, Jesse,** *Smith College;* **Jessamine Finch**, *Smith College;***David Moeller,** *University of Minnesota*

**Climate change and assisted colonization: A 5-year, 1000 km experiment with a southern Appalachian endemic forest plant, Diphylleia cymosa**

Climate change will be a top threat to biodiversity in coming decades. Species with small ranges, i.e. endemics, may be at increased risk of extinction, as unsuitable conditions may develop rapidly across their ranges. Human-assisted colonization has been proposed as one option to avoid extinctions by facilitating species in tracking suitable conditions poleward. This experiment explored the viability of this novel conservation approach for Diphylleia cymosa, a forest herb endemic to the southern Appalachian Mountains of the Southeast USA. In Fall 2008, we established a ~1000 km transect of seed sowing sites from 3 locations within the species range to 5 apparently suitable, but unoccupied, sites outside the range in the Northeast USA. Germination in 2009 was relatively high overall (44%) and did not differ significantly within vs. beyond the species range (40% vs. 46%). Survival from the seedling to juvenile stage (2009-2010) was significantly higher inside vs. outside the range (63% vs. 30%), possibly due to increased herbivory beyond the range. However, 2010-12 survival rates have been comparable inside vs. outside the range as juveniles have become established. Growth rates of experimental plants outside the range have been higher than those within the range, despite increased herbivory, and sexual reproduction is possible in 2013. These results suggest assisted colonization may be a viable option for some endemic species.

**Bellis, Mark,** *U.S. Fish & Wildlife Service;* **Danielle Kessler**, *U.S. Fish & Wildlife Service;***Elizabeth Hood,** *U.S. Fish & Wildlife Service*

**Global Conservation through Management of International Trade in Wildlife**

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) entered into force in 1975 and became the only global treaty to ensure that international trade in plants and animals does not threaten their survival in the wild. Stakeholders include 177 countries, in addition to various NGOs representing conservation, animal welfare, trade, zoological, botanical, and scientific interests. The backbone of CITES is the permit system. Permits are issued only if a country's CITES Authorities (e.g. - U.S. Fish & Wildlife Service) determine that trade is legal and does not threaten the species' survival in the wild. Approximately 35,000 species are protected by CITES. Bigleaf mahogany (Swietenia macrophylla) is an example of a species that has benefitted from CITES protection. In 2001, U.S. imports of bigleaf mahogany reached a high of 85,959m3. After being listed in CITES Appendix II in 2003, bigleaf mahogany imports have declined steadily to a low of 6,823m3 in 2011. Reduction in trade is just one step in ensuring the sustainability of species such as mahogany. CITES provides the legal framework to regulate international wildlife trade. Used in conjunction with strong law enforcement programs and capacity-building, CITES is a valuable tool for many conservation challenges--helping to curtail the rampant poaching of elephants and rhinos, putting a stop to illegal logging, and ensuring the long-term survival of species.

**Benitez-Malvido, Julieta,** *UNAM-Centro de Inv en Ecosistemas*

**Fungal diseases in disturbed Neotropical forests**

All plant structures at all stages of the life cycle, are subject to be colonized by microorganisms that may modify or interrupt their vital functions. In general terms a “disease” in plant pathology includes a series of microorganisms that disturb plant metabolism such as growth (hypotrophy and/or hyperplasia) in a portion of or throughout an entire plant causing even its death. Infectious agents could be fungi, nematodes, viroids, viruses, bacteria or even other flowering plants (e.g. the parasitic plant Epifagus virginiana). Fungi (sensu lato, i.e. including Oomycetes) are however, the major causal agents of plant diseases (i.e., ca. 75% of all plant diseases are caused by fungi) and jointly with insects comprise the major threat to wild and cultivated plant species worldwide. Fungal infection can cause local or extensive necrosis or abnormal growth in the different structures of plants. Several types of human disturbances in the Neotropics have shown to affect the interaction of plants with their fungal pathogens in natural ecosystems. Disturbance increased the levels of pathogen damage on plants. The observations are limited to foliar pathogens because of their ubiquity in tropical plant communities Firstly, leaf diseases in tropical plants are described; secondly the physical and biological factors involved in disease development and transmission; thirdly, the impact of anthropogenic disturbance in facilitating leaf fungal infection; then the potential consequences of disease spread, and finally, the implications of such disease induced changes in tropical rain forests function and conservation.

**Bennett, Elizabeth,** *Wildlife Conservation Society*

**Science-based enforcement to conserve commercially-valuable species**

Illegal hunting and wildlife trade are causing major population declines of many species, from elephants, rhinos and tigers to pangolins, turtles and songbirds. The trade is increasingly driven by organized criminal networks, with sophisticated technologies and methods of operation. Success in addressing this, therefore, also requires sophisticated methods. Fundamental to protecting commercially-valuable species are large numbers of well-trained, well-equipped personnel on the ground to protect source populations, and interdict at trade bottlenecks and end markets. Equally important is that enforcement programs operate at all stages on the basis of good science. This includes knowledge of the biology of the hunted species, data-driven law enforcement patrol systems, state-of-the-art tools to identify traded species and their provenance, and detailed monitoring at all levels. This presentation summarizes such methods, and provides examples of their deployment in field conservation programs.

**Berg, Joe,** *Biohabitats, Inc.*

**Stormwater and Aquatic Resources: Integrating Conservation and Restoration**

Society's management of runoff from developed watersheds with discharge to receiving streams results in degradation of aquatic resources. The integration of water resource engineers, ecologists, landscape architects, watershed scientists, and activists has resulted in a noteworthy change in the future management of these resources. Until the very recent past, emphasis was placed on conservation of dollars?now the focus is on conservation of remaining high value resources and restoration of degraded resources. This presentation will describe an integrated approach to stormwater collection and conveyance, eroded outfall repair, restoration of incised stream channels, and disconnected floodplains. The regenerative design approach increases storage and biological processing along the flowpath, optimizes floodplain/riparian zone reconnection, incorporates the elements of the material processing stream, and has been documented to provide significant benefits relative to other restoration approaches and to reference stream conditions, including peak attenuation, increased time of concentration, wetland and aquatic system benefits, and improved cultural elements (e.g., property values, reduced O&M costs, etc.). Perhaps more importantly, the regeneration of habitat provides for better fish and wildlife communities, and significant increases in public stewardship of the resource, which has translated into increased funding support for the conservation and restoration of habitat.

**Berger-Tal, Oded,** *Ben-Gurion University of the Negev;* **David Saltz**, *Ben-Gurion University of the Negev*

**Extinction of behaviors: the evolutionary consequences of anthropogenically induced behaviors**

Behavior serves as a mediator between genes and the environment by regulating the effects of the environment on the fitness of organisms. Thus, diversity of behaviors is crucial for populations to function in a changing environment. Anthropogenic alterations to the environment may cause behavioral changes in many species (e.g., habituation, avoidance). Since these behaviors usually enable animals to adapt to the disturbance, preventing a demographic decline and in some cases even increasing population size, they had been considered superficially beneficial conservation-wise. However, such behavioral changes may pose a less obvious yet significant risk - namely, a shift in the selective forces that may lead to the disappearance of certain behaviors. This can hamper the population's ability to withstand unforeseen future environmental changes and may ultimately lead to altering the evolutionary trajectory of the species. In this talk I will discuss the different factors affecting the chances of a behavior to go extinct. These include the type of stressor and the rapidity of its appearance, whether the behavior is genetically-wired or learned, and whether behavioral diversity in the population is the result of monomorphism of mixed strategies or polymorphism of pure strategies. I will further discuss the management implications of these different factors.

**Beston, Julie,** *University of Delaware;* **Theodore Nichols**, *New Jersey Division of Fish and Wildlife;***Paul Castelli,** *US FWS;* **Christopher Williams**, *University of Delaware*

**Management of Resident Canada Geese in the Atlantic Flyway**

Resident Canada geese have become a nuisance throughout much of the Atlantic Flyway due to their propensity to congregate in urban areas. Managers have implemented a variety of strategies - including egg depredation, September hunting seasons, and summer culling - in an effort to reduce the resident population while protecting migratory geese. We used banding data to estimate survival of resident geese in New Jersey. We found lower survival in rural areas where geese are more likely to be harvested, and we also found a decline in survival in more recent years corresponding with expanded culling operations in New Jersey. We explored the relative effectiveness of management activities by producing a population model and manipulating survival and reproductive rates. Culling was the most efficient strategy to reduce abundance because it acted on survival, which had the highest sensitivity, and could target geese in urban areas. Because urban geese are not available for harvest, the liberalization of September seasons would be relatively ineffective at reducing the population. Likewise, the insensitivity of population growth rate to reproductive parameters meant that large egg depredation efforts resulted in relatively small changes in population growth rate. Although public perception often deters managers from pursuing culling operations, they provide the most efficient way to reduce the resident population below the goal level while conserving the migratory population.

**Bhagwat, Shonil,** *The Open University*

**Mapping the sacred: a global map of sacred natural sites**

A global map of sacred natural sites, which are indigenous and community-conserved areas that have spiritual importance to people, is currently underway (www.mappingthesacred.org). The ambition is to map, assess, visualise, analyse and ultimately conserve our rich heritage of biocultural diversity – “the diversity of life in all of its manifestations: biological, cultural and linguistic, which are interrelated (and possibly coevolved) within a complex socio-ecological adaptive system” – which is being lost at an unprecedented rate (Maffi 2007). Sacred natural sites are considered a ‘parallel’ network of nature reserves, these areas are important for conservation of biodiversity, hosting a variety of habitats and species and forming hubs of cultural activity. Yet, there is very little information on their spatial distribution, their role in conservation of biocultural diversity and the rich cultural traditions that are associated with these sites. Dubbed as ‘nodes of nature and culture’ these sites have the potential to provide hubs for conservation of biocultural diversity. The conventional mapping is far too limited for sacred natural sites because there are hundreds of thousands of them distributed all over the world. Also, these sites are not just points or polygons on the map, but they are spaces rich in traditional rituals, myths, folklores, stories, narratives, performances and offerings which can be captured through audio-visual media. This projects therefore proposes a novel ‘citizen science’ approach to mapping and visual representation of sacred natural sites and it creates a platform and repository for a wide variety of data on these sites. The talk explores a variety of challenges encountered in the global mapping of sacred natural sites.

**Bhattacharyya, Silanjan,** *West Bengal State University;* **ARIJIT CHATTERJEE**, *WEST BENGAL STATE UNIVERSITY;***SOUMYA SARKAR,** *WEST BENGAL STATE UNIVERSITY*

**Traditions of Wild Biodiversity Conservation within Village Ecosystems in South West Bengal, India**

Existing conservation strategies overlook the wild biodiversity within villages. In this study, we explore the traditional co-existence of human populations with wild vertebrates in villages of south West Bengal, India. Intensive field surveys in 24 sample villages scattered over the region yielded data on occurrences and abundances of wild species along with information like people's perceptions etc. 389 species of wild vertebrates (41 mammals, 235 birds, 52 reptiles, 15 amphibians and 46 freshwater fishes) are found to live within villages in the region. Many are scheduled in the India's Wildlife Act(253 species) and the IUCN (24 species). Species richness per village ranges from 239 to 288. A village is a mosaic of 8-11 distinct habitats, each sustains some wild species. Majority inhabit small patches of wild bushes and tree groves (17.09-47.25% of village area). Despite a decreasing trend, their population sizes are still significant in these villages (e.g. 77-335 Varanus salvator, 15-80 hanuman langur/km2). Villagers accept these wild fauna as natural cohabitants. They assign sacred (e.g. langur, Cobras) or functional values (e.g. Monitors for eating snakes) and give special protections. Such pro-conservative tradition is now facing challenges from the increasing land demands from urbanization and cultural onslaught by it. Emergent conservation strategies must take into account this wealth of wild biodiversity and their conservation traditions remaining in villages.

**Biedenweg, Kelly,** *Natural Capital Project*

**Practitioner-academic partnerships: is this the way of the future?**

Science-based conservation can be enhanced by creating organizations and initiatives that link researchers and practitioners. Such organizations vary from non-profit, privately funded groups to state and federally-funded initiatives. As part of these efforts, natural and social scientists take an applied approach to working with conservation practitioners, planners, and businesses so that activities are both scientifically robust and contextually practical. Based on interviews with practitioners and scientists as well as personal experience, this presentation describes success stories and challenges in such projects. The stories cover the Natural Capital Project’s work with public and non-profit conservation organizations as well as businesses, and the University of Washington’s Puget Sound Institute’s work with the state-based Puget Sound Partnership. Primary challenges include physically positioning the bridging academics; finding charismatic scientists to cross the divide; developing a shared non-academic, non-acronym-laden vocabulary; working across practitioner-academic project timelines; and adapting to the political realities of practitioners. The consolidated examples will shed light on an increasing trend in academic-practitioner partnerships and stimulate discussion on the feasibility of such efforts.

**Bishop, Phil,** *Amphibian Survival Alliance*

**Review of the global amphibian crisis and an introduction to the symposium**

The IUCN Amphibian Conservation Action Plan (ACAP) is a unique example of a multi-disciplinary response to the global amphibian crisis. While there is a solid understanding of threats and a diverse academic constituency, compared to other vertebrate taxa there is only a limited global capacity to implement on the ground actions for amphibians. The ACAP prompted stakeholders from around the world to leverage some initial funding to implement real conservation actions that cross disciplines and benefit amphibians world-wide. The Amphibian Survival Alliance (ASA) acts as a global partnership for amphibian conservation and is working to mobilize a motivated and effective consortium of organizations to stem the rapid losses of amphibian populations and species worldwide. The purpose of this symposium is to convene some of the implementers of cutting-edge examples of amphibian conservation actions ranging from land acquisition to species management, law enforcement and policy, education and capacity building actions that cross a variety of disciplines. We believe that this session will be sufficiently novel to warrant the drafting of a white paper "The Global Amphibian Conservation Action Plan: Connecting systems, disciplines and stakeholders to save amphibians worldwide" and we will work with participants to ensure that it is published in an appropriate outlet.

**Biswal, Ashok,** *Regional Plant Resource Centre Bhubaneswar*

**Coastal Flora Diversity - A Holistic Documentary of East Coast of India**

Coastal wet lands - are imported self sustained ecosystem plays a significant role for the formation of a wide range of well diversified flora. These aquatic and wet land plants have immense importance for sustainable life support systems including economic and aesthetic values and as such have played a central role in the evolution of human settlement, agriculture, culture, industrial growth etc. An extensive floristic survey was conducted during the year 2012 in the wetland ecosystem of Coastal Odisha, Coastal West Bengal and Coastal Andhrapradesh of India. During the field survey, ethno botanical data have been collected. The documented data indicate that species were used to treat various diseases, for human food, for fodder, for manure, for animal foods, as insecticides and also making mat and basket .In this study we were especially happy, that our indigenous people wanted us to learn, understand, and appreciate where we were and how each species is useful in livelihood (Sustainable power that empowers our tomorrow). As India is one among 12 mega -biodiversity countries and 25 hotspots of the richest and highly endangered eco-regions of the world, there's a tremendous energy about east coast of India, an enigmatic quality that's absolutely unique, and that's what I love to share. Keyword: - Conservation, Livelihood, Ethno botany, Coastal flora, East Coast, India.

**Blackie, Helen,** *Lincoln University and Connovation Ltd;* **Ian Woodhead**, *Lincoln Agritech Ltd;***Duncan MacMorran,** *Connovation Ltd;* **Charles Eason**, *Cawthron Institute;* **Shane Inder**, *Auckland University of Technology;* **Jamie MacKay,** *University of Auckland;***Brent Barrett**, *Centre for Wildlife Management and Conservation*

**Advancements in wildlife recognition, monitoring and targeted control tools**

Recent research within our multi-disciplinary team involving ecologists, engineers and designers has focused on three novel developments 1) automatic species recognition and detection tools, 2) advanced population monitoring devices and 3) species-specific long-life control tools for invasive pests. This research demonstrates the success of an integrative approach to achieve practical solutions for conservation problems. Examples of these developments and their applications will be provided, including the use of these technologies to detect and then control a reinvading Norway rat (Rattus norvegicus) on a pest-free New Zealand Island. These technologies have been designed to offer cost-effective alternatives to current methods for monitoring and controlling animal populations, and have widespread applications in wildlife management and conservation scenarios.

**Blair, Mary,** *Center for Biodiversity and Conservation, American Museum of Natural History;* **Eleanor Sterling**, *Center for Biodiversity and Conservation, American Museum of Natural History;***Matthew Dusch,** *State University of New York - School of Environmental Science and Forestry;* **Christopher Raxworthy**, *American Museum of Natural History;* **Richard Pearson**, *Center for Biodiversity and Conservation, American Museum of Natural History*

**Using ecological niche models to infer evolutionary processes and inform conservation: A case study of lemurs in Madagascar**

An improved understanding of the evolutionary processes that generate diversification, and in particular how they are influenced by the environment, is crucial in the face of ongoing and predicted environmental changes that will threaten global biodiversity. Here we used climate-based ecological niche models (ENMs) to test hypotheses about ecological divergence and speciation processes between sister species pairs of lemurs (genus Eulemur) in Madagascar. We produced ENMs for eight species, all of which had significant validation support. We found non-equivalent niches between sister species pairs, varying degrees of niche overlap in ecological and geographic space, and support for multiple divergence processes. Specifically, three sister-pair comparisons supported the null model that niches are no more divergent than the available background region, consistent with an allopatric speciation model. However, for one pair we found support for niche divergence; and consistent with their parapatric distribution on an ecotone and the lack of obvious geographic barriers, these findings most strongly support a parapatric model of speciation. Our results support conserving intact ecotones as a means to maintain evolutionary processes, and our study takes a crucial first step towards better understanding how evolutionary processes and the evolutionary ecology of species may respond to continued environmental change.

**Blake, Stephen,** *Max Planck Inst. for Ornithology*

**Importance of roadless wilderness to African forest megavertebrates**

Habitat loss and degradation, over-exploitation of resources, invasive species, pollution, disease, and climate change are conservation priorities. Road proliferation facilitates all of these, yet how many conservation organisations have a Roads Coordinator? In tropical forests road impacts can be catastrophic. In central Africa, large mammals are hunted out along new roads with areas closest to roads being the hardest hit. Megavertebrates such as forest elephants are impacted by roads even in the most remote forests. Elephant abundance declines dramatically near to roads, and home range size increases with roadless wilderness size because elephants are afraid to cross roads. Each new road built into the forest will bring not just industrial exploitation, but also settlement and access to illegal harvest of wildlife and commercial markets, yet conservationists have little impact on road development and management. Most roads are built with the goal of evacuating natural resources to markets as cheaply as possible, but the cheapest route is often the most ecologically destructive and least socially beneficial. Development agencies see roads as the skeleton on which to build economic growth, and aggressively promote road expansion, yet seldom consider the negative ecological and social impacts. Conservationists must make a last ditch effort to develop and force implementation of a “least bad” regional roads blueprint if functional forests and their megafauna are to survive.

**Bland, Lucie,** *Zoological Society of London;* **Ben Collen**, *Zoological Society of London;***Jon Bielby,** *Zoological Society of London;* **C. David L. Orme**, *Imperial College London*

**Predicting the conservation status of Data Deficient species**

Forecasting the extinction risk of species from limited data is a critical step to enabling a better understanding of biodiversity patterns and threats to species. To date, over 65,000 species have been assessed by the IUCN, including 10,673 as Data Deficient (DD). Determining the status of DD species is essential to both developing a more accurate picture of biodiversity and enabling the protection of potentially threatened DD species. We compared the outcomes of seven Machine Learning tools in determining the threat status of non-DD mammals using taxonomic, life-history, geographical and threat information. We then used the best tool to predict the status of DD mammals. Machine Learning tools achieved very high classification accuracy (up to 92%) and ability to correctly identify threatened species (up to 94%). We predict 313 out of 493 DD species (64%) to be at threat, increasing the estimated proportion of threatened terrestrial mammals from 22% to 27% globally. We find that regions predicted to contain large numbers of threatened DD species are already conservation priorities, but show higher levels of species imperilment than previously recognized. We conclude that unless directly targeted for re-assessment and conservation, DD species are likely to slide towards extinction unnoticed. Taking into account information on DD species has substantial implications for tackling Linnean and Wallacean shortfalls, as well as conserving the earth's poorly known biodiversity.

**Blank, Sara,** *University of California-Santa Cruz*

**Bags and Tags: An empirical evaluation of policy change for reducing illegal recreational fishing of red abalone (Haliotis rufescens) in Northern Cali**

Illegal fishing has detrimental environmental and social impacts, but these effects are difficult to mitigate without reliable estimates of fisher noncompliance. This research applies the randomized response technique (RRT) to directly estimate non-compliance in the Northern California recreational red abalone (Haliotis rufescens) fishery before and after the introduction of new fishing regulations and marine protected areas (MPA’s). Anonymous paper-based compliance and sociodemographic surveys were conducted of recreational fishers in Sonoma and Mendocino Counties in August of 2007 and 2011. The 2011 survey found slight reductions in illegal take across most violation types. The sociodemographic information collected in 2011 reconfirmed higher non-compliance rates among visitors than local fishers; particularly within the newly designated MPA’s. Ignorance of rule change was the most common explanation provided by respondents for non-compliance, and the 2011 survey reflected declines in fisher knowledge of regulations. Promisingly, since the introduction of on-animal tagging regulations the proportional daily take limit violation among local residents was found to have decreased from 72% to 43%. These rule-specific violation estimates confirm some non-compliance reductions have been achieved, but also point to opportunities for improving managerial communication and enforcement.

**Blockstein, David E. ,** *Council for Science and the Environment*

**A Century Later: A Multi-disciplinary Effort to Share the Lessons from the Extinction of the Passenger Pigeon (Ectopistes migratorius)**

2014 is the centenary of the extinction of the Passenger Pigeon. It provides a teachable moment for scientists, educators, and public to consider how the most abundant bird in the world went extinct over a matter of decades and to consider its implications for today. The story of its extinction is often incorrectly oversimplified as “exterminated by overhunting”. Extinction was a result of the interplay between biological and human factors – including vulnerability resulting from specialization, the rise of technology (railroads and telegraphs), economics (market hunting to provide meat to urban markets) and values. The story of the Passenger Pigeon holds many lessons for today. These range from the obvious that abundance is not a predictor of resilience to the subtle that new forms of technology that may appear unrelated can actually be significant causes of extinction. Project Passenger Pigeon (P3) - a multi-disciplinary effort is engaging many people in conservation education. P3 includes music, theatre, poetry, film, stories, art, exhibits, speakers, a book, new research, digital and traditional media and many other approaches to share the story of the Passenger Pigeon and its relevance for today (www.passengerpigeon.org).

**Blossey, Bernd,** *Cornell University;* **Brian Greene**, *Cornell University*

**Bioindicators to assess the importance of different stressors threatening plant species of conservation concern**

Correctly ranking the importance of different stressors that threaten species of conservation concern is an essential step in developing successful management strategies. For example, teasing apart threats of introduced earthworms, land-use change, nutrient deposition, acid rain or deer herbivory may require elaborate experiments and development of demographic models. We developed potential alternatives using plant indicators to assess effects of introduced plants, introduced earthworms, deer herbivory and urbanization on native biota. By planting native species into riparian areas affected by rapid urbanization we were able to determine that privet invasion is a larger conservation concern than changes in hydrologic regimes. Planting species into earthworm invaded and uninvaded areas, or areas occupied by different introduced plant species while simultaneously manipulating deer herbivory showed overwhelming effects of deer with little effect of earthworms and invasive plants. We also used indicator species to assess effectiveness of deer sterilization and hunting on ecological goals in suburban deer management. Our results suggest that the single largest threat to conservation in eastern North America are overabundant deer. The planting of bioindicators appears a powerful and easy to use tool to directly assess threats by different stressors as well as habitat suitability for species of conservation concerns.

**Blowers, Andrea,** *Utica College;* **Kyle Ford**, *Utica College;***Sara Scanga,** *Utica College;* **Joel Ralston**, *Utica College*

**Local and landscape-scale habitat selection in five boreal birds threatened by climate change**

As global climates warm, species are predicted to shift their ranges poleward or up in elevation. Ecological niche models have been used to predict range shifts and local extirpations under various carbon emissions scenarios. However, these models are typically based on landscape-level climate data, and fail to consider local-scale habitat. In order to accurately predict responses to climate change, it is important that we understand the factors driving habitat selection at multiple spatial scales. We recorded the presence or absence of five species of boreal forest birds via mist netting and audio-visual surveys at 10 field sites in the northeastern United States. We measured 109 habitat characteristics describing plant species composition and habitat structure and combined them with 19 regional climate variables. Using a Principal Component Analysis, we explored the importance of these local- and landscape-scale variables in determining species distributions. The first two principal components accounted for 44% of the total habitat variation, and described differences among sites based on elevation, temperature and precipitation, red spruce (Picea rubens) and balsam fir (Abies balsamea) abundances, and several local habitat variables. Our results suggest that the factors driving habitat selection vary across co-distributed species, and that both local and landscape-scale variables are important when predicting range shifts.

**Boag, Angela,** *University of British Columbia;* **Peter Arcese**, *University of British Columbia*

**Comparing biodiversity modelling approaches in a high human impact landscape in British Columbia, Canada**

Predictive biodiversity models provide critical information for the study and management of threatened ecosystems. They can also be used to facilitate conflict resolution and improve communication among stakeholders involved in conservation planning. However, model developers rarely collect the robust data necessary to validate their predictions due to expense and effort, making it difficult to compare the on-the-ground utility of alternative models. This is especially important in high human impact areas where threats to biodiversity are complex. We developed a spatially explicit species distribution model for threatened herbaceous meadow plants in an area of intense human development using a GIS framework and existing survey data. We also modeled biodiversity in our study area using the InVEST Biodiversity model, which uses habitat quality and rarity as proxies for biodiversity. We sampled species richness in sites predicted by each model to have high and low plant diversity and compared accuracy between approaches. Field validation can expose key additional variables to include in predictive models, reveal trade-offs between alternative models, and should be a central priority for practitioners developing conservation planning tools.

**Bodin, Orjan,** *Stockholm Resilience Centre*

**The Problem of Fit: Comparing Social and Ecological Connectivity in Land-use Planning using a spatially explicit network approach**

The problem of institutional fit in social-ecological systems has been empirically documented and conceptually discussed in decades, yet there is still a shortage of research approaches to systematically and quantitatively identify the level of fit. We present a network-centric approach aimed to address this gap in cases where formal and informal interactions between multitudes of actors are at the focus of attention. The approach focuses on identifying patterns of collaborations between different actors managing different areas in a landscape, and then relates these patterns to ecological processes playing out in the landscape. We demonstrate our approach by comparing a social network of municipalities collaborating on wetland management, with the ecologically defined network of interconnected wetlands in the Stockholm Metropolitan Area in Sweden. We specifically test: (1) if interactions between neighboring municipalities are more common than average, and (2), while controlling for such possible neighborhood effect, if municipalities that are managing wetlands that are strongly interconnected interact more than average? A positive outcome on (2) would then imply a tendency towards achieving a good level of fit, whereas a positive outcome on (1) would only imply a tendency that might lead to a generally fair level of fit, however not necessarily particularly well suited for wetland management. A lack of positive outcomes on both (1) and (2) would indicate a lack of fit.

**Boesch, Don,** *UMD Center for Environmental Sci*

**Chesapeake Futures, 10 years later**

The Chesapeake Futures Report was a collaborative effort of natural and social scientists in 2003 to describe the future condition of the Bay in 2030 given three scenarios of environmental decision-making - status quo, 2003-stated policy commitments, and feasible but ambitious alternatives. Using land-use, nutrient, and ecosystem modeling to visualize the downstream effects of a given course of action, the “Futures” authors gave meaning to decisions being made at the time on land-use, resource use, and conservation. In the status quo scenario, modeling predicted population increases, 10 to 15% increase in nutrient loads, loss of open space, and continued degradation of water quality and fishery resources. Models of the second scenario, with implementation of the Chesapeake 2000 commitment to nutrient load reductions, predicted modest gains in water quality and fishery resources. The feasible alternatives scenario, which included nutrient reductions and green land use planning, would have provided marked improvements in air and water quality and ecosystem benefits. Now, 10 years after the report was published, which course of action have we pursued? Did the report influence policy-makers, and which Chesapeake 2030 are we moving towards? This talk, culminating this symposium addressing the current state of the Bay and continued positive direction of environmental stewardship, will initiate a constructive discussion of Chesapeake Bay environmental issues.

**Bonacic, Cristian,** *Universidad CatÛlica de Chile;* **Andrés Neyem**,

**LiveANDES: Advanced network for the distribution of endangered species and citizen science**

The number of common people visiting natural areas across the globe vastly outnumbers the scientist working in there, and the large numbers of visitors result in large numbers of wildlife sightings. This unrecorded wildlife sightings could be valuable to refine distribution ranges, gain data on habitat use or to identify the expansion of exotic species and their impact, among many other potential uses. With the idea of gathering these sightings, LiveANDES (Advanced Network for Distribution of Endangered Species) was developed to allow individuals to share and visualize their wildlife sightings via a software platform, while at the same time helping to create a global conservation community in The Americas. Detecting, uploading and sharing photos, notes, videos or audio from endangered species into LiveANDES is an innovative way to contribute to biodiversity conservation by promoting citizen science. LiveAndes has an input option for mobile phones. The value of data sharing for wildlife locations mainly refers to the need of mapping the presence and distribution of endangered species to assess their conservation status according to international standards (IUCN Red list). Currently, Live Andes is available for all terrestrial vertebrates of Chile and a searchable database by ecological, administrative and protected areas can be displayed for the whole country. Cross-country efforts are underway to develop the platform in Bolivia and North America for data sharing and mapping.

**Bond, Mark,** *Stony Brook University;* **Demian Chapman**, *Stony Brook University;***Elizabeth Babcock,** *Rosenstiel School of Marine and Atmospheric Sciences*

**Differences in elasmobranch assemblages between marine reserves and fished reefs on the Mesoamerican Barrier Reef**

Our previous research has shown that Caribbean reef sharks are significantly more abundant inside marine reserves when compared to similar fished reefs on the Mesoamerican Barrier Reef. We now pose the question: what effect have marine reserves had on the abundance of other elasmobranchs, such as batoids? Rays are not commercially targeted in Belize therefore our null hypothesis is that reserves have no effect on the relative abundance of these species. Baited Remote Underwater Video (BRUV) surveys were conducted on the forereef at four sites along the barrier reef in Belize, at two reserves and two fished reefs (N=50 per site). Of the combined 100 deployments at the reserve sites 13 batoids were observed compared to 58 observed at the fished sites. We constructed a generalized linear model (GLM) to explain the presence of batoids on BRUVs, which included "marine reserve", "location nested within reserve", habitat characteristics and environmental variables as potential factors. The GLM found that the factor "marine reserve" had a significant negative effect on the presence of batoids, while none of the habitat or environmental variables had a significant influence. We discuss ongoing research aimed at explaining this pattern, including potential mechanisms such as (1) mesopredator release due to reduced predation from reef sharks, (2) altered batoid behavior due to intimidation by sharks inside reserves and (3) increased competition for prey inside reserves.

**Boone, Michelle,** *Miami University of Ohio;* **Jason Rohr**, *University of South Florida;***Catherine Propper,** *Northern Arizona University;* **Christine Bishop**, *Environment Canada*

**The Influence of Industry: How Conflicts of Interest Compromise Pesticide Regulation**

Human and environmental health relies partly on federal agencies that set regulatory standards for pesticide use and registration. Decisions based on the best available data benefits regulators, the public, and natural world. However, current assessments for registering or reregistration pesticides can eliminate much to most of the research in the published, peer-reviewed literature allowing regulatory decisions to be based on only a few studies that are often conducted or directly funded by the pesticide manufacturer who is unambiguously impacted by the conclusions reached in these studies, thereby representing a clear case of conflict of interest. Our objectives are to 1) highlight how conflicts of interest can compromise regulation using the herbicide atrazine as a case study, particularly given its effects reported in the literature for amphibians and other vertebrates; 2) compare conclusions reached by regulators or stake holders versus independent scientists; 3) examine why studies are included or excluded in regulatory decision-making; and 4) offer recommendations for improving the regulatory process. We all have an interest in ensuring that regulatory decisions are based on all available research with sound experimental designs lacking conflicts of interest. Although current practices fall short in the US and other countries, a regulatory process that removes conflicts of interest is both plausible and essential to protect and manage human and environmental health.

**Boone, Michelle,** *Miami University*

**The Influence of Industry: How Conflicts of Interest Compromise Pesticide Regulation**

Human and environmental health relies partly on federal agencies that set regulatory standards for pesticide use and registration. Decisions based on the best available data benefits regulators, the public, and natural world. However, current assessments for registering or reregistration pesticides can eliminate much to most of the research in the published, peer-reviewed literature allowing regulatory decisions to be based on only a few studies that are often conducted or directly funded by the pesticide manufacturer who is unambiguously impacted by the conclusions reached in these studies, thereby representing a clear case of conflict of interest. Our objectives are to 1) highlight how conflicts of interest can compromise regulation using the herbicide atrazine as a case study, particularly given its effects reported in the literature for amphibians and other vertebrates; 2) compare conclusions reached by regulators or stake holders versus independent scientists; 3) examine why studies are included or excluded in regulatory decision-making; and 4) offer recommendations for improving the regulatory process. We all have an interest in ensuring that regulatory decisions are based on all available research with sound experimental designs lacking conflicts of interest. Although current practices fall short in the US and other countries, a regulatory process that removes conflicts of interest is both plausible and essential to protect and manage human and environmental health.

**Borg, Bridget,** *Denali National Park and Preserve;* **Laura Prugh**, *University of Alaska Fairbanks*

**Impacts of Breeder Loss on Wolf Social Structure, Reproduction and Viewability in Denali National Park and Preserve**

Perhaps no species is more emblematic of transboundary management issues occurring at the borders of protected areas as wolves. While protection of wolves within Yellowstone and Denali National Park provides the opportunity for thousands of visitors to see wolves each year, these wide ranging carnivores often travel across park boundaries. Mortality of individual wolves from frequently viewed packs due to hunting or trapping outside these parks has sparked widespread controversy, prompting concern regarding the impact of these losses. Loss of breeding individuals in particular could lead to pack dissolution, reduction in reproductive capacity of the pack, or behavioral changes at the individual or pack level. All of these factors can alter wolf viewing opportunities. We used 25 years of radio telemetry data in Denali National Park to quantify the effects of breeder loss on wolf pack dissolution and wolf sightings along the park road. Following breeder mortality, packs dissolved in 25% of cases. Pack size prior to breeder loss strongly influenced the probability of pack dissolution. When pack territory overlapped the park road, wolf sightings decreased following breeder loss in 83% of cases. These results indicate that wolf harvest adjacent to park boundaries may disrupt pack structure and reduce wolf viewings within parks when breeders are lost.

**Borker, Abraham,** *University of California - Santa Cruz;* **Matthew McKown**, *McKown;***Donald Croll,** *University of California - Santa Cruz;* **Portia Halbert**, *California State Park;* **Bernie Tershy**, *University of California - Santa Cruz;* **Cody Sullivan,** *University of California - Santa Cruz*

**Automated acoustic sensors for inland monitoring of endangered Marbled Murrelets (Brachyramphus marmoratus)**

For rare and elusive wildlife, the scale of monitoring efforts is often limited by expensive methodologies, sampling inconsistencies and the logistics of large spatial and temporal scales. Detection of rare events at scale is particularly limited by variable detection biases and limited sampling efforts. For vocalizing wildlife, automated acoustic sensors are one way to greatly expand sampling effort and reduce biases. We illustrate the limits and costs of current approaches to monitor the endangered Marbled Murrelet (Brachyramphus marmoratus), comparing traditional human audio-visual surveys with automated acoustic sensors combined with a semi-automated analysis approach. We selected seven long term monitoring sites in the Santa Cruz Mountains, California, where Marbled Murrelets are at low abundance. Automated sensors and analysis on average detected more murrelets at each site (t(df=6)=1.34, p=0.11), and measured relative activity at similar levels (R2=0.85, p=

**Borkhataria, Rena,** *Everglades Research and Education Center, University of Florida;* **Peter Frederick**, *University of Florida;***Colin Saunders,** *Individual;* **James Beerens**, *Florida Atlantic University;* **Jaime Collazo**, *North Carolina Cooperative Fish and Wildlife Research Unit;* **Lawrence Bryan,** *Savannah River Ecological Laboratory*

**Modeling the influence of Everglades hydrology on population dynamics of endangered wood storks in the southeastern U.S.**

The southeastern U.S. population of wood storks (Mycteria americana) was declared endangered in 1984 following declines in the Florida Everglades. Their range and population have since increased and a change in status from endangered to threatened is likely. Despite increases elsewhere, wood storks still do poorly in the Everglades. We combined a habitat suitability index (HSI) with a spatially explicit population model to explore how Everglades restoration may influence Everglades nesting and population dynamics for the larger population. Using satellite telemetry data from 2004-2011, we compared vegetation and daily hydrological characteristics at used and random locations in the Everglades using a proportional hazards model. Resulting HSI values were used as a covariate in a multistate state model to evaluate the probability of birds leaving the Everglades. HSI-dependent transition probabilities were then incorporated into a demographic model to explore how increasing habitat quality in the Everglades influenced the persistence of birds during the nesting season. Preliminary results indicate that persistence increased with habitat suitability. Increasing HSI by 50% more than doubled the number of chicks produced in the Everglades and increased the size of the SE US population by roughly 8%, indicating that despite shifts in nesting away from the Everglades over the past 40 years, restoration should have positive effects on the population as a whole.

**Borneman, Tracy,** *North Carolina Cooperative Fish and Wildlife Research Unit, NC State University;* **Theodore Simons**, *USGS, NC Cooperative Fish and Wildlife Research Unit, NC State University*

**Effects of human activity on American Oystercatchers (Haematopus palliatus) breeding at Cape Lookout National Seashore, North Carolina**

American Oystercatchers, a species whose population is of conservation and management concern, nest on coastal beaches where they are subject to anthropogenic disturbance. Therefore, we assessed the effects of a variety of human activities occurring at Cape Lookout National Seashore, North Carolina on nesting American Oystercatchers by looking for changes in behavior, physiology, and reproductive success. We expanded on-going monitoring of oystercatchers at Cape Lookout by supplementing visual observations with continuous video, audio, and heart rate recording at nests. Oystercatchers were equally likely to be on their nests before and during aircraft fly-overs, but were on their nests less often during off-road vehicle and pedestrian events than before those events occurred. Low-altitude military flights were the only human activity to significantly increase heart rate of incubating oystercatchers. Reproductive success during study seasons was comparable to or higher than past seasons. The number of daily off-road vehicle events was correlated to decreased daily survival rates and success of nests. Current levels of aircraft overflights are unlikely to affect nesting success during the incubation period. In contrast, off-road vehicles appear to affect both the incubation behavior and nest hatching success of American Oystercatchers.

**Bossart, Janice,** *Southeastern Louisiana University;* **Josephine Antwi**, *Texas A & M University*

**Small sacred forest groves retain the preponderance of biodiversity found in much larger forest reserves.**

Habitat fragmentation is one of the most pervasive threats to global biodiversity because it isolates populations into small, discrete habitat patches, which promotes loss of species and genetic diversity via local population extinctions, inbreeding, and genetic drift. We conducted a year-long systematic survey of the fruit-feeding butterfly communities of two large forest reserves and five small sacred forest groves in Ghana, West Africa. Few ecosystems of the world are considered as critically imperiled, or fragmented as these Upper Guinean forests. Overall we found species richness to be higher in the larger forest reserves. Nonetheless, in all but one case, the small sacred groves retained 84-93% of this species diversity despite accounting for less than 1-10% of the total area of the forest reserves. We also compared the patterns of mtDNA CO1 variation of three representative focal butterfly species that differ with respect to their predicted dispersibilities, e.g. based on their size, habitat specificity, and flight patterns. Patterns of genetic differentiation across species were broadly coincident with our predicted hierarchy of relative species dispersibility. But as before, there was limited evidence of biodiversity (genetic) erosion from the sacred groves, even of the species most impacted by fragmentation. These small community-based, indigenous conservation reserves are clearly currently functioning as valuable repositories of genetic and species diversity.

**Boudreaux, Karol,** *USAID*

**Challenges and opportunities for land tenure: agriculture, food security and gender**

Not Provided

**Bouzat, Juan,** *Bowling Green State University;* **Amanda Lyons**, *Bowling Green State University;***Gabrielle Knafler,** *Bowling Green State University\;* **Dee Boersma**, *University of Washington*

**Ocean basins and pathogen pressures drive genetic differentiation of Magellanic Penguin breeding colonies of the Atlantic and Pacific Oceans**

The identification of demographically and genetically independent populations is essential to define proper conservation units. Using mitochondrial COI and nuclear MHC DNA markers, we assessed levels of genetic structuring of Magellanic Penguin colonies from the Atlantic and Pacific Oceans. Genetic analysis of 128 individuals from 7 colonies revealed 30 COI haplotypes and 56 MHC alleles. Analyses of molecular variance showed that 23% and 22% of the observed variation in COI and MHC genes, respectively, can be explained by differences between ocean basins. In contrast, no significant variation was detected among colonies within ocean basins. Breeding colonies at the northern range of the Atlantic and Pacific Oceans showed a significant number of unique COI haplotypes and MHC alleles, likely the result of long-term demographic isolation driven by the separation of the ocean basins. The COI typing of the Punta Arenas colony, at the southern tip of the continent, revealed no significant differences with all three colonies from the northern Pacific range, suggesting that this colony is part of the Pacific population system. However, MHC typing of this colony showed genetic similarity to colonies from the Atlantic Ocean, likely as a result of similar pathogen pressures. Our results suggest that the regional genetic structuring of Magellanic Penguin populations is driven by oceanographic differences between ocean basins and distinct pathogen pressures.

**Bowne, David,** *Elizabethtown College;* **Candace Grand Pre**, *Franklin and Marshall College;***Jeffrey Hartranft,** *PA Department of Environmental Protection;* **William Hilgartner**, *Johns Hopkins University & Friends School of Baltimore;* **Dorothy Merritts**, *Franklin and Marshall College;* **Aleah Miller,** *Elizabethtown College;***Michael Rahnis**, *Franklin and Marshall College;* **Robert Walter,**

*Franklin and Marshall College*

**Is bog turtle (Glyptemys muhlenbergii) habitat buried under 250 year-old sediment? Re-evaluating conventional wisdom concerning habitat loss**

The bog turtle (Glyptemys muhlenbergii) is federally listed as threatened under the United States Endangered Species Act and as critically endangered on the IUCN Red List. The primary cause of its endangerment is usually cited as habitat loss due to wetland draining. We argue that this mechanism of habitat loss is not correct. Based on recent re-evaluation of valley bottom geomorphology in the Piedmont of eastern North America, we propose that bog turtle habitat is virtually absent in the modern environment due to the construction of milldams during the 17th to 19th centuries. These dams flooded, and then buried with slack-water sediment, widespread Holocene valley bottom wet meadows, which likely were ideal bog turtle habitat. As these milldams breach, deeply incised single-threaded channels evolve. This stream morphology is the most common fluvial system across the mid-Atlantic Piedmont today, but does not create suitable bog turtle habitat. Historical records document the ubiquitous presence of milldams within the historic range of bog turtles. The clear mechanism by which these extremely common dams could impact bog turtle habitat is compelling evidence to re-evaluate their habitat loss. Realization that bog turtle habitat was buried not drained may yield a more successful approach for the restoration of its habitat. Correct identification of the causes of a species' habitat loss and consequent population decline is essential to plan appropriate conservation action.

**Boyce, Mark,** *University of Alberta*

**Grasslands in Alberta: Soil Carbon storage:**

For ICCB 2010 we identified a grasslands conservation site in southern Alberta to offset the carbon footprint for congress participants who travelled to Edmonton. An investment of $50,000 from the Society for Conservation Biology contributed to the purchase of the 390 ha Wild Rose Conservation Area by the Alberta Conservation Association and the Alberta Fish and Game Association. The grassland had been degraded by heavy livestock grazing but native grasses rebounded after cattle were removed from the property. Soil organic carbon was sampled at 28 sites in September 2010 and again in September 2012. Even though 2012 was a dry year, an increase of 5.59 Mg C per ha in soil organic carbon was documented between 2010 and 2012. This amounts to a total of 2,184 Mg C for the property during the first 2 years of the project. Current management appears to be sequestering carbon at rates that should allow us to meet our agreement target of 7,780 Mg C SOC stored over 20 years on the site. Alberta’s Wild Rose project demonstrates the efficacy of grasslands conservation for carbon sequestration and storage.

**Boynton, Walt,** *Chesapeake Biological Lab;* **C.L.S. Hodgkins***;***C. O'Leary***;* **E.M. Bailey***;* **A.R. Bayard***;* **L.A. Wainger,**

**Multi-decade responses of a tidal creek system to nutrient load reductions: Mattawoman Creek, Maryland USA**

We synthesized diverse monitoring and modeling data for Mattawoman Creek, Maryland, to examine responses of this tidal freshwater tributary of the Potomac River estuary to a sharp reduction in nutrient loading. Oligotrophication of these systems is not well understood; questions on recovery pathways, threshold responses, and lag times remain. Prior to load reductions Mattawoman Creek was eutrophic with poor water clarity (Secchi depth <0.5 m), no submerged aquatic vegetation (SAV) and large algal stocks (50-100 ug l-1 chlorophyll-a). A substantial modification to a waste water treatment plant reduced annual average nitrogen (N) loads from 30 g N m-2 yr -1 to 12 g N m-2 yr-1 and phosphorus (P) loads from 3.7 g P m-2 yr -1 to 1.6 g P m-2 yr-1. Following nutrient load reduction, NO2 + NO3, and chlorophyll-a decreased and Secchi depth and SAV coverage and density increased with variable initial response lag times. A N budget indicated: diffuse sources now dominate N inputs, estimates of long-term burial and denitrification were not large enough to balance the budget, sediment recycling of NH4 was the single largest term in the budget, SAV uptake of N from sediments and water provided a seasonal N sink, and the creek system acts as a N sink for imported Potomac River nitrogen. Finally, strong relationships were found between N loading and algal biomass and between algal biomass and water clarity, key water quality variables used as indices of restoration in Chesapeake Bay.

**Brader, Kathy,** *Smithsonian National Zoo;* **Ken Wesley**, *University of Vermont*

**Video graphic Study on Brown Kiwi (Apteryx mantelli) Juvenile Behavior in Captivity**

The kiwi, indigenous to New Zealand, is a small flightless bird that is unique in the bird world. Detailed studies of kiwi behavior are limited due to their nocturnal nature. Two juvenile kiwi chicks, named Hiri and Areta, were monitored using a video camera for approximately 24 hours a day for approximately two months. Primarily this study focused on the budgeting of 26 different behaviors during different time periods. Many of the behaviors such as feeding, drinking, and probing had similar totals, compared to behaviors such as aggression, stretching-body, and jumping, which Hiri participated in more often than Areta. Areta only participated in running more often than Hiri. Certain behaviors, such as pacing, running, and jumping, were often seen more frequently at certain time periods. Territoriality including changes pertaining to the individual and their size of territory were also noted as the experiment progressed. Through this study we have a better understanding of how kiwi spend most of their time and can make adjustments to their environments to accommodate their everyday lives in captivity.

**Bradshaw, Corey,** *The University of Adelaide;* **Thomas Prowse**, *The University of Adelaide;***Barry Brook,** *The University of Adelaide;* **Christopher Johnson**, *University of Tasmania*

**Human impact and carnivore extinction in the disrupted ecosystem of prehistoric Australia: the dingo absolved**

The extinctions of megafauna in human prehistory are generally ascribed either to overharvesting or intense climate shifts. In contrast, the disappearance of two medium-sized marsupial carnivores, the thylacine and devil, from mainland Australia during the late Holocene, has been attributed to the human-assisted invasion of a competing predator, the dingo. This popular wisdom potentially neglects the simultaneous effects of human 'intensification' (population growth and technological advances) and climate change (particularly, increased ENSO variability). We developed a dynamic model system capable of simulating the complex interactions between the main predators (humans, thylacines, devils, dingoes), their marsupial prey (macropods), human population growth and climate change in late-Holocene Australia. Using detailed scenario testing and sensitivity analysis, we identify human intensification as the most probable extinction driver. We conclude that the prehistoric impact of humans on Australian mammals was not limited to the late Pleistocene (i.e., megafaunal extinctions) but extended into the Holocene.

**Bragina, Eugenia,** *University of Wisconsin-Madison;* **Matthias Baumann**, *University of Wisconsin-Madison;***Volker Radeloff,** *University of Wisconsin-Madison;* **Anna Pidgeon**, *University of Wisconsin-Madison*

**Effectiveness of Russian protected areas before and after transition to post-socialism**

Protected area effectiveness is a keystone of conservation biology. However there is a lot of evidence of poaching and illegal logging in protected areas, especially during economic crises. A famous example of such a shock is the Soviet Union collapse, in 1991. Our objective was to estimate the effectiveness of Western Caucasus (Russia) protected areas before and after the collapse of the Soviet Union, as determined by the rate of forest harvest. The Western Caucasus includes Caucasus Nature Reserve (no development, no people allowed), and other protected areas with less strict regime (e.g., Sochi National Park). We used Landsat TM/ETM+ scenes from four time steps spanning 1985-2010 to create a land cover map for each period (forest, agriculture, grassland, barren), then analyzed change in proportion of the landscape in each cover class over time. We found that forest disturbance in the Western Caucasus between 1985-2010 was not very high- between 7-12%. Forest disturbance was lower inside of the Caucasus Nature Reserve than outside. Protected areas with less strict controls on human access had higher forest disturbance rates, likely due to illegal harvest. The least amount of forest disturbance occurred in the 1990s, a time when the timber industry was in chaos. It appears that Caucasus Nature Reserve effectively repelled illegal harvest, protecting the unique ecosystems of the Western Caucasus, even in the difficult transition period of the 1990s.

**Breckheimer, Ian,** *University of Washington;* **Meade Krosby**, *University of Washington;***Peter Singleton,** *USDA Forest Service Pacific Northwest Research Station;* **John Pierce**, *Washington Department of Fish and Wildlife;* **Brad McRae**, *The Nature Conservancy;* **Joanne Schuett-Hames,** *Washington Wildlife Habitat Connectivity Working Group;***Sonia Hall**, *The Nature Conservancy;* **Brian Cosentino,**

*Washington Department of Fish and Wildlife;* **Karl Halupka,** *US Fish and Wildlife Service;* **William Gaines,** *Washington Conservation Science Institute;* **Robert Long***, Western Transportation Institute, Montana State University*

**Do connectivity models based on "naturalness" capture important habitat linkages for focal species? A case-study from the Pacific Northwest**

Conservation planners typically use one of two strategies to reduce biological complexity in large-scale analyses: (1) limiting their taxonomic scope to a small number of species (the "focal species" or FS approach) and (2) evaluating conservation value based on the degree of human modification (the "landscape integrity", or LI approach). Currently we have little basis for determining which approach is most appropriate, particularly for assessments of habitat connectivity in data-poor environments. Here we use information from a data-rich region, the Pacific Northwest of North America, to evaluate both approaches to identifying lands important for vertebrate habitat connectivity. We compared expert-based least-cost-corridor dispersal models for 23 focal vertebrate species to a set of generic least-cost-corridor models based on human modification of the landscape. We found substantial spatial agreement between dispersal corridors identified using the FS and LI approaches but also key differences, especially in agricultural landscapes. We also identify some of the common traits of focal species that are well- and poorly represented by the LI approach. We contend that a combination of FS and LI approaches can overcome some of the pitfalls of using either in isolation.

**Breitburg, Denise,** *Smithsonian Env Res Ctr*

**Water quality impacts on living resources**

**Breitschwerdt, Edward,** *North Carolina State University*

**The changing ecology of bartonellosis**

Bartonella species comprise a genus of Gram-negative, fastidious, intracellular bacteria that are being increasingly implicated in association with a spectrum of disease manifestations in animals and human patients. Prior to 1990, bartonellosis was a disease, caused by Bartonella bacilliformis that was geographically limited to the Peruvian Andes. In North America, infection with Bartonella quintana and Bartonella henselae was first recognized in 1990 in immunocompromised individuals infected with the AIDS virus. Subsequently, over thirty Bartonella species and sub-species have been characterized and named. Globally, these vector-borne (biting flies, fleas, keds, lice, sandflies and ticks) bacteria reside in diverse ecological niches throughout the world, where they cause persistent intravascular infection in various mammalian reservoir host species (cats, cattle, coyotes, deer, and numerous rodents and other small mammals) and opportunistic infections in non-reservoir hosts (dogs, dolphins, human beings, whales and others). Bartonellosis, now caused by at least 17 Bartonella sp., is a global emerging infectious disease of animals and humans that can be acquired throughout much of the inhabited planet. From an ecological perspective, numerous domestic and wild animals have co-evolved with various blood-borne Bartonella sp. and with the respective vectors that transmit these bacteria among animal populations throughout the world. Inadvertent human infection can result in a persistent bacteremia, potentially lasting decades. People with frequent vector exposure and extensive animal contact (transmission by bites and scratches) are at increased risk of acquiring bartonellosis.

**Bricklin, Rachel,** *Fordham University;* **J. Alan Clark**, *Fordham University;***Brian Walker,** *Fairfield University*

**Bird migration through cities: urban stopovers are not more stressful.**

As urbanization increases, potential stopover sites for migratory birds are more likely to be found in cities. Previous research showed that birds do utilize city parks to rest and refuel and can successfully gain both fat and lean body mass in such habitats. However, little is known about how urban environments affect migrant physiology. In this study, we compared stress levels in spring and fall migrants at an urban stopover site to those in a nearby rural nature preserve. To quantify stress, we measured baseline and stress response levels of the glucocorticoid hormone corticosterone in blood plasma. Though some corticosterone can be beneficial in the short term, elevated levels of this hormone over a long period can be detrimental. Because urban parks contain many potential stressors to migrants such as frequent disturbance by humans, high levels of anthropogenic light and noise, increased resource competition, and abundant non-native plants and predators, we predicted that birds in the urban site would have higher baseline levels yet lower stress response increases of corticosterone than birds in the rural site. However, we found no difference in baseline levels or stress response increases between birds at these sites. These results further support the importance and value of city parks as migratory stopover sites.

**Bridges, Andrew,** *Institute for Wildlife Studies;* **Daniel Biteman**, *Institute for Wildlife Studies;***David Garcelon,** *Institute for Wildlife Studies;* **Melissa Booker**, *United States Navy;* **Jessica Sanchez**, *Institute for Wildlife Studies*

**Know thy enemy: Research towards understanding an invasive carnivore population and mitigating its impacts on threatened island endemics**

Because invasive species pose tangible and often immediate threats to native biota, we as conservation biologists may focus on control or eradication without understanding their ecology or functional roles in their adopted ecosystems. On San Clemente Island, California, feral cat (Felis catus) control has occurred for >20 years, but only recently have we formally investigated their ecology. A long-term dietary analysis revealed a strong preference for native rodents, transition to native reptilian and avian prey when rodents decline, and substantial cumulative impacts on the vertebrate prey base. We used GPS collars to determine home-range, habitat use, overlap with native species, and to evaluate population control efficacy. Cementum annuli age estimates and population reconstruction analyses revealed a relatively stable population with some individuals living >15 years. In addition to direct effects through predation, we found cats likely compete for resources in both time and space with endemic island foxes (Urocyon littoralis) and endangered San Clemente loggerhead shrikes (Lanius ludovicianus mearnsi). They are more robust to removal techniques than was previously thought, and individuals may persist for many years despite the seemingly harsh environment and intensive control program. Our findings provide insight into interactions with native species, allow us to evaluate the feasibility and possible cascade effects of eradication, and inform future conservation efforts.

**Brillant, Sean,** *Canadian Wildlife Federation;* **Patrick Nussey**, *Canadian Wildlife Federation*

**Canada's saltwater cities and marine biodiversity**

Canadian coastal urban centres (saltwater cities) may affect marine wildlife due to their dense populations, municipal effluents, large industries and coastal structures. This research examined the effects of coastal structures on intertidal biodiversity. Coastal structures change the near-shore habitat and have been shown elsewhere to modify the natural distribution of species and facilitate the introduction of exotic species. The abundance and diversity of intertidal organisms was measured at several scales in Halifax harbour on natural rocky shores and on a variety of artificial structures. We used univariate and multivariate methods to test if species diversity, species abundances, or the composition of their biological communities varied among types of shores. Although coastal structures differ physically from natural shores, there were only small differences in patterns of biodiversity. Spatial variation was generally larger than differences among shore types, but some effects of shore types were notable. Several species were absent from coastal structures (especially mobile species) but fast growing species were abundant. Surfaces of structures were also more completely colonized than natural shores. No invasive species were found. Results are presented to improve the knowledge of planners and regulators of the effects of new coastal structures on marine biodiversity and to guide new ways of construction that will maintain biodiversity.

**Brooks, Jeremy,** *The Ohio State University;* **Kerry Waylen**, *James Hutton Institute*

**Exploring Synergies and Tradeoffs in Outcomes of Community-Based Conservation Projects**

Community-based conservation (CBC) projects have been heavily promoted since the 1980s but they have been neither consistently successful nor free of controversy. One area of controversy is whether and in which contexts CBC produces win-win solutions or trade-offs among multiple desired outcomes. The prevailing opinion is that synergies are rare. Since the goal of CBC is to provide ecological, economic, and social benefits, it is important to understand when CBC succeeds in producing synergies. While numerous studies have explored the factors associated with individual outcomes (ecological success), far fewer have examined the factors associated with synergies between outcomes (ecological and economic success). Here, we use a comparative database of 136 CBC projects in 40 countries identified by systematic review to evaluate synergies in pairs of outcomes from four domains (attitudinal, behavioral, ecological, economic). We find that synergies are most common between behavioral and ecological outcomes and economic and ecological outcomes. Using logistic regression we also suggest that factors like capacity building, local participation, and social capital are associated with synergies between different pairs of outcomes. These results could help improve the design of CBC projects to increase the likelihood of synergies, but we caution scholars and practitioners to be aware of the spatial and temporal dynamics of synergies and trade-offs that are not captured in our study.

**Brooks, Thomas,** *IUCN;* **Stephen Woodley**, *Parks Canada;***Annabelle Cuttelod,** *IUCN;* **Diego Juffe**, *IUCN*

**Progress towards a standard for identifying significant sites for biodiversity**

In 2009, the IUCN WCPA and SSC convened a taskforce on 'protected areas and biodiversity'. One of its objectives was to consolidate a standard for identifying key biodiversity areas, drawing together progress in both conservation science and practice (e.g., IBAs, IPAs, AZE). The effort has had four main outputs. 1) Publishing a review of recent work. 2) Convening a 'framing workshop', which defined the standard as identifying "sites that contribute significantly to the global persistence of biodiversity", and highlighted five key issues requiring attention. (3) Establishing working groups to tackle these issues: a) consolidating criteria, spanning genetic, species, and ecosystem diversity, developing a decision-tree to guide delineation; b) consolidating thresholds, informed by comparison with formal calculation of irreplaceability; c) linking to the GOBI process for identification of marine EBSAs; d) developing case-studies of applications - many of which are in sectors beyond conservation; e) proposing governance mechanisms for interaction between data providers, IUCN, and end-user applications. 4) Convening regional consultations in India, Korea, New Zealand, South Africa, UK, and USA. The joint taskforce has been re-established for the 2013-6 quadrennium, in which priorities are delivering the results of the five working groups, completing the regional consultations, developing the data infrastructure to support the new knowledge product, and publishing the standards.

**Brotcorne, Fany,** *University of Liège;* **Nengah Wandia**, *Universitas Udayana;***Roseline Beudels-Jamar,** *Royal Belgian Institute of Natural Sciences;* **Marie-Claude Huynen**, *University of Liège*

**Demographic trends and Streptococcus outbreaks in a synanthropic population of macaques (Macaca fascicularis), Bali (Indonesia)**

The sympatric relationship between humans and primates is a contemporary widespread phenomenon. Several primate species are capable for exploiting human-modified habitats in association with people, but the most successful species in South-east Asia is probably the long-tailed macaque (M. fascicularis). The low predation pressures in zones of interface and the inclusion of human food in macaques' diet can lead to local overpopulations. On the other hand, the risk of epidemic disease is simultaneously increased by the high primate density and the proximity with human vectors. Data presented here represent 25 years-population dynamics of a long term commensal-living population of macaques in Ubud Monkey Forest (Indonesia). This population experienced a dramatic growth with an 11% annual increase rate. In June 2012, we counted 615 individuals divided in 5 groups with a very high density of 61 macaques per hectare. However, two Streptococcus outbreaks have also been reported over the same 25 years period, temporarily limiting the steep positive demographic trend of this population. The last epidemic event in July 2012 resulted in a 14% mortality affecting 3 out of 5 groups of the population. Besides the anthropic factors promoting population growth, epidemic diseases play a significant role in shaping the dynamics of this synanthropic population and could have important implications in the future both in terms of local management and local conservation status.

**Broughton, Kathy,** *NOAA;* **Steve Gittings**, *NOAA*

**Developing National Marine Sanctuary Condition Reports**

**Browne, David,** *Canadian Wildlife Federation;* **Matt Carlson**, *ALCES Group*

**Conservation planning in Canada's western boreal forest: Modeling and communicating cumulative effects of large scale resource development**

Planning for regional wildlife conservation in an area of intensive industrial development requires a strategic understanding of ecological and socioeconomic trade-offs associated with alternative land use options and effective methods for engaging the public in large-scale land use decisions. A stock and flow, spatially stratified model (ALCES) was used to conduct a scenario analysis of cumulative effects for a 693,345 km2 region in the Boreal and Taiga Plains ecozones of western Canada. This area contains the world's second largest oil deposit, nationally significant conventional and shale gas deposits, and an annual allowable timber harvest of over 26 million m3. The project assessed the long-term (50 year) implications of a range of land use scenarios to ecological and socioeconomic indicators. Scenarios assessed the influence of development rate and conservation strategies on indicators such as total anthropogenic footprint, moose habitat suitability, fisher habitat suitability, native fish population integrity, employment by resource sector, and gross domestic product. Results indicate both positive and negative impacts on wildlife from habitat alteration and loss, pollution, and human population increase and demonstrate the types of trade-offs that would be required to achieve wildlife conservation in the region. An online education tool is being developed to translate model results into a mechanism for engaging students and the public in conservation planning.

**Browne-Nunez, Christine,** *Nelson Institute for Environmental*

**A Novel Approach for Understanding Conservation Crime? Focus Groups as a Tool for Understanding Inclinations and Evaluating Interventions for Illegal**

**Bryer, Mark,** *The Nature Conservancy;* **Paula Jasinski**, *Chesapeake Environmental Communications, Inc.*

**Getting more for our money: integrating habitat restoration priorities in Chesapeake Bay**

Tidal and sub-tidal habitats in Chesapeake Bay provide numerous benefits to people and nature, including fisheries production, water quality improvement, and shoreline protection. Yet, collective efforts that maximize the benefits from restoration of critical habitats are lacking. The National Oceanic and Atmospheric Administration and The Nature Conservancy, in partnership with the states of Maryland and Virginia and other federal agencies, are undertaking an effort to identify the most important habitats for protection and restoration in the waters of Chesapeake Bay. We are focusing on distinct habitat types - including benthic habitats, tidal wetlands, shorelines, and oyster reefs - and are using existing and novel GIS analyses, statistical analysis, and expert input to develop a common spatial framework and clear prioritization of protection and restoration projects throughout the Bay. This integration will help identify areas of overlap, allowing multiple restoration and conservation efforts to be consolidated, and provide larger ecological benefits for the same investment. In addition, it will identify areas of the Bay where permit reviews may be more or less complex due to due to the distribution of Essential Fish Habitat.

**Bull, Joseph,** *Imperial College London;* **Ascelin Gordon**, *RMIT;***Elizabeth Law,** *University of Queensland;* **Kenwyn Suttle**, *Imperial College London;* **E.J. Milner-Gulland**, *Imperial College London*

**Achieving 'No Net Loss' of Biodiversity: How the Outcome of Conservation Interventions Depends upon the Choice of Baseline**

There is an urgent need to improve evaluation of the outcomes of conservation interventions. Evaluation requires both an objective and an ecological baseline to be specified. 'Biodiversity offsets' are increasingly widespread interventions that have a clear objective: 'no net loss' of biodiversity (NNL). We use offsets to analyze the effects of baseline choice on whether interventions meet stated objectives. We develop two complementary models. Our theoretical model evaluates the outcomes of idealized interventions under different ambient biodiversity trends. An empirical model of native grassland offsets in Australia translates these outcomes into a real-world scenario. Achieving NNL depends simultaneously upon baseline choice and biodiversity trends. Against a fixed baseline (biodiversity at some point in time), offsets are unlikely to achieve NNL for deteriorating ecosystems, but might for stable/improving ecosystems. But against relative baselines (that account for underlying trends), NNL is only plausibly achievable for deteriorating ecosystems. By extension, baseline choice determines conservation effort required. Uncertainty around compliance is a stronger determinant of success than uncertainty in underlying biodiversity trend. Finally, offsets can result in NNL for projects but not at landscape scale. Our results underline the importance of specifying clear conservation objectives (such as NNL) and ecological baselines, providing new insight on baseline choice.

**Burgess, Emma,** *University of Queensland;* **Martine Maron**, *University of Queensland;***Patrick Moss,** *University of Queensland;* **Murray Haseler**, *Bush Heritage Australia*

**Pyrodiversity versus biodiversity: the influence of mosaic burning on bird species richness across multiple spatial scales**

Wildfires and altered fire regimes continue to threaten global biodiversity. This has stimulated much research into the ecological impacts of fire and effective means of burning to maintain biodiversity focused on the broadly accepted paradigm that 'pyrodiversity begets biodiversity'. Much work has been carried out at the alpha diversity level in relation to the fire event. Uncertainty, however, remains regarding the relationship between beta diversity and the fire regime mosaic. Controlled burning for biodiversity conservation thus remains a controversial topic. We assessed the alpha and beta diversity of woody plants and birds in the sub-tropical woodlands of Australia. A systematic, nested hierarchical approach to sampling has been adopted in 28 study landscapes, selected to represent gradients in fire history. Preliminary results suggest a significant relationship between species richness of birds and the fire history at the site or alpha diversity level. Species richness at the landscape or beta diversity level was not significantly influenced by fire-mediated heterogeneity. Increasing habitat heterogeneity was associated with landscape level species richness of birds. Further analysis will allow insight into the relationship between fire-mediated heterogeneity and bird community composition. These findings will provide an understanding of the operational minimum level of spatial diversity, at appropriate spatial resolution for effective ecological fire management.

**Burgess, Jerry,** *Johns Hopkins University;* **Katalin Szlavecz**, *Johns Hopkins University;***Christopher Swan,** *University of Maryland, Baltimore County*

**Vegetation Dynamics and Mesophication in Response to Conifer Encroachment within an Ultramafic Edaphic System**

The biological and evolutionary significance of serpentine habitats has long been recognized in the ecological community due to the unique endemic flora in these areas of high local biodiversity. In this natural experiment we investigate the coevolution of requisite biotic (vegetation dynamics) and abiotic (bedrock and soil properties) variables that occur over an environmental gradient in the Mid-Atlantic, USA where multifaceted drivers and mesophication are accompanying afforestation on native serpentinite grasslands endangering local biodiversity and endemic species. Woodland vegetation history was inferred by depth profiling of shallow forest soils using stable carbon isotopes. Changing soil δ13C isotopic signatures in the forests and grassland/woodland ecotone record a history of afforestation. We use an integrated physiochemical dataset combining plot spatial data with temporal data from dendroecological tree cores to evaluate vegetation dynamics. Comparisons between geologic, pedologic and vegetation properties indicate broad correlations across the encroachment gradient. Data suggest that many former C4 dominated grassland areas that were first invaded by Coniferous species are now experiencing an increased dominance by Acer, Nyssa, and more mesic Quercus and Fagus tee species. This ecosystem, which took centuries to millennia to evolve, appears to be fading from ecological memory in a manner of a few decades.

**Burgman, Mark,** *University of Melbourne*

**Expert judgment and group decision making: the role of intelligence**  
Risk management in conservation is characterised by urgent decisions, large numbers of poorly understood threats and contentious and substantial global ramifications. While some data sets are extensive, few are complete and most are inadequate or absent entirely. Gaps are filled by expert judgments. Intelligence is insight that can be used to improve the quality of decisions in this context. This presentation outlines some of the most pervasive and manageable frailties of expert assessments in such contexts. It describes structured protocols that have been developed and tested over the last five years to improve the accuracy and calibration of expert judgments of facts. It outlines how judgments are supported by data, foresight activities and dedicated software designed to search efficiently for relevant open-source information. Lastly, the presentation outlines the application of methods designed to support conservation risk management to a project in geopolitical risk assessment sponsored by IARPA, the research arm of the US Intelligence Service.

**Burns, Catherine,** *San Francisco Bay Bird Observatory;* **Vanessa Tobias**, *University of California, Davis;***Cheryl Strong,** *U.S. Fish & Wildlife Service;* **John Takekawa**, *USGS Western Ecological Research Center;* **Emilio Laca**, *University of California, Davis;* **Christina Donehower,** *San Francisco Bay Bird Observatory;***Josh Scullen**, *San Francisco Bay Bird Observatory*

**Conserving San Francisco Bay's waterbirds: three decades in a rapidly changing landscape**

The San Francisco Bay estuary provides critical habitat for over one million waterbirds annually. Although the landscape has been altered for well over a century by increasing levels of urbanization, and by the historic establishment of evaporator ponds for salt production, it remains heavily used by waterbirds. The area also hosts the west coast's largest tidal wetlands restoration project; the South Bay Salt Pond Restoration Project is implementing a plan to convert thousands of acres of salt ponds into tidal and managed wetland habitat. While the restoration to tidal marsh will increase habitat for many species, it also will reduce the overall habitat available for waterbirds. Through adaptive management, the Project is committed to maintaining historic levels of waterbirds in this landscape. To inform these efforts, the USFWS, San Francisco Bay Bird Observatory, USGS and UC Davis have partnered to assess changes in bird population levels and community composition for nine waterbird guilds. Data collected during the early 1980s were compared with current data to identify significant changes that have occurred over 30 years. We identified significant increases in populations for some guilds, such as gulls, and declines at all or some locations for other guilds such as divers, terns and grebes. We provide recommendations for the Project's development and for future adaptive management to ensure abundant and diverse waterbird communities.

**Busch, Jonah,** *Conservation International;* **Kemen Austin**, *World Resources Institute;***Alessandro Baccini,** *Woods Hole Research Center*

**How much could Indonesia's moratorium on new oil palm and timber concessions reduce emissions from deforestation?**

Reconciling the global goals of food security and climate stability requires shifting agricultural expansion away from forests and other high-carbon landscapes and toward lower-carbon landscapes. In May 2011, Indonesia instituted a two-year nationwide moratorium on new oil palm and timber concessions in primary forests and peat lands to address its deforestation, which contributes 3.3% of global greenhouse gas emissions. Using new high-resolution data on annual deforestation across Indonesia from 2000-2010, we provide the first estimates of the causal impacts of agricultural concessions on deforestation. We estimate that on average the designation of an oil palm (timber) concession increased average annual site-level deforestation by 60% (110%) relative to a counterfactual scenario in which a concession had not been designated at that site. If Indonesia's moratorium had been in place from 2000-2010 then emissions from deforestation would have been 578 MtCO2e (8.3%) lower over that period. A reduction of equivalent magnitude could have been achieved using a nationwide carbon-pricing instrument at $2.05/tCO2e in a mandatory program or $9.40/tCO2e in a voluntary program. If Indonesia's national target of 26-41% emission reductions is to be achieved, the current scope of the moratorium must be expanded to include clearing in existing concessions or outside of concessions, or carbon-pricing instruments must be implemented.

**Buttrick, Steve,** *The Nature Conservancy*

**Conserving the stage: using geophysical units as coarse-filter targets in conservation planning for climate change**

In a project funded by the Doris Duke Charitable Foundation, The Nature Conservancy is evaluating the use of land facets to inform our traditional biodiversity based conservation priorities over 4 ecoregions (66.7M ha.) in the Northwest. We initiated this work asking: Which geophysical factors and what categorical breaks within factors best describe the distribution of ecological systems in the Pacific Northwest? Does the category selection influence how well existing biodiversity-based portfolios capture the diversity of land facets? Starting with the land facet classifications created by Schloss et al. we evaluated 9 geology vs. 9 soil categories; 3 vs. 4 slope breaks vs. a 5 category combination of slope and aspect; and 10 300m vs. 5 600m elevation breaks. Soil outperformed geology. The 3 slope and 2 elevation combinations performed equally well. A consideration when creating land facets using different classes is the number of potential facets. 3 slope breaks x 5 600m elevation breaks x 9 soil categories creates 135 possible land facets. 5 slope/aspect breaks x 10 300m elevation breaks x 9 soil categories defines 450 land facets. To evaluate whether the choice of slope and elevation breaks influences the ability of a biodiversity based portfolio to capture land facet diversity we created land facet maps using multiple combinations of slope, elevation and soil and looked at how well land facets are captured within the Conservancy’s biodiversity based ecoregion portfolios.

**Byamungu, Robert,** *Sokoine University of Agriculture;* **Michael Muganda**, *Sokoine University of Agriculture*

**New Record Of An Endangered Bird Species In The Vanishing Coastal Forest. A Call For Intervention To Save The Species And Its Habitat**

First sighting of endangered bird species Sokoke pipit was made in Msubugwe forest. The species was encountered during a survey to establish the bird list. One individual bird was sighted by eye with other three recorded through their calls. The forest where the species was recorded is one of few remaining evergreen coastal forests in eastern Tanzania. This forest as for other coastal forests in Tanzania is facing severe anthropogenic deleterious factors including tree cutting. This kind of exploitation has previously destroyed Vikindu that was one among evergreen coastal forests in the same region and was also known to host good population of Sokoke pipit. The species is now locally extinct in Vikindu area following disappearance of its habitats. The same 'missile' that lead Sokoke pipit to local extinction in Vikindu forest is now aiming at Msubugwe. Following habitat destruction in Msubugwe, patches that once held vibrant stands of native trees are currently being encroached by grasses and inhospitable woody habitats. These new emerging habitats are unwelcome to the Sokoke pipit and thus are placing the species at high risk of local extinction in the Msubugwe. As more than seventy percent of Msubugwe forest has been destroyed, protection measures are therefore needed to stop habitat destruction if the forest and the bird species are to persist. We recommend stringent control measures to stop tree cutting in the forest for conservation of the bird species and its habitat.

**Calabrese, Justin,** *Smithsonian Conservation Biology Institute;* **Chris Fleming**, *Smithsonian Conservation Biology Institute;***Thomas Mueller,** *University of Maryland;* **Kirk Olson**, *Smithsonian Conservation Biology Institute;* **Peter Leimgruber**, *Smithsonian Conservation Biology Institute;* **William Fagan,** *University of Maryland*

**A novel semi-variance approach to extracting multiple movement modes from animal relocation data**

Understanding the factors governing animal movement has long been a fundamental problem in ecology and conservation biology, and technological advances make it possible to explore this problem in ever more detail. Relocation data often consist of a complex mixture of different movement behaviors, and decomposing this mix into its component parts is a key challenge in movement ecology. Composite random walk models have been the main tools employed in analyses of multiple movement behaviors or "modes". They can, however, be difficult to fit to data, are often parameter rich, and they require that the timescale(s) governing the movement process is (are) reasonably close to the data sampling rate. Here, we show how the semi-variance function (SVF) of a stochastic movement process offers both an alternative approach to identifying multiple movement modes, and a solution the sampling rate problem. We describe how a family of continuous-space, continuous-time stochastic movement models, representing a wide range of behaviors, can be expressed in terms of their SVFs. We then connect these SVFs to relocation data via variogram regression and compare them using standard model selection techniques. We illustrate our approach using Mongolian gazelle relocation data, and show that gazelle movement is characterized by a slow, ballistic foraging mode with a 10 hour timescale, a fast, diffusive patch search mode with a 2 month timescale, and an asymptotic diffusion mode on longer timescales.

**Camaclang, Abbey,** *University of Queensland;* **Tara Martin**, *CSIRO Ecosystem Sciences;***Hugh Possingham,** *University of Queensland*

**What's in a name? Reviewing the concept and current practice of critical habitat identification for threatened and endangered species.**

Uncertainty in the definition and identification of critical habitats has been a source of controversy in the US and Canada. To address this issue, scientists have recommended that critical habitat be defined as the subset of habitat required for long-term viability or recovery of the species, with population viability as the criterion for identifying critical habitats. However, the extent to which these recommendations are followed in practice has not been evaluated. In this study, I address this knowledge gap by reviewing US Federal Register documents on critical habitat designation as well as Canadian Recovery Strategies or Action Plans, and using content analysis to identify the approaches used to identify critical habitats and the factors that influence their use. For the majority of the species in the study, critical habitats were identified based on locations known to be currently occupied. Where only a portion of known occupancy is identified as critical, selection of these habitats was often based on the disproportionate importance of sites for meeting species needs, or the consistent use or presence of the species. Findings from this review reveal that scientific recommendations for identifying critical habitats are not well implemented, likely due to the limited availability of data. In light of this, evaluating the effectiveness of alternative approaches will be useful in informing the debate on the validity of existing and proposed critical habitat designations.

**Campbell, Donna,** *University of Central Florida;* **Denise Delorme**, *University of Central Florida;***Linda Walters,** *University of Central Florida*

**Ecosystem Protection in the Indian River Lagoon Using a Community-Based Social Marketing Plan**

The Indian River Lagoon (IRL) system on the east coast of central Florida, one of the most biologically diverse estuaries in North America, is being impacted by growing urbanization and human behaviors. In particular, recreational motorized boating activity is threatening the habitat and its biodiversity. Keystone species (oysters, seagrasses, marsh grasses, and mangroves) in the area have been negatively impacted by boat propeller scars, boat strikes, eroded shorelines, and boat wake induced dead oyster reefs. Through collaboration with social scientists, we hope that a community-based social marketing (CBSM) program with innovative approaches to increase voluntary Ecologically Responsible Recreational Boating (ERRB) will help protect these habitats. Eco-sensitive zones in Mosquito Lagoon (northernmost IRL) warranting better protection have been identified using GIS and field reconnaissance, and will be used to create a smart phone navigational application to assist recreational boaters in identifying these zones. We are recording boating activity and shoreline erosion at highly impacted and ecologically-stable control sites before and after the CBSM program. We will analyze any changes in boater activity, erosion, reef death, or prop scarring following the CBSM program to determine its effectiveness in protecting the estuary from negative human impacts.

**Campbell, Steven,** *Albany Pine Bush Preserve Commission;* **Neil Gifford**, *Albany Pine Bush Preserve Commission;***Amanda Dillon,** *Albany Pine Bush Preserve Commission*

**Numerical response of the endangered Karner blue butterfly (Lycaeides melissa samuelis) to recovery efforts at the Albany Pine Bush Preserve**

Pitch pine-scrub oak barrens is a globally unique, fire-dependent ecosystem of the northeastern United States. The destruction, fragmentation, and degradation of this ecosystem has contributed to the decline of the Karner blue butterfly (Lycaeides melissa samuelis; KBB), which is dependent on the barrens in the northeastern portion of its range. One of the last naturally-occurring populations of this endangered species occurs at the Albany Pine Bush Preserve in eastern NY. State, private, and federal partners have been actively recovering the Preserve's KBB population by restoring >200 ha of habitat since 1992 and by accelerating the colonization of habitat through the annual release of locally-derived, captive-reared individuals since 2008. To evaluate the effectiveness of these efforts, we have been monitoring abundances of first and second brood adults annually since 2007 using distance sampling. Preliminary results suggest that recovery efforts are succeeding. The first brood increased from 900 to 1800 adults whereas the second brood increased from 600 to 3800 adults. These abundance estimates are likely conservative because occupancy surveys revealed that KBB were present in many other parts of the Preserve. While KBB abundance was above the recovery threshold for the Preserve in 2012, we continue to monitor KBB abundance to ensure that recovery is maintained and to document the effects of future recovery efforts and other long-term processes such as climate change.

**Canessa, Stefano,** *ARC Centre of Excellence for Environmental Decisions;* **David Hunter**, *New South Wales Office of Environment and Heritage;***Michael McFadden,** *Herpetofauna Division, Taronga Zoo;* **Gerry Marantelli**, *Amphibian Research Centre;* **Michael McCarthy**, *ARC Centre of Excellence for Environmental Decisions*

**Optimal release strategies for reintroductions: cost-e  
ffective wild and captive populations**

Within reintroduction programs for endangered species, releases of different life stages can influence both management costs and program success. We assessed the trade-offs between releasing eggs or sub-adults in the ongoing captive breeding program for the critically endangered Southern Corroboree frog Pseudophryne corroboree in Australia. We used population models and numerical optimization to identify the release strategies that would maximize the wild population whilst meeting budget constraints and accounting for parametric uncertainty and demographic stochasticity. We measured success as the number of individuals in the wild after ten years. We compared optimal strategies with fixed plans in which only either eggs or sub-adults were released at constant rates. The optimal strategies identified were predicted to provide outcomes similar to the best fixed plans for sub-adult releases, but were up to 75% cheaper, and to yield up to 500% more wild adults than the best fixed plans for egg releases for only a 72% average increase in cost. Releasing early life stages might represent a viable option for risk-seeking managers with strict budget constraints, whereas releasing later stages may maximize the probability of establishing a viable population but increase management costs. Simple optimization of release strategies can help managers address this trade-off, improving outcomes, decreasing costs and explicitly accounting for uncertainty and constraints.

**Carim, Kellie,** *University of Montana;* **Craig Barfoot**, *Confederated Salish Kootenai Tribes;***Lisa Eby,** *University of Montana;* **Matt Boyer**, *Montana Fish Wildlfie and Parks*

**Evaluating genetic theory for long-term conservation of isolated populations: A case study on cutthroat trout**

Isolation management is the most successful method of protecting cutthroat trout (Oncorhynchus clarkii) from invasive species. Yet, isolation may reduce viability and cause loss of genetic diversity. Theoretical models for maintaining genetic diversity in isolated trout populations recommend a minimum 8km of stream habitat based on population density and effective size. To test these models and inform management, we compared genetic diversity in cutthroat trout across populations in two connected and 12 isolated streams of the Flathead River Basin, Montana. As expected, isolated populations in smaller streams had lower genetic diversity. However, the amount of genetic diversity lost within isolated populations varied independently of time since isolation. To better understand of how genetic diversity changes through time, we also analyzed seven geologically isolated populations from the same river basin. These seven populations showed reduced heterozygosity, regardless of stream length. Furthermore, geologically isolated streams had significantly lower average heterozygosity compared to streams recently isolated by anthropogenic activities. These results demonstrate inevitable loss of genetic diversity in populations persisting in isolated systems, highlighting the need to explore prevention of inbreeding depression under isolation. Our study has direct implications for management of native trout of the Rockies, and for genetic theory applied broadly across taxa.

**Carino, Apolinario,** *PENAGMANNAKI;* **Angelita Morales,** *Silliman University Biology Department;* **Rene Villalon,** *PENAGMANNAKI*

**Why do hunters hunt? A case study on Negros Island, Philippines**  
Hunting in general has been considered a major threat to wildlife conservation worldwide. The effects of subsistence and sport hunting on the decline of game species on Negros and in the Philippines have not been considered as important as habitat loss and alteration. This study aims to assess the current extent and frequency of hunting; identify the game species, hunting methods employed and reasons for hunting; assess local knowledge and attitudes towards legislations and programs protecting the environment and wildlife; and formulate recommendations aimed at developing improved wildlife conservation strategies and determine priorities for follow-up studies. Structured interviews and questionnaires were made amongst 152 hunters in the hinterland areas throughout Negros Island either informally approached or in group discussions for the interview. From the 128 subsistence and 24 sports hunters interviewed, a total of 72 vertebrate species were hunted, six of which are reptiles, two amphibians, 19 mammals, and 45 are birds, using 17 different hunting gears. The reasons for hunting include; to augment their food supply, protect their crops, sport or recreation and hunting for pet trade. Of all species hunted, nine are considered threatened species on the IUCN Red List. Educating hunter groups and the establishment of more privately owned or community-based initiated and managed wildlife sanctuaries may assist in the conservation of wildlife throughout the Island.

**Carlson, Anne,** *The Wilderness Society;* **Travis Belote**, *The Wilderness Society*

**How is restoration different in an era of shifting climate? Lessons learned from a large-landscape, collaborative project in Montana.**

Ecological restoration (defined as the return of an ecosystem to its former or historic condition) presents many significant challenges to managers and conservation practitioners as the climate continues to shift and change across the globe, creating a need for substantial revision of working conceptual models, planning, strategies, tools, datasets, and monitoring paradigms if these projects are to succeed. Here, we review: (a) the types of challenges that managers and stakeholders are likely to face as they endeavor to address climate change and restoration simultaneously in large landscapes, and (b) examples of the ways in which integrated, multi-disciplinary approaches to conservation and management across geospatial scales can provide innovative solutions to these challenges. Our discussion stems from lessons learned during the first three years of work on a ten-year, collaborative restoration project across 1.5 million acres of the Crown of the Continent in Montana. We have found that: (a) efforts to incorporate climate change principles, datasets, and tools into restoration projects become most feasible when focusing on specific restoration priorities and objectives within a project; (b) incorporation of climate change scenarios into existing management tools is critically important in facilitating planning for restoration treatments; and (c) significant changes to all aspects of monitoring programs are necessary to create information feedback loops for managers.

**Carr, Sarah,** *NatureServe- EBM Tools Network;* **John Rozum**, *NOAA Coastal Services Center- EBM Tools Network;***Patrick Crist,** *NatureServe*

**Finding the Right Tool(s) for Coastal Climate Change Vulnerability Assessment and Adaptation Planning**

Natural resource managers and coastal communities have begun to plan for the impacts of climate change on their local ecosystems and infrastructure. Many of these processes and approaches require the use of geospatial analyses and tools to model and visualize the impacts of a changing climate on ecosystems and human infrastructure, explore the effects of potential management decisions, and conduct effective public engagement. The variety of tools and lack of information on them make it difficult for practitioners to select tools most suited to their needs and capacities. The EBM Tools Network has developed a guide to geospatial tools for assessing and reducing the vulnerability of coastal ecosystems and infrastructure to climate change. The guide provides information on a set of key tools for multi-sector climate-related planning (e.g. planning which incorporates both ecosystem health and human well-being concerns), explains and illustrates the utility and role of tools in planning, and helps practitioners select appropriate tools for their projects. This presentation will describe available tools and the capabilities, limitations, and requirements for use for these tools and will provide advice for practitioners on how to go about selecting the "right" tools for their climate change vulnerability assessment and adaptation planning projects.

**Carretero-Pinzon, Xyomara,** *Colombian Primatological Association;* **Thomas Defler**, *Universidad Naiconal de Colombia;***Manuel Ruiz-Garcia,** *Pontificia Universidad Javeriana*

**How does the Colombian squirrel monkey cope with habitat fragmentation?**

Fragmentation and habitat loss are the main threats of primates worldwide. Primate species with restricted diet and/or higher spatial requirements have more risk of local extinction due to fragmentation and habitat loss. The Colombian squirrel monkey (Saimiri sciureus albigena) is a small endemic primate species that is endangered due to its high space requirements and small distribution area. Home range and diet data for one group of this species was collected using slow scan sampling in a fragmented area in Colombian Llanos. Home range of squirrel monkeys in fragmented areas was less than half of the reported home ranges in continuous areas. However, their diet was similar when compared to data from continuous areas. Fence-rows (tree-lines used to separate adjoining pastures) connecting fragments were being used as part of their home range and as a food resource in months of less fruit productivity of the forest fragments. Therefore, these corridors were seen to be essential for the species survival as they help cope with the high spatial requirements in fragmented landscapes.

**Carroll, Carlos,** *KCCR*

**Shifting Baselines For Endangered Species Recovery: Do Conservation-Reliant Species Merit Delisting?**

Recent reviews of the “conservation-reliant species” concept have proposed that human intervention in ecosystems is now so pervasive that we cannot realistically recover self-sustaining populations in the wild for the majority (e.g., 84%) of species. Some proportion of listed species may indeed require long-term intensive management, especially in light of twenty first century threats such as invasive species and climate change. However, applying the conservation-reliant paradigm to the majority of listed species represents an effort to fundamentally revise the normative basis for the ESA. Shifting the threshold of feasibility to allow delisting of conservation-reliant populations lowers the likelihood that delisted populations will meet other common recovery standards such as resiliency, redundancy, and representation. Such a change would shift the focus of the Services from achieving the broader goals of the ESA towards assisting non-federal agencies as “zookeepers” of narrowly-distributed populations. The normative debate as to whether a species should be delisted before acheiving a self-sustaining population should be informed by both the statute and the biology of the particular species. We use a case study on population connectivity restoration to propose a method for categorizing threatened species into four types of conservation reliance in order to better inform discussions on the tradeoffs inherent in accelerated delisting of threatened species.

**Carter, Eleanor,** *RARE*

**Building capacity and constituency to achieve conservation results: Protecting near-shore fisheries for people and biodiversity in the Philippines and Indonesia**

Fishing communities throughout the world now face the imminent threat of fisheries collapse. Although marine protected areas have demonstrated positive biological impacts, the acceptance, adherence, and enforcement of these areas are a socio-economic challenge. Rare is tackling this challenge by training local leaders and partners to use social marketing coupled with a strong conservation research framework in near-shore fishing communities across the Philippines and Indonesia. The impact of each campaign on the knowledge, attitudes, and support for marine conservation as well as key metrics associated with behavior change, enforcement, and reef health are monitored before, during, and after each campaign. Preliminary analysis of sites in the Philippines found 7/12 campaign sites with significant changes in knowledge, attitudes, behavior, and enforcement along with a mean 38.8% increase in fish biomass. Results from Indonesia demonstrate similar progress with mean increases in knowledge and attitudes greater than 20 percentage points post-campaign, significant changes in behavior and biophysical response at 5/10 sites. This analysis provides support for the role of community leaders and behavior change in developing appropriate fisheries management highlights the critical intersection of science, communication, and management needed for effective conservation.

**Castillo, Jessica,** *Oregon State University;* **Clinton Epps**, *Oregon State University*

**Landscape genetics of American pika at Crater Lake National Park, Oregon: evaluating the use of Mantel tests in a causal modeling framework**

The use of landscape genetics in conservation biology has increased in popularity because it provides a robust framework for evaluating hypotheses relating landscape to population connectivity. The appropriateness of Mantel tests, a standard method for evaluating correlation of genetic and ecological distances in such studies, has been questioned. However, few suitable alternatives have been proposed and rigorously evaluated. We use Mantel and partial Mantel tests in a causal modeling framework to evaluate the correlation between gene flow and landscape variables with American pikas (Ochotona princeps) in Crater Lake National Park. To assess whether this method correctly identifies the underlying relationship between landscape and gene flow, we followed with a population genetics simulation study that incorporated landscape resistance into individual dispersal probability. The results suggest that while it is difficult to distinguish among landscape resistance hypotheses that are highly correlated, the causal modeling approach is able to correctly identify the underlying relationships even with complex landscape hypotheses. We conclude 1) this approach is robust and 2) gene flow in pikas in Crater Lake National Park appears to be impeded by topographic relief and, to a lesser degree, south facing aspects. This study improves our ability to predict future effects of climate change on population connectivity of the American pika, and ultimately population vulnerability.

**Cattarino, Lorenzo,** *Griffith University*

**Systematic planning beyond conservation: a multi-objective, multi-action framework for freshwater biodiversity conservation.**

Despite their high biodiversity value and role in providing important services to different stakeholders, freshwaters are among the most threatened and modified environments on the planet, and require immediate conservation action. As threats to freshwater systems are diverse and spatially heterogeneous - while resources for conservation are finite - it is critical to identify priority management actions, as well as where these should be implemented, especially dealing with financial and socio-economic constraints. Unfortunately, traditional conservation planning does not identify the specific actions required to meet a particular conservation target, and rarely considers the cost and socio-economic impacts of multiple actions. We developed a framework for prioritizing different management actions, while minimizing costs and socio-economic impacts. We implemented the framework by combining distribution models for a suite of freshwater dependent species (fishes, turtles and water birds) with optimization techniques based on the functional response of species to different management actions. We applied the prototype framework within the Daly River catchment, in the Northern Territory, Australia. The framework allows the spatial allocation of different management actions, by including both ecological and socio-economic objectives. It therefore represents a novel approach that will greatly improve the effectiveness of freshwater biodiversity management and conservation.

**Caudill, S. Amanda,** *University of Rhode Island;* **Thomas Husband**, *University of Rhode Island;***Fabrice DeClerck,** *Biodiversity International*

**Assessment of Coffee Agroforestry as Habitat for Mammals: Sustainable Conservation Strategies for Biodiversity Protection**

Coffee agroforestry is a conservation strategy that has shown promise to support the diversity of bird, bat, and insect communities, but few studies have focused on terrestrial mammals in coffee farms. We surveyed mammal diversity in three coffee-forest landscapes of Costa Rica. Each site contained a 25-ha trap grid and was sampled in four sessions with a total of 46 sampling nights per site. We captured 1,258 mammals (600 of individuals) and recorded 16 species, with track plates and camera traps yielding an additional three species. In general, we found forest habitats to have greater richness and abundance of mammals than shade coffee, which in turn had more species and higher abundances than sun coffee habitats. The species richness within shade coffee rivaled that of the nearby forested areas, suggesting that shade coffee may be a complement to, although not a substitute for, native forests. Habitat type was significantly associated with abundance and richness, but the distance to forest was not. Increased amounts of shade canopy and herbaceous ground cover within the habitats were shown to significantly increase the mammal abundance and richness. Within coffee habitats, higher amounts of canopy cover within coffee farms was the influencing factor for higher abundance and species richness of mammals. Our results indicate that mammals should be included in the list of taxa that benefits from the increased canopy cover and vegetation complexity that shade coffee provides.

**Cawthorn, Michelle,** *Georgia Southern University;* **Eleanor Sterling**, *Center for Biodiversity and Conservation;***Ana Luz Porzecanski,** *Center for Biodiversity and Conservation;* **Adriana Bravo**, *Center for Biodiversity and Conservation;* **Nora Bynum**, *Nicholas School for the Environment;* **Laurie Freeman,** *Fulton-Montgomery Community College;***Stuart Ketcham**, *Division of Science and Mathematics;* **Tim Leslie,**

*Long Island University;* **John Mull,** *Weber State University;* **Theresa Theodose,** *University of Southern Maine;* **Donna Vogler***, State University of New York at Oneonata*

**Student Interpretation of Conservation Data: Does their Reach Exceed their Grasp?**

This study examined how well undergraduate students can develop data analysis skills relevant to conservation biology over the course of a single semester. Students completed two conservation data analysis exercises, pre and post self-assessments of confidence in data analysis skills, a classroom discussion, and pre/post content assessments. Between the first and second exercises, a data analysis teaching intervention was administered in all classes. Instructional and assessment materials were created and validated by 24 conservation educators led by the Center for Biodiversity and Conservation at AMNH. Results from one semester (100+ students) show that students scored significantly higher on post-content assessments for both exercises. We also found significant increases in student self-assessment of confidence in data analysis skills. However, when evaluated at the level of different skill dimensions, students' ability to represent and interpret data improved between exercises, but ability to complete calculations and draw conclusions was significantly worse on the second exercise. While our study demonstrates that direct instruction in data analysis does improve student performance overall, there is a disconnect between student self-assessment of their data analysis skills and their actual ability. This indicates that some aspects of data analysis may require different teaching intervention approaches.

**Celi, Jorge,** *Michigan State University;* **Stephen Hamilton**, *Michigan State University*

**Erratic Floods in Large River Floodplains of the Andean Amazon Region: Management and Conservation Implications**

Scientific understanding of neotropical floodplains comes mainly from work on large rivers with predictable seasonal flooding regimes. Less studied rivers and floodplains on the Andean-Amazon interface have multiple and more erratic regimes. Ecological roles of floodplain inundation differ in those ecosystems and have implications for animal and plant communities, and human activities. The goal of this study was to understand the hydrological interactions and habitat diversity of the Napo River, a major Andean tributary of the Amazon that drains exceptionally biodiverse foreland plains. This river system is envisioned by developers as an industrial waterway that would require hydrological alterations and affect floodplain ecosystems. Water level regimes of the Napo River and its associated environments were assessed using networks of data loggers that recorded time under water across transects extending inland from the river. These networks also included rising stage samplers that collected flood water samples for determination of their origin based on chemical composition. We found that wetlands along the river corridor exist across a continuum from strong to absent river influence, and are extrapolating this information to the whole area through remote sensing to better assess the extent and diversity of flooded environments. This research is improving the understanding of Andean Amazon ecosystems with implications for their sustainable management and conservation.

**Cerveny, Kassandra,** *Coastal States Organization*

**Wishing for Sessile Whales - Policy Considerations for Real World Marine Mammal Conservation**

When coastal and marine issues cross geo-political boundaries, effective management relies on conservation tools that are also multi-sector and cross-jurisdictional. As the conservation efforts for wide-ranging species are fundamentally different than that of other marine resources, so must the management efforts. Whether working across local, state and/or federal governments, inclusion of non-traditional conservation sectors and interests will only strengthen the success of management efforts. Multi-stakeholder involvement can bring disparate, and even disinterested, constituencies to the table to address management needs to find a compromise that meets the needs of all interested resource users while protecting the actual marine resource (e.g. marine mammals). Recent regional collaborations led by state governors specifically to address cross-jurisdictional coastal and marine issues provide a convening authority to bring stakeholders and multiple levels of government together. This ultimately results in benefitting both the economy and the resource base upon which it is built. These partnerships demonstrate the efficacy and efficiency of collaboration between stakeholders and federal, state, local and tribal governments.

**Chades, Iadine,** *CSIRO*

**The organisation of social networks for the optimal management of ecological networks**

While recent work on conservation or management of biodiversity in ecological networks has focused on calculating management rules, it has ignored the complexity of the management decision making process. The most urgent conservation problems often need coordinated action at regional, landscape or even global scales, necessitating the collaboration of several actors. While co-ordination of management actions is often viewed as desirable or even necessary, coordination is a non-trivial task that comes at a cost that needs to be accounted for in relation to the benefits it provides. Time and resources may not be readily available when managing threatened species under limited budgets; late decision making or insufficient funding risks extinction. Furthermore, the possible joint activities for any actor is constrained by whom the actors are able to interact with, i.e. their social networks. We determine the best performing social networks to optimally manage Susceptible-Infected-Susceptible ecological networks. We identify several distinct motif networks and use advanced stochastic dynamic programming methods to account for the uncertainty surrounding the ecological dynamics, the constraints imposed by different patterns of social interactions, and the cost of collaborative decisions. We provide a method for determining the best collaborative strategy given a social network to best achieve our objective on an ecological network.

**Chan, Fang-Tse,** *Endemic Species Research Institute,*

**Wildlife Release and Life Education Programs of Wildlife First Aid Station**

The Wildlife First Aid Station started to cooperate with the Bliss and Wisdom Buddhist Foundation in wildlife release program since October 2011. Before releasing the fully recovered wildlife, votaries participated in the interpretation of wildlife rescue and rehabilitation, the rescue story, and scientific information about the animal. We also provided a life education program for the votaries and their families. Through the end of 2012, we held 66 activities in which 4174 persons participated. According to the feedback received, they learned the correct way of respecting life and how our station treated wildlife.

**Chao, Ning,** *Bio-Amazonia Conservation International;* **Beth Polidoro**, *Arizona State University;***Kent Carpenter,,** *Marine Biodiversity Unit, IUCN,;* **Chih-Wei Chang**, *National Museum of Marine Biology & Aquarium;* **Manuel Haimovici**, *Universidae Federal do Rio Grande;* **Min Liu,** *Xiamen University;***Yvonne Sadovy de Mitcheson**, *Hong Kong University;* **Monica Peres,**

*Ministry of Environment*

**Diversity and risk of extinction of Sciaenidae (Pisces; Perciformes) and Results of IUCN Red List Assessments**

Sciaenidae (croakers & drums) are a major capture fishery resource from tropic to warm temperate coasts, estuaries and river basins worldwide. World fishery productions of croakers have reached near two million metric tons in 2010 (FAO). Three distinct phylogeographic regions of sciaenid fishes, New World, East Atlantic and Indo-West Pacific are defined. The New World has the richest species diversity (~170 species), while the East Atlantic (including the Mediterranean) the poorest with 18 species. Under the auspice of IUCN, the first global assessments of the risk of extinction for 280 sciaenids were completed. Twenty-three species (8.2%) are catalogued as threatened; four are Critically Endangered (CR-1.4%), six Endangered (EN-2.1%), five Near Threatened (NE-1.8%), and seven Vulnerable (VU -2.5%). The rest 172 species were considered Least Concern LC-61.4%), 81 Data Deficient (DD - 28.9%) and five were Not Evaluated (NE?1.8%). In country (regional) Red List Assessment are common; 52 Brazilian sciaenid species were reviewed (2012), which includes one EN (1.9%), two NE (3.8%), 35 LC (67.3%), 12 DD (23.1%) and two Not Applicable (3.8%). The Chinese Red Book (2009) included 4 EN (10.5%) and 15 VU (39.5) out of total 38 Chinese sciaenids. The discrepancies on distributions of categories may be due to differences in applying IUCN criteria at regional or national assessments. It may also reflect that the risk of extinction is more severe in certain regions.

**Charles, Kerry,** *Center for Biodiversity & Restoration Ecology, Victoria University of Wellington;* **Wayne Linklater**, *Center for Biodiversity & Restoration Ecology, Victoria University of Wellington*

**Tolerating, and planting for birds: Avian-human conflict in New Zealand**

Human-wildlife conflicts are increasing worldwide yet their management is critical to maintain public support for conservation, particularly in urban areas where residents have limited opportunity for positive wildlife interactions. Since more negative attitudes to wildlife may lead to reduced support for biodiversity conservation, it is important to understand the relationship between city dwellers' attitudes to wildlife and their experience of wildlife problems. In Wellington City, New Zealand, human-wildlife conflict is emerging due to damage caused by North Island kaka, a threatened endemic parrot. We conducted a household survey of Wellington residents and used an Information-Theoretic approach to multi-model selection and inference to investigate the relationship between residents' biodiversity awareness and wildlife engagement and their attitude to birds and bird-related problems. Planting trees to attract birds was the only predictor to provide substantial inference for attitude (ωi = 0.873) and engaging with birds by planting moderated the negative relationship between experiencing a problem and attitude towards birds. Hence attitude to birds and tolerance to problems may be most closely associated with a person's experience and engagement with birds rather than negative experiences. Management of human-wildlife conflicts should integrate social behaviour change with more traditional ecological approaches to wildlife conflict management.

**Chassot, Olivier,** *Tropical Science Center;* **Graeme Worboys**, *Jagumba Consulting;***Bernal Herrera Fernández,** *Tropical Agricultural Research and Higher Education Center-CATIE;* **Linda McMillan**, *McMillan Associates - Business Consulting;* **Ian Walker**, *Parks Victoria;* **Rod Atkins,** *Commonwealth Marine Reserves Operations Section*

**A new global platform: UICN's International Connectivity Conservation Network**

A connectivity conservation approach recognizes that conservation management is needed on the lands around formal protected areas to buffer them from threatening processes originating off-reserve and to care for biodiversity assets found on other land tenures. The International Connectivity Conservation Network (ICCN) is a World Commission on Protected Areas (WCPA) voluntary network of individuals and organizations working on individual terrestrial and marine large-scale connectivity conservation projects and initiatives around the world. It works on a voluntary basis and primarily aims to provide information, share knowledge and offer assessment in order to foster the preservation, protection and promotion of connectivity conservation in the face of climate change's challenges to conservation and sustainable development. The ICCN seeks to benefit its members by providing current information on connectivity conservation management and highlighting and sharing best practices based on its member's actions in the field of connectivity conservation on a large-scale. Membership is open to large-scale connectivity conservation managers, researchers, other professionals and community group representatives working on connectivity conservation initiatives. Achieving conservation outcomes across the landscape matrix involves active management, policy support and conservation outcomes in an integrated way across a range of land tenures.

**Chassot, Olivier,** *Tropical Science Center;* **Guisselle Monge Arias**, *Tropical Science Center*

**Bird conservation across borders in the El Castillo-San Juan-La Selva Biological Corridor, Nicaragua-Costa Rica**

In Mesoamerica, the endangered Great Green Macaw (Ara ambiguus) highly depends on Dipteryx panamensis for feeding and nesting, and on adequate, intact forest habitat. As migrating species are not limited by borders, the successful establishment of the El Castillo-San Juan-La Selva Bi-national Biological Corridor between Nicaragua and Costa Rica has been and remains essential for the conservation of the Great Green Macaw: it is the center piece of an altitudinal north-south gradient that contributes to mitigate the climate change effects on ecosystems. The Tropical Science Center and Fundación del Río took a leading role in the consolidation and implementation of cross-border alliances and nature conservation activities through a campaign that focuses on promoting the awareness of the ecology and conservation of the Great Green Macaw in the lowlands of the San Juan River. The main results to date have been the understanding and concern of stakeholders regarding the challenges faced by the Great Green Macaw, and a positive shift in land use change dynamics at the landscape level. In 2006, The Agua & Paz Biosphere Reserve was created in Northern Costa Rica, with the ultimate aim at establishing a transboundary Biosphere Reserve. Data from a 2009-2010 census show that the population of Great Green Macaws has increased along the conservation actions that have been undertaken since 1994 in order to protect the habitat of the Great Green Macaw.

**Chatwin, Anthony,** *NFWF, former TNC*

**Priorities for coastal and marine conservation in South America: Five years later**

In 2007, we compared threats and the state of protection of marine ecoregions across South America. Our review focused on some of the most populated coastal countries on the continent, including Brazil, Chile, Colombia, Ecuador, Peru and Venezuela. The primary threats identified were fisheries, pollution and urban development. The Nature Conservancy, national governments, USAID and other supporters developed conservation planning in each of these countries using consistent methodology which allowed cross-ecoregional comparisons. Though some progress has been made in threat reduction, in the establishment of new protected areas, notably in Chile and Ecuador, and the creation of a ministry of fisheries in Brazil, much work remains to be done. With growing understanding, we also propose new opportunities for 2013 in marine conservation across South America.

**Chaudhary, Anand,** *SUNY College of Environmental Science and Forestry;* **Khadananda Paudel**, *Bird Conservation Nepal;***Richard Cuthbert,** *Royal Society for the Protection of Birds;* **Bhupal Nepali**, *Bird Conservation Nepal;* **Ishwari Chaudhary**, *Bird Conservation Nepal;* **Hirulal Dangaura,** *Bird Conservation Nepal;***Krishna Bhusal**, *Bird Conservation Nepal*

**Piloting Vulture Safe Zone in Nepal as an integrated approach to conserving Asia's critically endangered vultures**

Since the early 1990s South Asian vultures have declined dramatically and four species are listed as critically endangered in the IUCN BirdLife Red List. The primary cause of decline has been identified as the veterinary drug diclofenac. In Nepal, Vulture Safe Zone has been created covering 39,212 square kilometers as an integrated approach to vulture conservation involving advocacy, sensitization, exchange of diclofenac with vulture safe drug meloxicam, provision of safe food and collection of pledge from veterinarians through community based approach. This approach is being supplemented through captive breeding, monitoring vulture colonies, vulture arrival at safe feeding sites and, knowledge and drug use practice of veterinary community. We recommend that Vulture Safe Zone approach is the way forward for in-situ conservation of these critically endangered raptor species.

**Chavanich, Suchana,** *Chulalongkorn University;* **Voranop Viyakarn**, *Chulalongkorn University;***Chalothon Raksasab,** *Chulalongkorn University;* **Pataporn Kuanui**, *Chulalongkorn University;* **Kenji Iwao**, *Akajima Marine Science Laboratory;* **Makoto Omori,** *Akajima Marine Science Laboratory*

**Restoration of reefs around Sattahip, Chonburi Province in the upper Gulf of Thailand**

Coral reefs in Sattahip, Chonburi Province in the upper Gulf of Thailand have been declined in the past years due to both anthropogenic activities and natural disturbances. Thus, several techniques both sexual and asexual propagations have been introduced to restore some reefs in the area. Asexual propagation including transplantation of fragments and whole coral colonies were used. In addition, mass coral cultivation using sexual reproduction technique (eggs and sperms were collected and fertilized) was also initiated. At present, more than 10 species of corals could be cultured through sexual propagation technique. The results from the coral fragment study showed that within 1.5 years after transplantation, some transplanted fragments of genus Acropora started developing gametes. From the long term monitoring, there was no difference in the numbers of fish species and the groups of macroinvertebrates found between 2- year transplanted, 8-year transplanted, and natural coral areas. Thus, the transplantation allows invertebrates and fish to colonize and utilize the transplanted corals as a habitat.

**Che-Castaldo, Judy,** *National Socio-Environmental Synthesis Center;* **Maile Neel**, *University of Maryland, College Park*

**Predicting population extinction risk based on biological traits and anthropogenic threats**

The rapid growth of human populations and the resulting increase in human activities have led to an accelerated rate of biodiversity loss. However, contributions of specific anthropogenic activities (e.g., urban development, pollution) to the rate of species extinction have been difficult to determine, in part due to lack of a standardized system for classifying anthropogenic threats. I developed a hierarchical threat classification scheme by combining and modifying existing schemes to categorize actual threats for all plant and animal species listed under the U.S. Endangered Species Act. I then tested this scheme on a set of plant species for which there are published demographic data, and estimated population growth and extinction risk for these species. Using tree-based statistical analyses, I found that particular threats, such as non-native species and harvesting for resource use, were associated with lower population growth rates than other threats. Biological traits such as life form and small population size also affected demographic rates. However, high within-species variation resulted in relatively low model accuracy, and relationships depended on the level of specificity of threat classification. Implementation of the threat classification scheme will allow more standardized reporting of threats in recovery plans, and quantifying relationships between threats and extinction risk will help inform management goals for species facing particular threats.

**Chelliah, Karpagam,** *Centre for Ecological Sciences;* **Raman Sukumar**, *Centre for Ecological Sciences*

**How many Asian elephants are killed illegally for ivory and in conflicts? A matrix modeling exercise of populations with varying sex ratios in India**

The illegal killing of elephants, both for ivory and as a result of elephant-human conflicts, is of serious conservation concern. While rates of illegal harvest of the African elephant have been well documented, the same is not true of Asian elephant populations in which only males may carry tusks and are targeted for ivory, resulting in artificially skewed sex ratios. We adapted Jensen's (2000) 2-sex, density-dependent Leslie matrix model to infer harvest rates of Asian elephant populations at several sites in India from field data of three population parameters, namely, adult (>15 years) female to male ratio, male old-adult to young-adult ratio, and proportion of adult males in the population. We applied this model to several populations exhibiting adult sex ratios varying from about 1:2.5 to 1:60. Mortality rates in adult male elephants were enhanced by only 17% due to illegal killing in populations such as Kaziranga in the northeast, not much affected by ivory poaching because >50% of bulls are tuskless. In contrast, southern Indian elephant populations where tusked bulls constitute >90% of male phenotype showed enhanced adult male mortality by over 300% at places such as Periyar. When results from the six sampled sites are extrapolated across the country, our model indicates that about 125 adult male elephants have been killed annually on average for ivory and in conflicts since the 1980s. Ivory poaching has however declined noticeably in the past decade.

**Cheng, Li-Yi,** *Bliss & Wisdom Group, Taiwan*

**Life Conservation, Mind Cultivation**

The Bliss & Wisdom Group is a Buddhist community in Taiwan that promotes organic cultivation and implements the empathy-and-appreciation concept for farmers and consumers through collect-and-sell organic produce. Being organic can be the solution for conserving endangered species, habitats, catchment of soil, and water. The Group releases life-threatened animals in a ritual that protects them from harm and applies the teachings of Buddha that underscore compassion for sentient beings. To avoid adverse impacts that occur when animals are released inappropriately, the Group partners with various conservation institutions including the Wildlife First Aid Station of Endemic Species Research Center and the National Museum of Marine Biology and Aquarium.

**Cheung, William,** *University of British Columbia*

**Projecting climate change impacts on conservation of marine species**

Climate change is causing changes in distribution, phenology and body size of marine fishes and invertebrates, potentially affecting the conservation of marine species, particularly those that are already threatened by other human activities. Using ensemble of outputs from species distribution models, climate models and scenarios, we projected future changes in distribution of exploited marine fishes and invertebrates as well as species that were threatened by fishing activities globally and in specific regions. Changes in habitat suitability in marine protected areas were assessed for these species. Moreover, changes in range area and the degree of overlap between commercial and threatened species ranges was calculated as a proxy of the potential threat posed by overfishing through bycatch. Furthermore, the potential interactions between reduced species abundance from overfishing and responses to climate change were investigated. The ensemble projections suggest shifts in species distribution poleward and into deeper waters, resulting in changes in range overlap between threatened and commercially exploited species, and the habitat suitability of existing protected areas. Fishing is expected to exaggerate impacts of climate change on exploited marine species through reduction of their adaptive capacity. The adverse consequences of these changes on conservation of marine species vary between regions. Although the models show large variation in the predicted consequences of climate change, the multi-model approach helps identify the potential risk of increased exposure to human stressors on threatened species.

**Choudhury, Arpita,** *Association of Fish and Wildlife Agencies;* **Amber Pairis**, *California Department of Fish and Wildlife*

**We Are All In This Together: Partnership as the Backbone of Climate Adaptation in the United States**

The challenges for natural resources manager are both complex and costly ones. Increasing temperatures, rising sea levels, and increased frequency of extreme weather events as well as other impacts such as habitat fragmentation, invasive species, and disease require collaboration among conservation partners in order to leverage resources for a more informed and coordinated response. Partnership as a mechanism for conservation is not a new concept but climate change poses some unique challenges which require consolidated efforts to fill knowledge gaps and define management actions on the ground. In the United States, state fish and wildlife agencies are charged with managing fish, wildlife, and their associated habitats for the country. Assisting fish and wildlife to adapt to a changing climate is a new addition to the charge. The challenges of climate change and its associated impacts are currently being addressed by state agencies and their conservation partners through collaborative partnerships and innovative solutions that help overcome the barriers of funding, lack of capacity, and knowledge to ensure that the best available climate science is being used in adaptation efforts. The proposed presentation will highlight different aspects of state fish and wildlife adaptation activities and the need for collaboration and partnership across disciplines to help reduce the impact of climate change on fish and wildlife and their associated habitats.

**Christie, Patrick,** *University of Washington*

**Creating Space for Interdisciplinary Research and Translation**

Important changes are needed to disciplinary theories and methods to support interdisciplinary and integrated ocean and coastal management policies and implementation. This review argues that theories and methods should conform to a perspective that ocean management is a societal activity with diverse goals ideally informed by interdisciplinary information. The review focuses on the integrated coastal management (ICM) and marine ecosystem-based management (EBM) frameworks and the marine protected areas (MPA) management tool. It begins by suggesting that at present there is a notable imbalance in the degree of effort allocated to monitoring the ecological and social dimensions of ocean resource use and policy processes. Based on how Western society and an influential epistemic community construct ‘the environment’ and society’s relation to the environment, natural sciences play an inordinately important role in the description of the problem and policy recommendations. The discourse advocating for a global networks of marine protected areas, without adequate consideration of society impacts and responses, represents an example of this imbalance. The analysis concludes with suggestions for balancing ocean and coastal interdisciplinary research and reframing key issues, creating self-reflexive and multidisciplinary research teams, and reworking educational programs.

**Church, Don,** *Global Wildlife Conservation*

**Designing a global network of protected areas for threatened amphibian species**

Over 800 Threatened amphibian species occur entirely outside the world’s network of protected areas. Many of these species are extremely range-restricted and thereby especially vulnerable to loss of habitat. At the pinnacle of extinction risk are over 300 species that occur only within single sites. To date, there has been no initiative aimed at protecting habitat for these species but, under the new Amphibian Survival Alliance, local partnering groups will be asked to lead the development of protected area networks for amphibians within their countries and regions of operation.

**Chynoweth, Mark,** *University of Utah;* **Josip Kusak**, *University of Zagreb;***Emrah Çoban,** *KuzeyDoga Society;* **Aysegul Karaahmetoglu**, *KzeyDoga Society;* **Çağan Şekercioğlu**, *University of Utah*

**Conservation ecology of gray wolves in a human dominated landscape in eastern Turkey**

Eastern Turkey, where the Caucasus and Iran-Anatolian global biodiversity hotspots meet, holds one of the largest populations of gray wolf in Europe, but is also experiencing a biodiversity crisis. The degradation and fragmentation of wildlife habitat, the depletion of natural prey base, high-speed traffic on roads, and the direct persecution of wolves increasingly threaten their populations. The fragmented habitats in the region may not be able to support viable wolf populations in the near future, but there are no reliable, long-term studies of wolf populations in Turkey. The goal of our research is to understand the habitat requirements and movement patterns of Turkey's wolves and to guide wildlife conservation efforts in the area. In 2011, we were able to capture, collar and track wolves for the first time in Turkey. We deployed GPS/GSM collars on two adult male wolves captured in Sarikamiş National Park and three rehabilitated juvenile wolves born in spring 2011 to track their movement for one year at 6-hour intervals. Adult males appear to be more active and travel significantly farther distances during nocturnal hours (t = 15.48, p

**Clark, J. Alan,** *Fordham University;* **Christine Sheppard**, *American Bird Conservancy;***Janet Starwood,** *Audubon Pennsylvania*

**Exploring how light color affects nocturnal migrants in an urban landscape**

Most passerine birds and bats migrate at night, and many migrant species show population declines. Mortality during migration is substantial, and migrants are often attracted by artificial light sources, leading to often fatal collisions with human structures. Reducing the attraction of illuminated human structures is important to migrant conservation. Recent studies with communications towers showed that switching from steady burning red or white light to strobes can substantially reduce avian collisions. A few studies have suggested that green or blue light may not attract migrating birds as strongly as white or red light. We used a set of 24 spot lights in downtown Philadelphia during fall migration to compare how night-migrating birds responded to white, green, and blue light. We counted the number of birds flying through light beams as well as their flight direction on a single night during fall migration. We documented substantially more birds in the white light than in the blue or green light. In addition, we found three times more birds either circling in the white light or flying in directions not consistent with fall migration. This small study highlights the importance of better understanding how light color affects migrants. Such information can help inform public policy to help reduce the negative effects of increasingly urban landscapes on nocturnal migrants.

**Colla, Sheila,** *Wildlife Preservation Canada*

**A multi-stakeholder, interdisciplinary approach to native pollinator conservation in North America**

Several pollinating hymenopteran and lepidopteran species are currently or are in the process of being listed federally and provincially as at-risk species in Canada. The newly formed IUCN SSC Bumblebee Specialist Group will be assessing the status of the global bumblebee fauna within two years. This poster with introduce species known to be in decline in North America and talk about next steps in conservation management for native bees and other native pollinators. Particular focus will be made on rapidly declining bumblebees and extirpated butterflies. Working with several industrial and not-for profit partners, government agencies and the public, Wildlife Preservation Canada has recently launched a hands-on, science-based, native pollinator recovery program. Projects include species-specific habitat restoration, habitat creation, captive breeding and reintroduction, translocation and citizen science monitoring. Successes and challenges in this interdisciplinary, multi-stakeholder program will be discussed.

**Collen, Ben,** *Institute of Zoology;* **Louise McRae**, *Institute of Zoology;***Tom Hart,** *University of Oxford*

**Towards monitoring global penguin population change**

Monitoring wildlife in the Earth's most rapidly changing ecosystems provides insight into patterns of environmental change, from which to make informed conservation decisions. Observed and predicted changes in climate, and the expansion of fisheries in Antarctic and sub-Antarctic regions are two causes of concern, which make monitoring of species in this remote part of the world critical. No inclusive monitoring network exists for this region, one of the world's least comprehensively studied and most rapidly changing. We present an index of change in penguin population status across oceanic regions of the southern hemisphere to present an index of regional change. We show using data from 14 penguin species an overall average decline in abundance over the last 37 years. Our results also reveal contrasting fortunes for western and eastern penguin populations, which broadly mirror continental scale warming and cooling patterns. Our results suggest growing threats will continue to have unequal impacts on species, requiring regionally tailored management, and supporting the need for further research to evaluate species specific responses to climate change and other threats. Expanded monitoring is required to ensure the best possible evidence base from which to protect penguins in a changing environment. We evaluate how the current limited monitoring network influences our findings, and use this as a means to suggest how monitoring might be expanded.

**Comer, Pat,** *NatureServe*

**Methods and tools to integrate biophysical variability into the design of climate-smart conservation networks**

By combining current data, ecological knowledge, and planning tools, we can better cope with uncertainty and design climate-smart networks for biodiversity conservation. Land classification units describe and map unique combinations of what we believe to be ecologically-relevant geophysical space. Mapped vegetation provides a powerful expression of the biotic response to geophysical space. Together, they can describe biophysical variability in reliable terms practical for conservation planning. For designing regional conservation networks, we combined maps of land classification units with major vegetation types, and then used spatial optimization to ensure that the network represented biophysical variability within high-integrity blocks. Representation goals are stated in terms of a) overall vegetation type extent, in b) patch sizes sufficient to support disturbance dynamics, and c) proportional extent of each vegetation/geophysical combination. Spatial optimization tools aid in combining layers to identify most-intact areas to efficiently meet goals. Over time, networks can be kept current through adjusting goals and building on successful conservation investments. Coping with climate change demands science support for adaptive management through the likely changes of upcoming decades. Fully utilizing current knowledge, data, and tools is essential. This is one approach to providing for local-scale connectivity today while facilitating adaptation to future conditions.

**Comeros, Mia Theresa,** *Old Dominion University;* **Colin Buxton**, *Institute for Marine and Antarctic Studies, University of Tasmania;***Bruce Mann,** *Oceanographic Research Institute;* **Barry Russell**, *School of Environmental and Life Sciences, Charles Darwin University;* **Kent Carpenter**, *Old Dominion University*

**Predictors, Patterns and Processes of Extinction Risk in Porgies (Family: Sparidae)**

The Porgies or Seabreams (Sparidae) are widely distributed in tropical and temperate coastal waters around the world. These fishes are highly esteemed food and recreational fish and are of considerable commercial importance in many parts of the world. Intrinsic life history characteristics such as specialized reproductive modes, aggregate spawning behavior, and specific habitat preferences coupled with extrinsic threats from fishing pressure and widespread habitat destruction have lead to population declines for several species in the family. We model the correlates of threat utilizing known intrinsic and extrinsic traits that predispose these species to an elevated risk of extinction. Interactions of intrinsic rates (late maturing, long-lived, and restricted ranges) and extrinsic rates (coastal development, exploitation) are shown to be good predictors of heightened extinction risk. We also calculate the spatial overlap of areas of high diversity and threatened populations with areas of high cumulative threats to identify critical knowledge gaps and highlight priority areas for conservation. The factors that drive species to increased extinction risk are complex and highly interconnected in nature. Improved understanding of these drivers can lead to better management strategies to counter the effects of biodiversity loss in this rapidly changing world.

**Concannon, Lianne,** *The University of Reading;* **Malcolm Nicoll**, *The University of Reading;***Ken Norris,** *University of Reading;* **Carl Jones**, *Durrell Wildlife Conservation Trust/ Mauritian Wildlife Foundation;* **Vikash Tatayah**, *The Mauritian Wildlife Foundation*

**When is enough, enough? Using capture-recapture to inform optimal population monitoring for the endangered pink pigeon Nesoenas mayeri**

Conservation funds are limited; therefore maximising the efficiency of monitoring is critical. We used a Capture-Recapture (CR) approach to identify the optimal level of effort required to deliver core data for the long-term monitoring programme in place for the pink pigeon (Nesoenas mayeri), endemic to Mauritius. We imposed a number of reduced-effort monitoring strategies to daily-level data spanning 2008-2011 from one subpopulation and used a CR approach to attempt to identify (i) an optimal level of monitoring effort and (ii) establish whether a decrease in effort affected estimates (and precision) of survival (φ) and/or recapture rate (P). We then explored potential budgetary and time savings associated with the identified optimal level of monitoring. The analysis showed that effort can be reduced from the current level of 56 hours a month to an optimal of 18 hours a month, without negative effects on the estimates or precision of the key parameters of interest. 68% of the effort currently invested by the pink pigeon recovery programme on monitoring activity does not yield additional data; this time could be reallocated to more beneficial conservation management activities or staffing levels restructured accordingly. The novel use of the CR framework in this study may be of application to other threatened species monitoring programmes. The study demonstrates an example of a strong working partnership between a research institution and a conservation organisation.

**Conlisk, Erin,** *San Diego Zoo Institute for Conservation Research;* **Sara Motheral**, *San Diego Zoo Institute for Conservation Research;***Rosa Chung,** *San Diego Zoo Institute for Conservation Research;* **Bryan Endress**, *San Diego Zoo Institute for Conservation Research*

**Modeling the optimal site for coastal cactus wren habitat restoration to mitigate threats of fragmentation and wildfire**

Threats to wildlife from habitat fragmentation and increased fire frequency are common in Mediterranean ecosystems. Whereas the remaining Southern California coastal sage scrub serves as refuge for rare flora and fauna, this habitat is threatened by frequent, human-ignited wildfires. The coastal cactus wren, a California Bird of Special Concern, serves as a "canary in the coal mine" for a variety of coastal sage species (e.g., the California gnatcatcher and orange-throated whiptail). The cactus wren depends on fire-sensitive Opuntia and Cylindropuntia species. The San Diego Zoo's Institute of Conservation Research has committed to restore 20 hectares of wren habitat. To locate sites which mitigate fragmentation and wildfire risk, we use a population model created from maps of wren abundance, cactus habitat, land use, and predicted fire probability. We forecast the relative abundance of wrens under the following management options: augment existing habitat patches, create new patches in areas with low fire risk, and create new "stepping stone" patches to connect existing patches. Wildfire risk is estimated by relating previous fire locations to a variety of demographic and environmental variables. We find that the best management strategy depends on (i) wren dispersal distance, (ii) post-fire habitat recovery, and (iii) the magnitude of edge effects on the smallest patches. Our results are being vetted by local park managers and conservation groups.

**Conteh, Abu,** *Victoria University of Wellington;* **Michael Gavin**, *Colorado State University;***Jennifer N. Solomon,** *Colorado State University*

**Quantifying illegal hunting via a new methodological approach**

Illegal resource use is a major threat to conservation in nearly every ecosystem. Accurate data on the magnitude of illegal resource use is critical for effective conservation management, but gathering such sensitive data faces considerable methodological challenges. We present the first conservation-based application of a version of the randomized response technique (RRT; adapted from Tracy and Fox 1981) designed to quantify sensitive behaviour. Previous conservation studies have used RRT to estimate proportions of populations involved in illegal activities and to identify sectors of the population involved. However, to date, no published study has used RRT to quantify the magnitude of illegal resource use (i.e. the amount of resources extracted). We quantified the number of animals illegally hunted within the Western Area Peninsula Forest Reserve in Sierra Leone over a nine-month period by eight local communities. We use the results to examine spatial variation in conservation threat in the protected area, and conclude that areas of highest threat differ depending on how threat is assessed (i.e., proportion of population involved vs. number of animals extracted). We argue that the version of RRT presented here provides a more accurate picture of the impact of illegal activity on biodiversity; and we outline how this method can be used by future studies to assess the sustainability of resource use patterns.

**Cook, Carly,** *University of Melbourne;* **Hugh Possingham**, *University of Queensland;***Richard Fuller,** *University of Queensland*

**A review of systematic reviews of conservation evidence**

Systematic reviews are a comprehensive method for summarizing evidence about the effectiveness of interventions that have proven highly successful at promoting evidence-based practice in disciplines such as medicine. They can be a powerful tool for synthesizing the best available evidence about which management actions are most effective under particular circumstances, and making that information freely available to practitioners. We investigated the contribution made by this growing body of literature to conservation practice by examining all of the systematic reviews of conservation evidence that have been completed. I will describe the type of implications that systematic reviews currently have for management practice and the recommendations that review authors provide for improving the scientific evidence base so that it is more relevant and useful for decision makers. I discuss the strengths and weaknesses of how this rigorous method has been applied in conservation, highlight some of the ways their benefits could be enhanced, and describe some of the key innovations that promise to make systematic reviews a more effective tool for facilitating evidence-based conservation in the future.

**Cooper, Brian,** *Towson University;* **Joel Snodgrass**, *Towson University*

**Relative Influence of Predator Populations on Amphibian Assemblages in Urban Environments**

In developed areas, stormwater retention ponds have been used to control runoff from impervious surfaces. Even though it is known that urban ponds support life, it is likely that comparable urban and rural habitats will have different factors structuring their communities. Existing ecological theory views variation in life history characteristics among amphibian larvae to result from the tradeoff between avoiding desiccation in shorter hydroperiod ponds and avoiding predation in longer hydroperiod ponds. However, it is unclear if current ecological models adequately describe urban systems. To evaluate the potential role of predator-prey interactions in structuring larval amphibian communities in urban systems, we compared predator and larval amphibian communities in urban and rural ponds along a hydroperiod gradient. Samples of the communities were collected from 28 urban and rural wetlands, located in Maryland, USA, using dip nets and minnow traps. In both wetland types, variation across the hydroperiod gradient was present. The community structure in larval amphibians was similar in both urban and rural wetlands and was most diverse in longer hydroperiod wetlands. However, predator communities in urban environments were less diverse than their rural counterparts. These results suggest that hydroperiod is a significant force structuring aquatic communities in urban systems, but disturbance from human activities impacts predator communities in longer hydroperiod urban ponds.

**Cornick, Leslie,** *Alaska Pacific University*

**Integrating Marine Mammal Conservation in the 21st Century - Conceptual Framework**

All marine mammals are protected in the US under the Marine Mammal Protection Act, and some species have additional protection under the Endangered Species Act. However, few species exist only in the US, so conservation plans often must include international cooperation, including First Nations tribes. Marine mammals also frequently interact with industry via competition, by-catch, and critical habitat designation. Many marine mammal species are consumed by subsistence users, and internationally through commercial and scientific whaling exemptions to the IWC. Thus, marine mammal conservation must take a multidisciplinary approach and integrate priorities of diverse stakeholders. The presentations in this symposium will present topics in human dimensions of marine mammal conservation, marine mammals as a food security issue for indigenous peoples, cooperative education and research programs with industry in Alaska, and the interface between marine mammal conservation and coastal zone planning and process. Parts II and II of this symposium will take place at the Marine Mammal Biology Conference, and the final symposium at the Third International Marine Conservation Congress.

**Cornman, R. Scott,** *USGS - Leetown, VA*

**Deep sequencing and bioinformatic analysis of environmental DNA**

The development of eDNA markers with high sensitivity and specificity is facilitated by the continued improvement of sequence databases, particularly ‘barcode’ databases that provide broad taxonomic representation at just one or a few genetic loci. However, deep genetic sampling of an ecosystem of interest remains a useful preliminary step for the development of an eDNA monitoring program, particularly if the project entails long-term investment or has management implications. Sequencing technologies and bioinformatic approaches will be discussed with respect to marker development as well as a general tool for quantifying biodiversity. Bioinformatic tools can also be used to organize and display species distributions derived from eDNA. The success of integrative approaches will strongly depend on the quality of the metadata that describe environmental samples and how they are processed.

**Coroi, Mihai,** *Mott MacDonald*

**Biodiversity, ecosystem services and oil production: an integrated conservation approach**  
A Biodiversity Action Plan (BAP) was prepared to ensure the biodiversity and ecosystem services (BES) in an oilfield development in South-East Iraq are conserved and enhanced. The BAP study area includes Hawizeh Marshes Ramsar Site (part of the Mesopotamian Marshes). In the last decades, these marshes have been significantly affected by drainage, reduced inflows, wars, pollution and climate change. A comprehensive desktop review and baseline surveys were undertaken for hydrology, biodiversity, ES and livelihoods of the Marsh Arabs. The surveys included habitats and flora, mammals, birds, reptiles, amphibians, fish and Odonata. A new habitat classification of the study area was produced based on interpretation of satellite imagery and ground truthing. The surveys confirmed the presence of several globally threatened species and many species of conservation concern in Iraq. A series of participatory workshops with Marsh Arabs and observation surveys in markets where marsh produce was being sold, were designed and carried out. The BAP actions include avoidance of impacts on BES and the livelihoods of the Marsh Arabs; further monitoring and research; BES enhancement; and stakeholder engagement and awareness raising. This project involved using a multi-faceted approach, where environmental consultants, several international and local conservation NGOs and an oil company worked together and consulted with stakeholders to achieve the best outcomes for biodiversity and ES conservation.

**Cortina-Villar, Sergio,** *Colegio de la Frontera Sur, Mexico;* **Celine Dutilly**, *Colegio de la Frontera Sur, Mexico;***Driss Ezzine,** *Colegio de la Frontera Sur, Mexico;* **José Nahed**, *Colegio de la Frontera Sur, Mexico;* **Héctor Plascencia**, *Colegio de la Frontera Sur, Mexico;* **Susana Aguilar,** *Colegio de la Frontera Sur, Mexico;***Elvia Porcayo**, *Colegio de la Frontera Sur, Mexico;* **Roberto Aguilar,**

*Colegio de la Frontera Sur, Mexico;* **Viridiana Cano,** *Colegio de la Frontera Sur, Mexico*

**Understanding the role of payments for ecosystems services and collective action in the effectiveness of protected areas in Chiapas, Mexico**

Mexico has 41 biosphere reserves that cover 12.6 million ha. Many of these protected areas were inhabited prior to being protected, and buffer zones were formed using proprietors’ land. In the state of Chiapas, the original dwellers resisted the decrees of protection because these meant a partial restriction in the use of land. In addition, the reserves’ management plans state that the land uses must become sustainable. In the Biosphere Reserve El Triunfo, local communities and reserve authorities have been in contact for more than 20 years. During this period, the rate of deforestation has diminished, and it seems that the land use community control has increased. The aim of this presentation is to present an advance of our study on the role that policies such as payments for environmental systems (PES) have played in these changes. We also are examining in which way collective action has been modified to gain effectiveness in conservation. At present, we have understood that many communities have committed to conservation of natural ecosystems, thanks not only to the implementation of PES but also to a long relationship between local communities and other stakeholders. We think that it is necessary to identify the key aspects of this relationship that have contributed to create new conservation practices. Better policies can be designed from studies like this.

**Counsell, Chelsie,** *Florida State University;* **J. Craig**, *NMFS Southeast Fisheries Science Center;***Steven DiMarco,** *Texas A&M University*

**The Effects of Seasonal Hypoxia on the Spatial Distribution of Protected Marine Species and Apex Predators in the Northwestern Gulf of Mexico**

Hypoxia (dissolved oxygen, DO, ≤2.0 mg/l) is a growing problem within marine systems that results primarily from high levels of nitrogen in fresh water runoff. The inherent interplay between terrestrial and marine stakeholders makes hypoxia a particularly challenging issue. Low DO can lead to mortality for sessile organisms and altered habitat for fishes and other upper trophic level species. Prior studies have shown that forage fishes can avoid bottom water hypoxia by aggregating near hypoxic edges. This study investigates the effects of riverine inputs and hypoxia-induced shifts in the distribution of prey species on protected species (sea turtles and dolphins) and apex predators (sharks). For four summers, synoptic aerial and oceanographic surveys were conducted within the northwestern Gulf of Mexico (seasonal hypoxic events can be >20,000 km2). Using spatial interpolations, electivity indices, and generalized models, we found evidence that the spatial distributions of these marine megafauna are altered in the vicinity of the hypoxic zone, but patterns are complex and vary by species. Understanding the indirect effects of hypoxia on top predators and protected species may influence commercial fishery bycatch standards and support downsizing intensive farming operations on land. Our data also suggests the presence of a biodiversity hotspot associated with the Mississippi River plume. Elucidating fluctuations in its location could guide the establishment of a marine reserve.

**Coutts, Shaun,** *The University of Queensland*

**Interactions between independent mangers changes the invasion of widespread weeds**

Weeds infestations can easily cross property boundaries. As a result one individual’s decision to manage or not manage a weed can affect everyone else in the surrounding area, and the success of large scale weed control programs. This makes it imperative to understand how human behavior affects coordination of local management efforts, and subsequently persistence and spread of weed species at landscape scales. I will look at what game theory and agent based models can teach us about how individual manager behavior interacts with weed population ecology. One recurrent finding is that while coordination is very important for weed control, it is likely to be difficult to achieve in large groups of weed mangers. We use an agent based model to show that high social or economic cost can help coordinate weed management. Social cost was only important if it was independent of weed prevalence, suggesting that early access to information, and incentives to act on that information, may be crucial in stopping a weed infesting large areas. Our results show that the behavior of individual land managers can have a large effect on a weeds extent at the landscape scale, even if each individual weed manager only had access to a small part of that landscape.

**Cox, Michael,** *Dartmouth College;* **Forrest Fleischman**, *Dartmouth College;***Emily Blackmer,** *Dartmouth College*

**Does Establishing Property Rights Protect Forests from Roving Bandits?**

Many conservation policies are based on the idea that secure property rights prevent the overexploitation of resources. Evidence from studies of fisheries indicate that secure property rights do not necessarily prevent "roving bandits," who have high levels of mobility and low levels of dependence on a particular resource, from overexploiting resources they own, and then moving on. In this paper we conduct an exploratory case-based examination to test whether roving bandits are present in forest conservation. As sessile resources, forests do not require an inherent level of user mobility, and thus may not encourage roving banditry the way that fisheries do. However, as slow-growing resources they may provide additional incentives for resource users to "cut and run" from one resource system to the next. To test for the presence of and explore the mechanisms behind roving banditry in forest conservation, we use published literature to examine the behavior of forest product firms in the United States and Southeast Asia. With heavily capitalized forest industries, these two areas represent likely cases for the existence of roving banditry. We find evidence of roving banditry in some, but not all, forest products firms in these regions, and conduct a systematic comparison of cases that exhibit and do not exhibit roving banditry in order to assess policy options that may prevent roving bandits from destroying forests.

**Craigie, Ian,** *James Cook University;* **Robert Pressey**, *James Cook University*

**The management costs of protected areas in Queensland, Australia**

Protected areas are the cornerstone of global conservation efforts yet despite their importance our knowledge of the financial resources required to effectively manage them is remarkably poor. For the vast majority of protected areas we have little understanding of what is being spent, what should be spent or what factors drive costs. Here I present the results of a project to answer these questions in some of Queensland's 10 million hectares of protected estate. I present estimates of current spending broken down by separate management activities and calculations of the extra funding required to meet all stated management objectives. The results show that currently when funding is constrained managers prioritize activities which are unrelated to biodiversity such as maintenance of visitor facilities, leaving biodiversity related activities especially underfunded. Analysis using mixed effect models shows that the key factors driving variation in spending levels changes with location within Queensland, however it is clear that visitor numbers, ecosystem type and the frequency of extreme meteorological events are important drivers of costs. These new data offer the opportunity to gain a much improved understanding of the costs of managing protected areas effectively; which in turn will lead to better spatial planning and improved allocation of limited funds across protected area networks.

**Crees, Jennifer,** *Zoological Society of London*

**Dynamics of large mammal range shifts and extinction: evidence from the Holocene record of Europe**

Accurate baseline data are crucial for establishing the extent of species declines and their threat status. Whilst conservationists can often access species occurrence data on decadal time scales, reliable information from older periods can be rare or seldom used, leading to so-called 'extinction filters' where populations and species lost prior to historical memory are omitted from conservation research. I used a comprehensive database of c.20,000 zooarchaeological records and regional last occurrence data of European large mammals to track their distributions in ArcGIS over the past 10,000 years (the 'Holocene' epoch), a period of relative climatic stability. This enabled analysis of range contractions for extant species as well as species which were already highly threatened or extinct prior to the industrial 'historical era'. Overall results indicated that most large mammal ranges have fluctuated in response to human activity rather than remained stable throughout the Holocene. Spatial trajectories over time were species-specific and several large herbivores appear to have been impacted more heavily and earlier than carnivores, challenging current consensus on the particular vulnerability of large carnivores. The research demonstrates the importance of linking ecology and conservation with disciplines such as archaeology and palaeontology in order to understand long-term declines and extinction risk even for apparently well-studied species and regions.

**Crist, Patrick,** *NatureServe*

**A Toolkit Approach to Integrating Conservation with Land Use, Resource, and Infrastructure Planning**

Conservationists have recently recognized that conservation planning does not happen in a vacuum. To effectively integrate conservation with land use, resource management, and infrastructure planning, it is necessary to engage the various sector agencies in multi-objective planning. While several difficulties must be overcome, primarily from the stove-pipe history of such planning, the development of information workflows supported by software tools can lower the bar for such collaborative planning. The complexity of such spatial planning requires the use of a variety of specialized tools including ecological modeling tools, ecosystem process tools, sector-specific modeling tools such as urban growth modeling, and a variety of conservation assessment, optimization, and planning tools. This session will provide a methodology for visualizing the information workflow among sectors using a scenario-based planning approach and identifying and integrating tools into the workflow. The approach will be illustrated with several examples applied to integrated land-sea planning, managed area planning, land use planning, and infrastructure planning. The approach was recently published in the Journal of Conservation Planning and participants will be provided with links to technical guides that detail the methodology.

**Croes, Jennifer,** *Imperial College, London;* **E.J Milner-Gulland**,

**Closing Shop? Spatial, temporal and cultural trends of illegal wildlife trade through Traders' eyes**

Illegal wildlife trade is ranked as the third largest illegal trade after drugs and weapons in scope and value. An increasing demand for wildlife is putting a strain on wild populations through unsustainable harvesting, resulting in possible extinction in the wild. Southeast Asia is the hub for international wildlife trade as key consumer and supplier Wildlife trade is a multi-faceted commerce continuum involving a number of different actors along the complex harvester to end-consumer supply chain. Traders are the suppliers to the end-consumer who drive demand for live animals for the exotic, live pet trade and Traditional Chinese Medicine (TCM). There is currently very limited research and literature in aligning socio-economic aspects into illegal wildlife trade, yet economic and social factors drive demand and supply. Understanding motivational drivers, demographic and socio-economic factors and social & cultural values allows for long-term solutions to combat this conservation challenge. I conducted semi-structured interviews with traders at six live, pet markets in Jakarta and Bali to understand the traders' socioeconomic profile and demography and gain an insight of their perceptions, attitudes and behaviours using 12 focal species as a point of reference. Conservation actions are based on human behaviours. Any solution requires a multidisciplinary approach and include all the major stakeholders from hunter, trader to end-consumer.

**Cronin, Drew,** *Drexel University;* **Cirilo Riaco**, *Bioko Biodiversity Protection Program;***Gail Hearn,** *Drexel University*

**Conservation monitoring on Bioko Island: Bridging the gaps between bushmeat market dynamics, primate populations, and wildlife patrols**

Bioko Island, Equatorial Guinea is one of the most important places in Africa for primate conservation, but a lack of effective law enforcement has encouraged commercial bushmeat hunting, which now threatens the remaining primate populations. Since, 1997, the Bioko Biodiversity Protection Program has recorded over 41,000 primates in the market of the capital, Malabo, documenting both a "mardi gras" phenomenon in consumption patterns, and the negative effects resulting from government intervention. Nevertheless, the relationship between market dynamics and the status of wild populations is poorly understood, detracting from the efficacy of conservation efforts. To address this, surveys were conducted to assess how the relative abundance of monkey species varied spatially in relation to differing degrees of hunting intensity. Overall, primate abundance decreased as hunting intensity increased, while variation existed in species specific responses to hunting levels. Our data suggest that terrain features and a steady research presence have afforded some populations a modicum of protection; however, given current bushmeat trends, an absence of enforcement, and rapid development allowing greater access to remote areas, these modest defenses will be short lived. We conclude that in addition to institutionalized support and effective law enforcement, current monitoring efforts should be nationalized and expanded to provide economic incentives for public conservation.

**Crouse, Debby,** *US Fish and Wildlife Service*

**Revisions of the US Endangered Species Recovery Planning Guidance**

There are currently more than 1300 endangered and threatened domestic species listed under the Endangered Species Act (ESA). The US Fish and Wildlife Service and National Marine Fisheries Service have developed joint guidance for the development of recovery plans to guide the development and implementation of individually tailored recovery programs to return these species to a point where they no longer need to be listed under the ESA. The current guidance was developed in 2004 and was designed to create effective recovery programs based on the best science available at the time of plan development. The agencies are currently working on updates and revisions to this guidance, focusing on 3 areas in particular. The revisions are intended to enable more precise development of recovery criteria, make plans more useful for agency biologists applying the section 7 consultation provisions of the ESA, and facilitate easier adaptation to new information as it becomes available.

**Cummings, Anthony,** *Syracuse University;* **Jane Read**, *Syracuse University*

**Modeling the Distribution of Rare Multiple-Use Plant Species in a Fragmented Northern Amazonian Landscape**

Multiple-use plant species are commercially logged, provide food for wildlife, and non-timber forest products for human populations. In the neotropics the range of these species inevitably straddles a diversity of land ownership arrangements, including indigenous lands, State-owned properties, and protected areas, where different approaches to resource management persist. For rare species different management approaches could potentially push them towards extinction. The probabilistic distribution of six locally-rare and four abundant species was examined to determine how they may be impacted by gold mining on State-owned lands. Species were mapped at fourteen Southern Guyana study sites within a 50,000 km2 study area and their distribution characteristics used to generate probabilistic landscape-level distribution models. All species, rare and abundant, showed probabilistic distribution on State-owned and indigenous lands and within protected areas. Distribution on State-owned lands subjects species to gold mining pressures, which are increasing with the climbing market price for gold and leading to higher demands for mining permits. Current approaches to gold mining in the neotropics involve widespread removal of trees regardless of their conservation status or ecological importance. Sustainable management of these resources therefore requires reformation of codes of practices for gold mining and inputs from all stakeholders at the landscape-level.

**Cunningham, Heather,** *Natural History Society of Maryland*

**The Maryland Amphibian and Reptile Atlas: A volunteer-based distributional survey.**

Citizen science projects are gaining popularity in herpetological research and conservation. The use of citizen science projects to document amphibian and reptile distribution patterns has increased over the past decade with global, national, and regional projects being initiated. The Maryland Amphibian and Reptile Atlas (MARA) was launched in 2010. It is a five-year, citizen science project to document the distribution of all the herpetofauna in Maryland. A variety of approaches are being used to engage the public in the MARA, including the use of web-based social media, electronic newsletters, live animal exhibits, a dedicated project website, a smartphone mapping application, and online data submission. These efforts resulted in 788 volunteers participating in the project to date. Additionally, the MARA has been used as a project in Science Technology Engineering and Mathematics (STEM) education in some public schools in Maryland. At the mid-point of the project, 20,612 animal sightings during 18,823 active survey hours have documented 88 of Maryland's 93 species. The MARA will establish a baseline by which future changes in the distribution of native herpetofauna can be assessed. As a citizen science project it has the added benefit of educating citizens about native herpetofauna, an important step in creating an informed society that actively participates in the long-term conservation of Maryland's nature heritage.

**Cypher, Alysha,** *The Center for Conservation Studies, Inc.;* **Andrew Keth**, *The Center for Conservation Studies, Inc.*

**The Clarion-Limestone Amphibian Research Center: A Model for Public Participation in Conservation.**

With the future of funding for conservation projects and research being uncertain, it is crucial that scientists rally public support for science. The Clarion-Limestone Amphibian Research Center (CLARC) is a model for promoting science and conservation to the public on a local-scale. Located on the grounds of a public school district in Clarion, Pennsylvania, this facility brings university, high school, and elementary students together in herpetological conservation and research. Projects utilizing models like the timber rattlesnake, spotted salamander, and eastern hellbender provide students with experiences unique to CLARC. Not only are students involved in conservation research and public education, but they are directly involved in the design, construction, and day-to-day operation of the facility. The students are empowered and also gain skills across disciplines including science, the arts, management, marketing, and public relations. By linking a public school district, a state university, and community organizations and businesses, CLARC has become a successful example of community-based conservation that is largely publicly-funded. By designing this facility around student education and professional development, we have increased public participation and support of science within the local community and beyond.

**Dabek, Lisa,** *Woodland Park Zoo;* **Joan Castro**, *PATH Foundation Philippines;***Janet Edmond,** *Conservation International*

**Healthy Family, Healthy Forest: Integrating Community Health and Conservation in Papua New Guinea**

This talk will address the benefits from an integrated family health and conservation project in Papua New Guinea (PNG). PNG is one of the most diverse countries and one of the poorest. PNG ranks 148 out of 182 countries in the 2007 Human Development Index (UNDP). The YUS Conservation Area (CA) is the first government-recognized conservation area in PNG and encompasses approximately 180,000 acres of forest. It serves as a model for protecting other significant ecosystems in PNG. In this remote area of high biodiversity, the Tree Kangaroo Conservation Program (TKCP) has been working to protect and manage forest and wildlife through a holistic community-based conservation program building local capacity for conservation and improving socio-economic services and livelihoods. Since 2011, TKCP has been working with the US AID-funded BALANCED Project to integrate health and conservation activities. The project has implemented an integrated approach to: train community agents to educate about linking family health, community health and natural resources to improve human health and protect nature; train youth peer educators to become stewards of the environment and their own health; advocate to local authorities about the benefits of the Population, Health, and Environment (PHE) approach as a means for achieving improved health for YUS; increase male participation in family health activities. This presentation will discuss an innovative integration of conservation and health.

**Danoff-Burg, James,** *San Diego Zoo Global;* **Maggie Reinbold**, *San Diego Zoo Global;***Robin Keith,** *San Diego Zoo Global;* **Samantha Young**, *San Diego Zoo Global;* **Corrin LaCombe**, *San Diego Zoo Global;* **Kirstie Ruppert,** *San Diego Zoo Global*

**Zoo-based Teacher Professional Development - An Effective Means for Integrating Conservation Science and Advocacy into Classrooms**

Most learning happens in informal settings for most people, which certainly holds true for school teachers. We were interested in exploring the value of informal science learning environments for enhancing teacher training and professional development. To this end, we quantified the short-term (months) and longer-term (years) improvements in objective content knowledge and curricular integration of an immersive, three-day teacher training workshop at the research arm of the San Diego Zoo. Middle school and high school life science teacher alumni (N=151) from across the nation were involved, as were a set of teachers (N=65) who had applied to the program but were not selected to participate, who then acted as a control group. Relative to the control group, the treatment teachers demonstrated significant gains in teaching effectiveness, conservation attitude, and ability to integrate workshop materials into existing subject matter back in their classrooms. We conclude that informal science learning environments can significantly contribute to helping teachers integrate conservation into their classrooms, and the in the process building support for in-situ conservation efforts.

**Darling, Emily,** *Simon Fraser University;* **Tim McClanahan**, *Wildlife Conservation Society;***Isabelle Cote,** *Simon Fraser University;* **Tom Oliver**, *Hawaii Institute of Marine Biology*

**Community disassembly on coral reefs: a functional approach for a stressful world**

Conserving biodiversity in the face of climate change and existing human pressures is particularly challenging for species-rich ecosystems, such as coral reefs. We investigate the usefulness of a trait-based, life-history approach to evaluate the impacts of multiple stressors on reef-building corals, a notoriously species-rich and threatened group. We show that life-history strategies can predict community responses to fishing and temperature-driven bleaching using a 20-year time series of coral assemblages in Kenya. Prior to the 1998 bleaching event, coral communities within no-take marine reserves were composed of three distinct life histories - competitive, stress-tolerant and weedy species - that exhibited strong declines following bleaching with limited recovery. In contrast, fished reefs had lower coral cover and fewer genera, and were composed only of stress-tolerant and weedy corals that were less affected by bleaching. We also discuss a new cross-disciplinary project that seeks to integrate life-history traits and functional diversity with climate models to develop a regional climate adaptation plan for Indo-Pacific coral reefs.

**Davalos, Andrea,** *Cornell University;* **Victoria Nuzzo**, *Natural Area Consultants;***Bernd Bloseey,** *Cornell University*

**Determining effects of multiple stressors to develop successful management of rare and endangered forest plants**

Forest ecosystems in eastern North America face multiple threats including habitat loss and fragmentation, invasions, overabundance of native species, nutrient deposition and climate change. While each stressor may have independent detrimental effects on native biota, stressors often co-occur and are likely to have synergistic effects. We used a combination of field and common garden experiments, and matrix population models to assess the importance of deer herbivory, nutrient addition, and introduced plants and earthworms on the demography of four rare forest herbs (Aristolochia serpentaria, Agrimonia rostellata, Carex retroflexa, and Trillium erectum). After five years, individuals of all species, except for C. retroflexa, responded to deer exclusion with significant increases in size and reproduction and population growth rate. Life table response analysis indicated positive contributions of deer exclusion to growth rate, mainly by increasing the probability of flowering plants to remain reproductive. The remaining studied factors had no independent or interactive effect on the demographic parameters of either species. Biodiversity conservation projects should critically consider effects of multiple stressors; however, our results emphasize the importance of deer as structural forces in forests of North America and indicate that reductions in deer populations are imperative (and may be sufficient) to restore and preserve populations of rare plant species.

**Davidson, Ana,** *Stony Brook University;* **Kevin Shoemaker**, *Stony Brook University;***Ben Weinstein,** *Stony Brook University;* **Catherine Graham**, *Stony Brook University;* **Volker Radeloff**, *University of Wisconsin-Madison;* **Carlo Rondinini,** *Sapienza University of Rome*

**Forecasting global mammal extinction risk in a changing world**

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 identify those species that are most vulnerable to extinction and map their spatial distribution around the globe. Here, we: 1) used machine-learning and spatial modeling approaches to understand the interactions of intrinsic and extrinsic drivers of mammal extinction risk; 2) used this information to predict risk across all mammals, including IUCN "Data Deficient" species; and 3) conducted a spatially-explicit assessment of these results to understand how risk is spatially related to human impacts across the globe. We found that intrinsic and extrinsic variables interact strongly to predict extinction risk across mammals, and that there are critical thresholds in these variables at which risk rapidly increases. We also identify regions of high current and latent risk, and show how these areas overlap with human impacts and protected areas.

**Davies, Tammy,** *University of St Andrews;* **Nathalie Pettorelli**, *Institute of Zoology, Zoological Society of London;***John Ewen,** *Institute of Zoology, Zoological Society of London;* **Rohan Clarke**, *Monash University;* **Will Cresswell**, *University of St Andrews;* **Guy Cowlishaw,** *Institute of Zoology, Zoological Society of London;***Ioan Fazey**, *University of Dundee*

**Quantifying the impact of land use change on biodiversity and people: a case study from the Solomon Islands**

Land use change is a major threat to biodiversity through loss of habitats and fragmentation, particularly in developing regions, where human populations are expanding and where the majority of people depend on natural resources for their livelihoods. Understanding and quantifying the impacts of land use change on both biodiversity and the local people is important in order to develop appropriate conservation management plans. Using a remote region of the Solomon Islands as a case study, we undertook a multidisciplinary approach that included assessing species richness and relative abundance of birds (line transects) and bats (acoustic monitoring) in 5 land use types (primary and secondary forest, gardens, mixed cocoa and monoculture cocoa). We also assessed how household wealth affected livelihood strategies and use of natural resources, using locally defined indicators of poverty and multi-round interviews during a 6-month period. We found wealthier households were more likely to be engaged in cash cropping activities and also found biodiversity to be lower in these areas. This suggests that the activities of the wealthiest are having a negative impact on both biodiversity and the forest-based subsistence livelihoods of the poor. Our study demonstrates the importance of understanding the socioeconomic context for large-scale habitat management to ensure equitable sharing of benefits and that the poor are not further marginalised through restriction to essential resources.

**Davis, Frank W.,** *University of California Santa Barbara*

**Putting multi-jurisdictional conservation planning into practice in California**

Hundreds of public and non-governmental organizations ranging from large federal land management agencies to local land trusts engage in some form of conservation planning in California. Although much of this planning remains poorly coordinated, especially across public and private lands, regional multi-jurisdictional conservation plans are being developed and implemented throughout the state, many in response to state and federal endangered species laws. In this talk I will describe several innovative conservation planning efforts that connect regional priority-setting to local implementation. I will also discuss some institutional challenges to narrowing the planning-implementation gap, and new opportunities for financing conservation actions.

**de Azua, Christine Real,** *Energy and Environment Consultant*

**Leveraging national accounting and cost-benefit analysis tools for the environment**

The case has long been made that GDP is not a measure of welfare or progress—yet it continues to be misused as a proxy for or condition of progress. Laws and treaties are in place to protect endangered species and biological diversity, yet their implementation is often ignored or trumped on the basis that it is “too costly.” At the same time, the field of ecological and environmental economics is mature. The case for tools and measures that better value the environment is well established. Some governments or agencies are making progress using those tools and measures. To accelerate this integration, existing practical leverage points and “bridges” to decision-making need to be reinforced, and new ones identified and used. International leverage points include international organizations that issue relevant guidelines, and treaties asking parties to develop and use such measures. Leverage points at the national and state level, with a major, but not exclusive, focus on the U.S. including instances of federal policies, rulemakings, and programmatic decisions will be discussed. We will present the results from consultations and interviews with decision makers and practitioners in government and in the investment and nonprofit communities about such leverage points and how they can drive more environmentally sustainable and restorative decisions and investments.

**De Barba, Marta,** *Laboratoire d?Ecologie Alpine;* **Christian Miquel**, *Laboratoire d?Ecologie Alpine;***Frederic Boyer,** *Laboratoire d'Ecologie Alpine;* **Eric Coissac**, *Laboratoire d'Ecologie Alpine;* **Pierre Taberlet**, *Laboratoire d'Ecologie Alpine*

**Feeding ecology of a reintroduced brown bear population in a human dominated environment using dna metabarcoding and next generation sequencing**

Understanding ecological processes in human-dominated environments is critical for conservation and management practices. Wildlife restoration in Europe is indeed challenged by widespread human presence and activities. Diet studies are particularly important for evaluating the ecology of population of conservation concern, and have a key role in monitoring feeding habits under climate change and increased human-induced modifications. We used DNA metabarcoding and next generation sequencing to develop a standardized approach for molecular, non-invasive, omnivorous diet analysis. We validated this method on 370 fecal samples collected from the reintroduced brown bear population in Northern Italy over eight years since the translocation. We identified plant, vertebrate, and invertebrate components of omnivorous bear diet with a taxonomic resolution at the genus and species level in >65% of the cases. Plants and invertebrates majorly comprised diet composition at the population level, but individual variability and seasonal patterns in diet were revealed. Species of agronomic importance for the local human population and cattle were also found in the diet. The results of this study provide unprecedented ecological insights that are critical for understanding the impact of human activities on this bear population and for the implementation of conservation strategies to reduce conflicts with humans. It also shows the value of this molecular approach for deciphering complex diets.

**De Bruyn, Luc,** *Research Institute for Nature and Forest (INBO)*

**Species in a fragmented landscape. How policy scenario's change species distributions**

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

**de Guzman, Christmas,** *University of the Philippines (UP) Los Baños*

**Thread trailing as a method of determining terrestrial movement and habitat use of Siebenrockiella leytensis in Cabayugan,Puerto Princesa, Philippines**

The Philippine Forest Turtle, Siebenrockiella leytensis is currently categorized as Critically Endangered under the IUCN Red List of threatened species. Understanding its ecology is crucial in establishing the baseline information necessary for the formulation of conservation strategies of the species. Thread trailing was used to gather data on the movement of Siebenrockiella leytensis in two study sites along the Cabayugan River, Puerto Princesa City. The turtles were captured using modified hoop traps. Morphometric measurements were taken before each individual was fitted with spools and released. Terrestrial movement were calculated from coordinates of the thread trail taken from the point of release to the endpoint near the river. Movement were calculated from the coordinates obtained. Vegetation along the thread trail was compared with movement maps to indicate habitat use. Results showed that males have the longest distance travelled at 137.5m while females and juveniles traversed an average distance of 137m and 109.3m respectively. Adults moved through areas with relatively less vegetative cover whereas juveniles moved across areas with thicker cover. During these movements, turtles were observed roaming, feeding and resting. Thread trailing proved to be useful on land but is disadvantageous in aquatic habitats because evaluation of the spatial ecology of terrapins in water is limited by the length of the thread in the spool, water current and depth.

**Deichmann, Jessica,** *Smithsonian Conservation Biology Institute;* **Reynaldo Linares-Palomino**, *Smithsonian Conservation Biology Institute;***Alfonso Alonso,** *Smithsonian Conservation Biology Institute*

**Using expert opinions to define Biologically Sensitive Microhabitats for improved biodiversity conservation during hydrocarbon exploration in Amazonia**

Industrial operations in the Amazon Basin inevitably have impacts on the vast biodiversity within. These influences are likely to grow as human activity moves further into Amazonia. Working in collaboration with industry during development is an important step in identifying and avoiding potential impacts, and mitigating or restoring biodiversity post-impact. In order to strengthen biodiversity conservation during development across the complex landscape of Amazonia, we must first define which microhabitats are most important for species survival, which of these are most sensitive to changes, and to what degree they can sustain different impacts. To answer these questions, we surveyed 100 taxonomic experts representing a wide range of Amazonian fauna to develop a list of Biologically Sensitive Microhabitats (BSMs), such as natural licks for mammals and birds or phytotelmata for amphibians. BSMs were then ranked based on characteristics of BSM-dependent species (endemism, range, reproduction, etc) to create a hierarchy of sensitivity. Our next step is to identify BSMs in operation areas and test their susceptibility to a variety of impacts including seismic exploration, establishment of wells and camps, and construction of linear infrastructure. By defining and evaluating the sensitivity of BSMs essential to species' survival, we can provide specific recommendations to government and corporations on how to minimize the impacts of operations and how to restore BSAs if affected.

**Delgadillo Méndez, Diana Alexandra,** *Universidad de La Salle / Fundación Conserva;* **Joanna Delgadillo**, *Fundacion Conserva;***Oscar Ramos,** *Fundacion Conserva/Unversidad de Los Andes;* **Carolina Barrett**, *Fundacion Conserva;* **Marcela Beltrán**, *Fundación Conserva;* **Jorge Parra,** *Fundación Conserva*

**Community Territorial perception in the Chicamocha Canyon, Colombia: baseline to implement a conservation plan for two endemic and endangered birds.**

Niceforo's Wren and Chestnut-bellied Hummingbird are endemic and endangered bird species to the Chicamocha canyon in Colombia. Agriculture, fires and logging have been identified the most common causes of habitat loss affecting the distribution and population sizes of both species. In order to develop a conservation plan in the region, local perceptions of natural resources and territorial planning were investigated in 36 communities. 48 workshops were organised to identify territorial perception features based on social cartography methods. Water was identified as the most important natural resource for communities. Pollution, drought and misuse were perceived as main causes of shortage of water supply. Although participants showed knowledge about plants and animal species of the region, few people identified the endangered bird species and ignored their ecological importance. Participants perceived also that social aspects such as envy and the lack of solidarity influence on the way in which the community faces environmental challenges. Thus, locals identified weak capacities in sustainable production, soil recovery, reforestation, recycling, territorial planning and leadership strategies. Our results show that social and educational changes are urgent for the protection of the two endangered bird species. Therefore, conservation plans should build up key capacities for conservation and sustainable use of biodiversity in the Chicamocha.

**Dell'Apa, Andrea,** *East Carolina University;* **Jeffrey Johnson**, *East Carolina University;***David Kimmel,** *East Carolina University;* **Roger Rulifson**, *East Carolina University*

**The international trade of spiny dogfish: a social network analysis for the fishery management**

The spiny dogfish (Squalus acanthias) is a shark of significant international commercial value and there is concern over its conservation status. The major demand for its meat is from the European Union (EU) market, with the US and Canada as its two major contributors. The US has yet to support a spiny dogfish listing in the CITES Appendix II, although the US Atlantic stock is under a fishery management plan (FMP) that proved to be successful in providing a certified sustainable fishery. We employed a cumulative sum technique to compare trade data for frozen spiny dogfish export from US and Canada to the EU in relation to the FMP adoption. We also constructed a social network to visualize changes in the European trade scenario for spiny dogfish after adoption of the FMP and to predict future trade flow potentially affecting the conservation status of regional dogfish stocks in relation to recent management measures introduced in Europe. The social network analysis revealed that the exclusion of spiny dogfish from trade regulation lists eventually will affect the conservation status of dogfish stocks in Africa, Asia, South America, and the Mediterranean and Black Seas. Our results suggest that the species listing would provide an economic benefit for the US Northwest Atlantic fishery, and will eventually foster the conservation status of other regional stocks worldwide and the search for a more sustainable global exploitation of spiny dogfish.

**DellaSala, Dominick,** *Geos Institute, SCB North America*

**Roadless in North America: climate smart planning for public lands**

Roadless areas play a pivotal role in preparing large landscapes for climate change. In the USA, the Roadless Conservation Rule protected >23 million ha of inventoried roadless areas (IRAs) that provide refugia for climate-forced wildlife migrations, are a buffer against weed invasions, and contain high concentrations of carbon-dense forests. IRAs are source areas for facilities that treat and distribute drinking water; the cost-savings to water treatment plants and highway departments from avoiding sedimentation caused by logging in IRAs is estimated at ~ $18 billion annually. IRAs also provide $490 million annually in waste treatment, services that will only increase in value as climate change triggers regional droughts. Although there is no national roadless policy in Canada, an inventory of intact areas by Global Forest Watch-Canada shows them concentrated in northern latitudes and forest zones with boreal and coastal rainforests. Canada’s boreal region, in particular, contains one-quarter of the world’s wetlands, more surface water than any other continental-scale landscape, and stores an estimated 147 billion tonnes of carbon, equivalent to >25 years of current emissions. Road building and development compound stressors to ecosystems already dealing with accelerated climate change and degradation of critical ecosystem services. Climate change policies need to protect intact areas to achieve effective climate adaptation and mitigation responses.

**Dennison, William C. ,** *Integration and Application Network, University of Maryland Center for Environmental Science;* **Heath Kelsey**, *Integration and Application Network, University of Maryland Center for Environmental Science*

**Environmental report cards: A tool to integrate monitoring data, engage stakeholders and catalyze actions**

Environmental report cards have emerged as a technique to integrate monitoring data and provide feedback to a wide audience. There are several reasons for employing environmental report cards including a) raising environmental awareness, b) engaging citizen scientists and c) catalyzing management actions. Management objectives need to be clearly defined and a five step process of developing report cards can be used to assess progress in achieving these objectives: 1) conceptualization, 2) choosing indicators, 3) defining thresholds, 4) calculating scores and 5) communicating results. Effectiveness of management actions can be tracked with report cards. Report card credibility relies on independent rigorous assessments by environmental scientists. Citizen scientists can also contribute to report cards, particularly at small spatial scales, provided adequate training and quality control mechanisms are in place. Report cards can take advantage of emerging sensor, information and computational technologies. There are several environmental report card examples that serve as models for other regions, for example, Chesapeake Bay, Great Barrier Reef, Mississippi River, Gulf of Mexico, Southeast Queensland waterways, Maryland Coastal Bays. These examples of report cards used at different geographic and complexity scales will be used to develop some insights as to which report card approach may be applicable in other areas. In addition, the coupling of environmental report cards with a governance model, e.g., BayStat, will be discussed.

**Dey, Dipayan,** *South Asian Forum for Environment;* **Jyotiskona Barik**, *School of Oceanographic Science, Jadavpur University*

**Studies on Relative Growth Rate and Survival of Mangrove Seedlings under Climate Stress in Deltaic Sundarbans of India**

In coastal India 78% mangroves occur in Sundarbans, the largest continuous block of deltaic mangrove estuary in the world. Mangroves have limited capacity for vegetative reproduction and depend on successful establishment and survival of seedlings for forest regeneration or spread. Mangrove seedlings can sequester more carbon than mature mangrove and in addition, seedlings play important role in quantification of net carbon flux in mangrove ecosystem. But the seedling stage is a critical phase in the life cycle and is particularly crucial for mangrove establishment owing to climatic stress in the intertidal habitat. Present study tries to assess the seedling survival rate and simulates growth of the ones that survived in different estuarine system of Indian Sundarbans, which is under climatic stress owing to saltwater intrusion and rigorous erosion. Perusal of results suggest that propagule buoyancy, period of obligate dispersal, anchoring time in action of tides and currents are found to be the primary factors determining dispersal and establishment of mangroves. Further, when propagules reach a newly formed habitat other factors like predation, interspecies competition, frequency and duration of flooding along with physico-chemical characteristics of soil and water become important in determining establishment, survival and succession. The intervention is significant as a decision support research in mangrove conservation under climatic stress.

**Dhanjal-Adams, Kiran,** *University of Queensland;* **Howard Wilson**, *University of Queensland;***Bruce Kendall,** *University of California Santa Barbara;* **Colin Studds**, *University of Queensland;* **Richard Fuller**, *University of Queensland*

**Distinguishing local and remote drivers of change in migratory bird populations**

Recent analyses of monitoring data from Moreton Bay, Australia, have identified declines in abundance of up to 79% between 1994 and 2008 for a suite of migratory shorebirds. However, resident species that remain in Australia all year round are not declining. This suggests that declines in Moreton Bay may be being driven from impacts elsewhere in the East Asian-Australasian Flyway. Here we assess the relative importance of factors local to Moreton Bay, in addition to those reflecting threatening processes elsewhere along the migratory routes of the birds, in explaining population trends. To achieve this, we first contrast a spatial formulation of the N-mixture model with existing non-spatial models to estimate abundance of migratory shorebirds in Moreton Bay and identify how these have changed since 1994. Prior to these analyses, the spatial data collected across Moreton Bay was amalgamated into a non-spatial index of bird abundance; the average number of birds counted per site visited. In contrast, N-mixture models allow spatially variable threats to be incorporated by entering sites separately into the model. Finally, we distinguish local and remote drivers of population decline by testing the effects of a range of covariates on abundance, including: climate, habitat loss and habitat degradation at non-breeding, stopover and breeding sites. Result indicate that a combination of local effects within Moreton Bay and those acting at stopover sites in East Asia best explain the observed declines in Australia. Our work shows that data from a single point in a migratory flyway can be used to draw inference about what is driving population dynamics from elsewhere along the migratory route. Our results highlight the urgent need for broader scale analyses of shorebird abundance to identify exactly where in the flyway the drivers of decline are operating most strongly.

**Dharithreesan, Nidhi,** *NJIT;* **William Kuhn**, *Rutgers University;***Gareth Russell,** *NJIT;* **Kimberly Russell**, *NJIT*

**Automated identification of bees and dragonflies**

Assessing biodiversity requires surveying insects within an ecosystem, but identifying the species can be difficult because of the skill sets required and the time needed to develop them. Automated identification systems are advantageous because they do not rely on user knowledge of taxonomy. We developed a fully automated program that uses pre-processing of wing images and an Artificial Neural Network (ANN) to identify bees and dragonflies to species level. To date our system has attained 100% accurate identification for 2 out of 12 test bee species and 6 out of 13 test dragonfly species, and greater than 80% accuracy for 7 out of 12 test bee species and 10 out 13 test dragonfly species. By requiring only the single input of wing images by the user, the program has the potential to speed up an ecosystem survey, where common species easily identified by the program constitute the bulk of samples. With this automated system, we can use pre-existing collections of identified specimens to expand our pool of identifiable species. The speed of identification provided by systems like ours offers advances in detection of invasive species, species monitoring, assessing ecosystem function, and conservation.

**Di Fonzo, Martina,** *University of Queensland;* **Hugh Possingham**, *University of Queensland;***Will Probert,** *University of Queensland;* **Joseph Bennett**, *University of Queensland;* **Shaun O'Connor**, *Department of Conservation, New Zealand;* **Jodie Densem,** *Department of Conservation, New Zealand;***Liana Joseph**, *Wildlife Conservation Society;* **Ayesha Tulloch,**

*University of Queensland;* **Richard Maloney,** *Department of Conservation*

**Re-evaluating persistence objectives in conservation planning: are lower thresholds or species-specific targets more cost-effective?**

When planning for the management of multiple threatened species with a limited budget, wildlife managers prioritize certain actions over others in order to conserve the most species into perpetuity based on a common persistence objective. The New Zealand Department of Conservation has developed a rigorous project prioritization protocol (PPP) to optimize resource allocation. The aim is to secure the greatest number of unique species with a 95% probability of persistence over the next 50 years by carrying out species-specific actions for multiple populations. It may be possible to fund many more species with the same budget if this high level persistence target was relaxed. We use a data-set of all 700 New Zealand threatened species projects to examine how many more species could be conserved if we reduce their probability of persistence by managing fewer populations per species. We re-evaluate the use of persistence objectives in conservation planning using two approaches: a) presenting the relationship between target persistence levels and number of species managed, and b) relaxing the PPP objective so that the cost-effectiveness of every individually-managed population is considered separately and the maximal number of species conserved is calculated without an arbitrary persistence threshold. Our findings advance the field of threatened species priority setting by offering an alternative prioritization approach that is not underpinned by a common threshold of persistence.

**Di Marco, Moreno,** *Dep. of Biology and Biotechnology, Sapienza University of Rome;* **Luigi Boitani**, *Dep. of Biology and Biotechnology, Sapienza University of Rome;***David Mallon,** *Dep. of Biology, Chemistry and Health Science, Manchester Metropolitan Univ;* **Angela Iacucci**, *Dep. of Biology and Biotechnology, Sapienza University of Rome;* **Mike Hoffmann**, *IUCN Species Survival Commission, c/o UNEP-WCMC;* **Jan Schipper,** *New College of Interdisciplinary Arts and Sciences, Arizona State University;***Piero Visconti**, *Computational Science Laboratory, Microsoft Research;* **Erik Meijaard,**

*Borneo Futures Project, People and Nature Consulting International;* **Carlo Rondinini,** *Dep. of Biology and Biotechnology, Sapienza University of Rome*

**Lessons from the past: a retrospective evaluation of the global decline of carnivores and ungulates**

Parties to the Convention on Biological Diversity certified the importance of monitoring the conservation status of biodiversity. Yet too often the lack of data has resulted in the evaluation of a limited monitoring period, even for species with long generation times such as carnivores or ungulates. We have reviewed literature sources on the past threat status of the world's carnivore and ungulate species, and have applied current criteria to assign them retrospective Red List categories. All the assigned categories have undergone a sequential expert check process. A negative trend in the conservation status of carnivores and ungulates has characterised the past 40 years, and has exacerbated after 1996. Between 1975 and 2008 the proportion of threatened species increased from 29% to 36%, with 23% of species undergoing a deterioration in status. Ungulates experienced a steeper decline than carnivores, and large-bodied species had a steeper decline than small ones. A negative trend was especially marked in Southeast Asian species, with 50% of them moving one Red List category closer to extinction. Conversely, South American felids recovered following the fur trade ban of the CITES convention (in 1975). International conservation efforts had a role in reverting the decline of several species, but did not stop the global declining trend. A better understanding of the recent pathways of global species decline will help to better frame future conservation strategies.

**Diamond, Juliane,** *Lincoln University;* **Victor Blanco**, *Song Saa Private Island;***Ronlyn Duncan,** *Lincoln University*

**Knowing sea turtles: local communities informing conservation in Koh Rong archipelago, Cambodia**

Three globally threatened species of sea turtle have been recorded in the waters around the Koh Rong archipelago off Cambodia's southwest coast: the green turtle Chelonia mydas, the hawksbill Eretmochelys imbricata and the leatherback Dermochelys coriacea. In order to learn about how communities around the Koh Rong archipelago interpret and interact with these species we investigated the local human populations' relationship and use of these turtles. Our study used qualitative social science research methods including semi-structured interviews, a participatory mapping exercise with a community fisheries committee, a focus group, as well as participant observation and ethnographic note taking. The study identified four frames of reference for the sea turtle: turtles as victims, turtles as occasional food, turtles as spiritual beings, and turtles as a promise for the future. These frames of reference were expressed in all villages and amongst most demographics. Our study also identified several perceived threats to sea turtle survival around the Koh Rong archipelago. Most frequently cited were trawling boats, nets, Vietnamese fishermen, hooks, illegal fishing and overfishing. Understanding how local people interpret and interact with sea turtles and perceive threats to their survival provides important insights for the implementation of nature conservation and education programs, which our study aims to inform.

**Dickson, Brett,** *Conservation Science Partners;* **Luke Zachmann**, *Conservation Science Partners;***Christine Albano,** *Univeristy of California Davis;* **Leslie Duncan**, *Pew Environment Group*

**Identifying new conservation priority areas and opportunities on unprotected roadless lands in the western U.S.**

How to identify terrestrial conservation targets that are politically viable and scientifically valid is a topic of ongoing discussion in the global conservation community. In the U.S., vast areas of public land, including those administered by the Bureau of Land Management (BLM), present a conservation opportunity, but also a challenge due to diverse interests of many stakeholders and inherent conflicts arising from a multiple use mandate. For the 11 contiguous western states in which the BLM chiefly operates, we used a novel multiple criteria analysis to model and map contiguous areas of unprotected roadless BLM land that possessed important ecological indicators of high biodiversity, resilience to climate change, and landscape connectivity. Specifically, we leveraged a systematic process of variable selection and available spatial datasets to implement a statistically robust analysis of seven key indicators at three different spatial scales and to locate Conservation Priority Areas (CPAs) across 294,274 km^2 of BLM land. Within this extent, we identified 43,196 km^2 of land with relatively high conservation value and 26 unique CPAs totaling 6,057 km^2. Most CPAs were in Utah and Nevada, where the majority of BLM lands are located. Identifying these CPAs provides multiple stakeholders with a diverse set of places and data that can be useful in ongoing efforts to promote landscape conservation and special designations on lands managed by the BLM and adjacent owners.

**Dieng, Moussa,** *Department of Forestry, Michigan State University*

**LANDSCAPE CARBON MEASUREMENT IN AGROFORESTRY SYSTEMS IN SAVANNA ENVIRONMENTS OF RURAL SENEGAL Toward a model of measurement of trees outside of fores**

Agro-forestry combines a multitude of benefits both in the environmental, social and economic side. As a mitigation strategy, agro-forestry derives its importance from the multitude activities which all have the potential of creating income for farmers and contribute to fix a large quantity of carbon in the biomass as well as in the soil. However, the benefits of carbon for farmers cannot be fully perceived if the carbon is not quantified accurately and the efforts to estimate carbon sequestration in agro-forestry systems are still facing a big challenge. In my study I will use techniques that combine ground and remote sensing data to measure the carbon stocks in rural farming systems under agro-forestry in landscape level. The first part of the analysis will develop the basic measurement tools for monitoring carbon stocks in systems of trees outside of forests using remote sensing, ground measurements and GIS. Regression analysis will be used to estimate the change in the tree dbh from a given change in the tree crown projected area to predict tree dbh from the given crown projected area. The second part of the study will seek to understand the degree to which local farmers and community groups can be collaborators in the carbon measurement process by assessing their ability to make measurements.

**Dietsch, Alia,** *Colorado State University;* **Michael Manfredo**, *Colorado State University;***Tara Teel,** *Colorado State University*

**Social trust and governance: How modernization is creating a greater need for collaborative conservation**

Collaborative decision-making is becoming increasingly popular in the conservation arena. This all-inclusive approach to managing common resources is in direct contrast to the expert model of decision-making, where managers are regarded as the final authority to deal out decisions to those affected. While many scientists and practitioners are applauding this surge in collaboration, few stop to consider why it is becoming so necessary. One theory suggests that modernization, indicated by urbanization and rising levels of income and education, creates an atmosphere in which people, whose basic needs are provided for, can focus on higher order values of self expression. Modernization, therefore, would lead to distrust in traditional hierarchical forms of government and toward more politically open systems. We tested this theory in regards to its potential impact on wildlife-related thought in the western U.S. We found that mutualism, a wildlife value orientation that considers animals as deserving of rights and caring, was associated with values focused on self expression and political freedom. We additionally determined a negative relationship between mutualism and trust in state-level fish and wildlife agencies, meaning that trust declined as mutualism scores increased. Findings indicate that modernization is fostering more egalitarian beliefs within society, suggesting a need to continue, and in some cases increase, collaborative efforts to reach conservation goals.

**Dixon, Adam,** *World Wildlife Fund;* **Don Faber-Langendoen**, *NatureServe;***Carmen Josse,** *NatureServe;* **John Morrison**, *World Wildlife Fund - United States;* **Colby Loucks**, *World Wildlife Fund - United States*

**Distribution mapping of world grassland types for biodiversity**

Ecoregions dominated by grassland ecosystems have historically provided ample goods and services to the human population. Intense land use has resulted in a vast transformation of historic grasslands into cropland and grazing lands. In temperate grassland biomes, the rates of protection compared to conversion are the lowest of all biomes. We combine the International Vegetation Classification with the Terrestrial Ecoregions of the World to provide an analysis of global grassland biodiversity capable of being integrated into global policy and management decision-making frameworks. With a combination of these two systems we can advance a systematic, detailed biodiversity measurement apparatus which can account for biodiversity in a broad sense, including not only biological information, but also the spatial ecological complexes within which species occur. We have produced an up-to-date map of grassland ecosystems supported with basic vegetation data and ecoregional distributions, which we hope will guide grassland ecosystem management efforts through our current age of global economic expansion and population growth. We suggest using our framework to develop better, more adaptive management strategies and developing governmental policy based on each hierarchal level of biodiversity, including structure, function, and composition of the ecosystem, species, and genetic makeup contained therein.

**Dobbs, Kirstin,** *Great Barrier Reef Marine Park Authority;* **David Wachen**, *Great Barrier Reef Marine Park Authority*

**Assessing the 'Outlook' of the Great Barrier Reef**

**Dobson, Annise,** *Cornell University;* **Bernd Blossey,** *Cornell University*

**Deer and invasive earthworms: drivers of forest plant community transformations?**  
Degraded forests with inhospitable growing conditions are limited in their ability to function as dispersal corridors or ecological refuges for species responding to a changing climate. Our research addresses the shift from a complex understory plant community to one dominated by few invasive or generalist species. Two increasingly recognized drivers of this apparent collapse are earthworm invasions and increased deer abundance. Earthworms alter forest floors by removing the characteristic humic layer, while selective deer browse pressure favours unpalatable species. Although deer and earthworms are independently credited as drivers of forest degradation, this is the first investigation of both within a unified experimental context (and in the field). Our research employs a factorial design represented by a network of paired 50 x 50m fenced and open plots (N=10) along a gradient of deer browse intensity and presence/absence of earthworms to isolate distinct and synergistic impacts of deer and earthworms on native understory plant communities. I will present survivorship of 12 plant species and relate these data to earthworm species distributions and deer browse. Mechanisms structuring relationships between plants, earthworms and deer are likely nuanced and indirect, and our experiment seeks to determine the relative contribution of these mechanisms to the transformation of forest communities that happens in front of our eyes.

**Dobrowski, Solomon,** *University of Montana*

**Climate refugia and scale: How complex terrain shapes the velocity of climate change**

A concern for species conservation is whether or not the rate of climate change will exceed the rate at which species can adapt or move to suitable environments. At the same time there is increasing awareness that climatic heterogeneity driven by complex terrain may spatially buffer the effects of rapid climate changes. This has prompted the use of climate velocity for estimating the rate of climate change as it accounts for regional changes in climate and the ability of topographic heterogeneity to buffer biota against these changes. Here we assess the climate velocity (both climate displacement rate and direction) for minimum temperature, actual evapotranspiration, and climatic water deficit over the contiguous US during the 20th century (1916–2005). Climate velocity for these variables demonstrate complex patterns that vary spatially and temporally and are dependent on the spatial resolution of input climate data. Climate velocity estimates increase as the spatial resolution of climate data is coarsened due to the fact that coarsely grained data underestimates the heterogeneity of climate gradients in areas of complex terrain. The sensitivity of climate velocity to climate data resolution is most pronounced at fine grain sizes highlighting the importance of topoclimatic variability for assessing the capacity of organisms to keep pace with changing climate.

**Dolrenry, Stephanie,** *Lion Guardians;* **Leela Hazzah**, *Lion Guardians;***Laurence Frank,** *Living with Lions*

**African lion adaptation and survival in non-protected human-altered landscapes**

African lion (Panthera leo) populations are becoming increasingly isolated with regional extinction imminent for many areas. Their survival in many regions is largely dependent on non-protected landscapes. Human-altered landscapes often surround protected areas and are frequently considered not suitable for long-term maintenance of lion populations. However, many of these areas, although depleted, have the potential to support carnivores, albeit at lower densities than found in protected areas. Furthermore, they are essential for maintaining the connectivity between larger protected populations and are thus important components of effective conservation strategies. We present findings on a long-term study of a lion population living on non-protected human-dominated lands and that is often in direct conflict with humans. We explore basic characteristics of the persecuted lion population, particularly in relation to behavioral and ecological adaptations to survival in human-altered areas. We also examine how the increased tolerance of local human communities could allow the movement and survival of carnivores in non-protected areas thus maintaining connectivity and viability of protected populations. Although protected areas are necessary for long-term persistence, alone they are not enough. Most of the lands required for carnivore survival are in lands that are affected by human populations.

**Dominguez Alvarez, Luisa,** *Instituto Nacional de Ecología y Cambio Climático;* **Erwin Marti**, *Instituto Nacional de Ecologia y Cambio Climatico;***Amanda Gonzales,** *U.S. Fish and Wildlife Service*

**Bi-national Cooperation for Biodiversity Conservation: The Wildlife Without Borders - Mexico Program.**

Created in 1995 by the US Fish and Wildlife Service and the Secretary of Environment and Natural Resources of Mexico, the Wildlife Without Borders - Mexico program (WWB - Mexico) represents a cooperative effort to conserve the biodiversity and the integrity of the natural wealth shared by these two nations. WWB-Mexico builds human and institutional capacity for biodiversity conservation and management through training. The program provides small grants by partnering with key stakeholders from government agencies, private sector, universities, schools, NGOs, indigenous and peasant farmers organizations. Important and valuable lessons have been learned in the last 18 years during the implementation of more than 310 projects (over $9 million USD in funding and $24 million USD in local counterpart contributions), that have trained more than 12,000 people while benefiting more than 104 species of international concern.

**Donnelly, Melinda,** *University of Central Florida;* **Linda Walters**, *University of Central Florida;***Jennifer Manis,** *University of Central Florida;* **Paul Sacks**, *University of Central Florida;* **John Stiner**, *Canaveral National Seashore*

**Restoring Habitats and Conserving History: Living Shoreline Stabilization in Canaveral National Seashore**

Living shoreline stabilization, an alternative to hard-armoring techniques, uses biomimicry to decrease erosion, provide structurally complex intertidal habitat, and potentially adapt to future sea level rise. Beginning in 2008, we scientifically tested living shoreline techniques and found a multi-species approach with oyster shells, Spartina alterniflora transplants, and 1-yr old mangrove seedlings reduced erosion along major boating channels in Canaveral National Seashore, FL. We applied our living shoreline methodology to protect Turtle Mound, a Native American shell midden, experiencing severe shoreline erosion. In April 2011, we worked with multiple stakeholders, including the Park service, local government, recreational anglers, and community volunteers, to stabilize 200 m of shoreline. Volunteers deployed 1140 oyster shell mats, 622 S. alterniflora transplants, and 450 mangrove seedlings (Rhizophora mangle and Avicennia germinans) grown by local schools. On-going monitoring has documented no significant difference in the rate of erosion compared to control living shorelines. However, mean percent cover of S. alterniflora and mangrove species increased from less than 3% before stabilization to 33% and 30%, respectively, after 20 months. Oyster recruitment was 24 oysters per 0.25 m2. Continued monitoring allows for continued evaluation and adaptation of our science-based approach to living shoreline stabilization and guides current and future projects.

**Dougherty, Dawn,** *University of California Santa Barb*

**Going beyond NTZs: designing TURF-Reserves for fish and fishing**

Recent studies have shown that small-scale fisheries around the world are in poor condition and are following a trajectory of continued decline. The state of these small-scale, data-limited fisheries is a concern for the health of marine ecosystems, the livelihoods of those that depend on them, and global food security. While marine reserves have been successful in achieving conservation goals, they may not be enough to address livelihood and food security goals when fisheries surrounding the reserves are still subject to open access management. One possible solution to the challenge of simultaneously conserving marine ecosystems and ensuring productive and sustainable fisheries is to couple marine reserves with exclusive access to fishing grounds by local fishing communities. By having spatial property rights for fishing grounds (i.e. TURFs), local communities will reap the benefits of sustainable management practices and enforcement of marine reserves. To predict the timing and magnitude of community benefits, our team is developing models to compare alternative data-poor adaptive management methods for coupled TURF-reserve systems and the possible timing of fishery recovery and ability to achieve multiple objectives when applying these methods. We also consider the optimal spatial design of these systems to balance conservation and economic objectives.

**Douglas, Kristin,** *American Museum of Natural History;* **Kimberley Landrigan**, *American Museum of Natural History;***Adriana Bravo,** *American Museum of Natural History;* **Katharine Hanson**, *American Museum of Natural History;* **Jenna Conversano**, *American Museum of Natural History;* **Ana Luz Porzecanski,** *American Museum of Natural History;***Eleanor Sterling**, *American Museum of Natural History*

**Strengthening Conservation Capacity through Strategic Resources and Partnerships: the Network of Conservation Educators and Practitioners**

There is an urgent need for trained biodiversity conservation professionals capable of applying critical thinking, conservation science, and adaptive management to rapidly changing environmental challenges. Yet limited access to training resources and opportunities is one of the greatest obstacles to building capacity in conservation globally. To meet this need, the American Museum of Natural History's Center for Biodiversity and Conservation and its partners developed the Network of Conservation Educators and Practitioners (NCEP). NCEP improves conservation capacity worldwide by: 1) increasing access to high quality, open access teaching and training materials; 2) advancing an active approach to learning that models the realities of conservation practice and builds critical skill sets; and 3) fostering strategic thinking about different capacity building strategies, such as establishing professional competence standards, in-service training and certification for conservation professionals, and strengthening academic programs in conservation. We will present the latest additions to our collection of over 100 training modules available online (http://ncep.amnh.org) and share lessons learned from our activities in over 15 countries. By supporting long-term planning for capacity building and targeting the trainers of conservation professionals, NCEP expects to have an amplified and sustained impact, as students become the researchers, managers, and decision-makers of the future.

**Douglas, Leo,** *American Museum of Natural History*

**Parrots, bananas, and Neoliberalism: A systems view of human-wildlife conflict on the island of Dominica.**

Human-wildlife conflicts are often complex non-linear issues that frequently become conjoined with or surrogates for pre-existing, broader socio-economic struggles between stakeholder groups. On the island of Dominica conflict centered the behavior, meaning and value of native threatened parrots perceived as crop pests is an emerging conservation concern. Using a grounded theory approach I demonstrate that conflict between stakeholders about parrot-induced crop losses is a complex system involving an unintended collision of State-facilitated parrot population recovery efforts, government-led post-banana agricultural diversification policies, festering grievances related to the loss of economic power, financial security, and social status among farmers living in Dominica’s post-banana era. Overall crop loss attributed to parrots on Dominica has become a surrogate issue and focal point within a larger, volatile public dispute about the state of agriculture and the security of farmers. The findings suggest that, given the conflict’s complexity, efforts to understand and mitigate the ongoing dispute in a traditional linear manner, as purely a wildlife-crop loss issue, will be unproductive. Furthermore, it illustrates the advantages of a multidisciplinary systems perspective both in the study and management of this and similar conflicts towards the identification of leverage points for intervention and long-term resolution.

**Dovie, Delali,** *University of Ghana, Legon, Accra, Ghana*

**Establishing Indicators for Understanding Impacts of Climate Change on Ghana's Savannah Ecosystem**

Climatic change and variation, and human activities are leading to land degradation in arid, semi-arid and dry sub-humid ecosystems. In Ghana, the consequence has been a progressive desertification in the savannah ecosystem. The estimated total land area of Ghana prone to desertification is 64.97% (165,000 km2). Of this, close to 50% is occurring in the three uppermost savannah-dominated regions facing the greatest hazard of climate change. Several interventions to halt desertification and alteration in biodiversity have been undermined by the failure to identify where critical resilience resides in savannahs towards developing appropriate indicators to strengthen that resilience. A rapid expert assessment was used to identify the impacts of climate change on biodiversity and indicators to drive interventions that address impacts at the human-biodiversity interface. Impacts range from gene level through to ecosystems with the adverse effect of increased temperatures on gene banks, least adapted species, quality of vegetation and pasture, pathogenic wildlife diseases, plant regeneration and wildlife breeding patterns were amongst some of the sensitive results. Loss of wildlife habitat and increased invasive species were also identified. Increased temperatures, increased short-period precipitation and flooding, scanty rainfall and change in onset of rains, and increased drought intensity and duration were cited as key indicators to drive resilience decision-making.

**Dowell, Stephanie,** *Fordham University*

**Monitoring Monitors: Genetic Structure of the Highly Exploited Nile monitor, Varanus niloticus**

Overexploitation is a leading cause of biodiversity loss and species extinction. Identifying genetic subdivisions in highly exploited species is necessary to minimize the loss of distinct populations and overall genetic variation. The Nile monitor, Varanus niloticus, is extensively harvested for the skin trade in countries throughout the Sudano-topical region of Africa, yet little is understood about the genetic structure of this species. In this investigation, polymorphic microsatellite loci were used to assess the patterns of genetic differentiation in V. niloticus across the Sudano-topical region. The main hypothesis was that V. niloticus populations would exhibit genetic isolation among the major watersheds throughout the region. Significant population genetic structure was observed, as assessed with Bayesian analysis of population structure and F-statistics. However, discrete populations were not confined to individual drainage systems. Additionally, extensive structuring was observed among sub-populations of the Lake Chad region, despite their relative close proximity. The large-scale fluctuations of Lake Chad and the surrounding hydrology within the last thousand years could account for the observed genetic structure of the V. niloticus populations. In addition, the genetically unique populations present in Mali could call for more stringent V. niloticus trade regulations to preserve the genetic diversity of the species.

**Draheim, Megan,** *Virginia Tech Center for Leadership*

**Leopards and Coyotes: Conflict over Social Constructions, Values and Solutions in Mumbai and Denver**

As more people live in recently urbanized areas and as more wildlife becomes acclimated to living close to people, the potential for human-wildlife interactions increases. In the case of predators, these situations can become explosive, but also provide an opportunity for conservationists to gain further understanding of complex interactions with the goal of furthering conservation efforts. We compared human-coyote conflict in suburban Denver, USA and human-leopard conflict in Mumbai, India, using quantitative and qualitative social science methodologies. In both cases, perceptions of conflict were rooted in narratives of predators and their place in urban areas. Some felt that leopards and coyotes belonged and were willing (and in some cases glad) to accept sharing the landscape with these animals. Others felt that predators do not belong in urban landscapes, which was expressed through fear and/or demands for management interventions such as trapping and translocations (in India) and lethal control (in Denver). Neither of these measures have proven effective and in some cases can increase conflict. Significantly, there are similarities and differences in the social constructions of predators at the two sites, which help to shape the social conflict over them. Understanding these underlying narratives about human-predator interactions can help conservation practitioners to better target outreach and educational programs to better ensure positive conservation outcomes.

**Draper, Chris,** *Born Free Foundation*

**Compassionate Conservation: a Synthesis Between Animal Welfare and Conservation**

With increasing threats to wild animal populations and increasing need for conservation interventions come associated risks to the welfare of individual animals. There is a need to fully examine the interplay between animal welfare costs and benefits within conservation problems and solutions. Conservation interventions that involve harm to animals must consider factors such as the necessity of intervention, the likelihood of success and more humane alternatives. The full extent of anthropogenic impact on wild animals and how far human responsibility extends to the welfare of free-living wild animals needs to be considered. Compassionate Conservation aims to develop and refine robust and humane frameworks that fully consider individual animals within conservation research and practice in which the focus is on species, populations, or ecosystems. There is an increasing recognition that a Compassionate Conservation approach of considering individual animal welfare within conservation policy and practice can improve conservation effectiveness and increase acceptance and support. I will provide an introduction to the emerging Compassionate Conservation initiative, highlight areas of interaction between conservation practice and animal welfare, and examine how far animal welfare ethics and science extend “into the wild”.

**Drew, Joshua,** *Columbia University;* **Les Kaufman,** *Boston University*

**Using population genetics to inform historical ecology: Functional endemism in a coral reef fish**  
Quantifying population connectivity is important for visualizing the spatial and temporal scales that conservation measures act upon. Traditionally, migration based on genetic data has been reported in migrants per generation. However, the temporal scales over which this migration may occur do not necessarily accommodate the scales over which human perturbations occur, leaving the potential for a disconnect between population genetic data and conservation action. Here, we present a new metric called the "Rule of Memory" which helps conservation practitioners to interpret migrants per generation in the context both of human modified ecosystems and the cultural memory of those doing the modification. Our rule states that clades should be considered functionally endemic regardless of their actual taxonomic designation if the migration between locations is insufficient to maintain a viable population over the timescales of one human generation (20 years). Since larger animals are more likely to be remembered, we quantify the relationship between migrants per human generation (N) and body mass of the organism in question (M) with the formula N = 10M−1. We then use the coral reef fish Pomacentrus moluccensis to demonstrate the taxonomic and spatial scales over which this rule can be applied. Going beyond minimum viable population literature, this metric assesses the probability that a clade's existence will be forgotten by people throughout its range during a period of extirpation.

**du Plessis, Katherine,** *PercyFitzpatrick Institute of African Ornithology;* **Susan Cunningham**, *Percy FitzPatrick Institute of African Ornithology;***Rowan Martin,** *PercyFitzpatrick Institute of African Ornithology;* **Phillip Hockey**, *PercyFitzpatrick Institute of African Ornithology;* **Amanda Ridley**, *School of Animal Biology*

**Too Hot to Handle: Can Desert Birds Cope with Increasing Temperatures?**

Recent mass mortalities of birds, bats, and even humans highlight the substantial threat that rising temperatures pose to species worldwide. Although less dramatic, temperature increases may also result in sub-lethal fitness consequences. These effects may be especially detrimental in desert ecosystems, where species already live near the upper limits of their thermal tolerances, and where heat waves are predicted to become more frequent and severe. While climate change driven range and population shifts are well established, the mechanisms that underpin these processes remain poorly understood. Our multidisciplinary study bridges this gap by quantifying the behavioural (thermoregulation and foraging) and physiological (body condition) responses to increasing temperature of Southern Pied Babblers (Turdoides bicolor) in the Kalahari Desert. Even within the current range of temperatures experienced in the Kalahari, results indicate that increases in air temperature lead to behavioural changes that negatively impact body condition. Consequently, our investigation illustrates an important mechanism by which this species is vulnerable to future warming. This research demonstrates the value of investigations of temperature-dependent behaviour in the context of impacts on body condition, and suggests that increasingly high temperatures will have negative implications for the fitness of these arid-zone birds.

**Dubois, Natalie,** *Defenders of Wildlife;* **Judith Boshoven**, *Foundations of Success*

**Incorporating Climate Change into a Strategic Conservation Planning Framework**

While many conservation practitioners have begun to recognize the threats that climate change poses to natural systems, the response in terms of planning and implementation of adaptation strategies has lagged behind, in part due to a lack of specific guidance on how to incorporate general adaptation principles into specific conservation and management efforts. Here we present a methodology developed to explicitly incorporate threats from climate change into an adaptive planning framework used by a number of major conservation organizations and a small but growing number of natural resource agencies. Our approach builds on existing efforts by explicitly integrating a climate vulnerability framework into the threat assessment and ratings steps described in the "Open Standards for the Practice of Conservation" to identify new threats resulting from climate change, interactions, and synergies with existing threats. We use this framework to identify adaptation strategies that (a) intervene on non-climate threats to reduce the effects of exposure or maintain adaptive capacity of the resource, (b) use restoration to decrease the sensitivity or increase resilience of the resource, or (c) protect/restore occurrences that are less likely to experience exposure. This process provides a systematic and transparent approach to incorporating climate change into conservation planning that is transferable across scales and can be used in a variety of contexts.

**Dudley, Nigel,** *Equilibrium Research*

**How effective are sacred natural sites at conserving biodiversity: a review of the evidence**

**Dumoulin, Christine,** *University of Tennessee Knoxville;* **Paul Armsworth**, *University of Tennessee Knoxville*

**Locating conservation offices for efficient management**

Under given management plans and sets of reserves, we seek to identify office locations for managers that minimize unnecessary travel. Every management plan that involves regular site maintenance incurs travel costs, which depend on the overall distance between reserves and managers' base offices. Minimizing the overall office-to-reserve distance reduces travel costs, meaning that more of an organization's operating budget can be spent directly on conservation. Travel-optimal office locations also reduce the amount of carbon dioxide equivalent (CO2e) emitted during management. We use operations research methods to solve this optimization problem heuristically for two real-world case studies. The Yorkshire Wildlife Trust (YWT), UK, and the Nortwest Florida Water Management District (NWF), USA, differ in their organizational structure, extent and road densities. For each, we found the optimal location of all existing offices, and for an additional office when the others remain in their current locations. For both case studies, we identified office configurations that reduce travel cost relative to their current locations. In YWT, an optimally located additional office would reduce annual travel costs by £25,000. An optimal configuration of NWF's four existing offices would save $85,602 annually. Both outcomes produce enough savings to hire an additional management officer. Each of these solutions also prevents the annual emisson of 20-23, and 45-49 tons of CO2e, respectively.

**Dunn, Kristina,** *Clemson University*

**Field Assessment of the Effectiveness of DiazaCon on Reducing Gray Squirrel Reproduction and Population**

The Eastern gray squirrel (Sciurus carolinensis) (EGS) is one of the most common wildlife species in urban and suburban communities within the eastern United States. Due to their relative adaptability and lack of predators in urban environments, their numbers have increased in communities across their natural range leading to a corresponding increase in human-squirrel conflicts. Most notably is the damage EGS are causing to trees and shrubs in managed landscape settings. Efforts to control EGS numbers and their associated damage have been limited to exclusion techniques, habitat modification, repellents, trapping, shooting, and recreational hunting. Unfortunately in some situations, these alternatives are not effective, practical, or socially acceptable as tools for controlling their numbers and associated problems that they cause in urban and suburban communities. This project is the first field test of DiazaCon in reducing EGS reproduction and damage. DiazaCon has been shown to be effective at inhibiting reproduction in a variety of birds and mammals. An additional benefit of DiazaCon is that it is an oral bait so it does not require capturing EGS; therefore, it may be a cost-effective method of controlling their reproduction and damage on Clemson University's main campus.

**Dunstan, Piers,** *CSIRO;* **Nicholas Bax**, *CSIRO*

**Conservation on the High Seas -Rapid Progress in Defining Ecologically and Biologically Significant Areas (EBSAs)**

The oceans cover 70% of the Earth's surface, and the majority of this area (or half the Earth's surface) is in Areas Beyond National Jurisdiction (ABNJ). The international community provided a program of action for achieving sustainable development of the oceans, coastal areas and seas at the Rio Earth Summit in 1992, however sustainable use of living resources on the high seas has been challenging and remains a major concern for the international community. In 2002, an aspirational target was set to establish marine protected areas, including representative networks by 2012. In 2008, the Conference of the Parties to the CBD adopted seven scientific criteria to identify ecologically or biologically sensitive areas (EBSAs) to enhance conservation and management measures and encouraged competent parties to conduct regional workshops. The first regional workshop, convened by the Secretariat of the Convention on Biological Diversity (SCBD) in November 2011 was to identify potential EBSAs in the western South Pacific region. Subsequent workshops have been held in the Western Atlantic, Southern Indian, Eastern Pacific, and Southeast Atlantic and North Pacific oceans. We report on the results of those workshops here, discuss their progress through the international negotiations at the 16th meeting of the CBD Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and COP11, and look to the future.

**Dutta, Trishna,** *Smithsonian Conservation Biology Institute and George Mason University***; Sandeep Sharma*,*** *Smithsonian Conservation Biology Institute and George Mason University;* **Jesús E. Maldonado*,*** *National Museum of Natural History, Smithsonian Institution;* **Thomas C. Wood***, George Mason University;* **Hemendra Singh Panwar***, Peace Institute Charitable Trust;***John Seidensticker***, Smithsonian Conservation Biology Institute*

**Using a genetic approach to test the functionality of forest corridors: case study from India**

We used molecular tools on non-invasively collected fecal samples of leopards from protected areas and corridors in central India. Using a panel of neutral markers, we identified 217 individuals, and evaluated their genetic structure. We further evaluated gene flow in the landscape, using simulations and coalescent approaches. We found that leopards use these corridors, and found several first and second generation migrants in the landscape. Current gene flow levels are significantly lower than historic gene flow, and all results indicate that these corridors are effective in maintaining genetic connectivity for leopards in this landscape. We suggest corridors to be protected for the conservation of the long term persistence of large carnivores in this landscape.

**Eakin, C. Mark,** *National Oceanic and Atmospheric Administration;* **Russell Brainard**, *National Oceanic and Atmospheric Administration;***Charles Birkeland,** *University of Hawaii at Manoa;* **Paul McElhany**, *National Oceanic and Atmospheric Administration;* **Margaret Miller**, *National Oceanic and Atmospheric Administration;* **Matt Patterson,** *National Park Service;***Gregory Piniak**, *National Oceanic and Atmospheric Administration;* **Matthew Dunlap,** *University of Hawaii at Manoa;* **Mariska Weijerman,** *University of Hawaii at Manoa*

**Incorporating Climate Change and Ocean Acidification into Extinction Risk Assessments for 82 Coral Species**

Ocean warming and acidification threaten many species with extinction, but species-specific impacts remain difficult to predict. Marine invertebrate species facing potential extinction are often rare, with uncertain taxonomies and poorly known life history and ecological traits. This makes determining extinction risks challenging, and is best met through integration across multiple scientific disciplines. In 2009, the U.S. National Oceanic and Atmospheric Administration (NOAA) was petitioned to list 83 tropical, reef-building coral species as endangered or threatened under the U.S. Endangered Species Act (ESA). An expert Biological Review Team (BRT) assessed the extinction potential for each species using a expert-based approach. The BRT determined that warming and ocean acidification posed two of the three most important extinction risks to corals. Species with wide geographic and habitat ranges and lower exposure or sensitivity to key threats were interpreted to be at less risk of extinction. NOAA has since proposed the listing of 12 of these species as endangered and 54 as threatened. As ocean warming and acidification are occurring globally, it has become clear that, while necessary, local management and conservation efforts alone are insufficient to conserve coral reef diversity. Efforts to address carbon dioxide emissions directly need to be implemented soon to prevent the loss of many species of corals and ecosystem services provided by coral reefs.

**Egoh, Benis,** *JRC-EUropean Commission;* **Joachim Maes**, *JRC-EUropean Commission;***Grazia ZULIAN,** *Contractor at JRC;* **Maria Luisa PARACCHINI**, *JRC-EUropean Commission;* **Giovanni Bidoglio**, *JRC-European Commission*

**What is most important in prioritizing areas for restoration in Europe? Biodiversity, ecosystem services or cost.**

Target 2 of the EU biodiversity strategy for 2020 ask for the restoration of 15% of degraded areas to ensure the protection of biodiversity and delivery of ecosystem services. To achieve this goal, restoration work must be properly targeted. Several criteria are important in selecting areas where restoration should be focused in Europe. In this study, we explore the implications of using different criteria in identifying priorities for restoration. We first of all focused the targets on biodiversity through the articles 17 sites, then on seven ecosystem services (Soil carbon only and carbon storage including above and below ground carbon, livestock production, water infiltration, erosion control, nitrogen retention and energy production). We also explore the implications for including economic cost and found that, economic cost greatly influenced the selected areas where restoration needs to be focused by shifting priorities from the highly degraded western and southern parts of Europe, to the less degraded eastern and northern parts of Europe. Our results also showed that targeting areas within the habitat directive reporting with conservation status U1 will provide the biggest benefit both for species and ecosystem services but at least 18% of Europe has to be restored to achieve a 10% target in areas important for habitat and species and at least 2% of ecosystem service .

**Ellis, Alicia,** *University of Vermont;* **Taylor Ricketts**, *University of Vermont;***Sam Myers,** *Harvard University*

**Linking ecosystem services and human health: Crop pollination, nutrition, and burden of disease in developing countries**

It has long been known that pollination is an important ecosystem service that improves crop yields, and recent research highlights the important nutrients derived from animal-pollinated crops. However, no studies have established an empirical relationship between pollination and actual health outcomes or identified populations that benefit most from pollination in terms of nutritional diseases. To establish these relationships, an integrated approach that links ecological and public health disciplines is needed. In this study, we ask how an incremental reduction in pollinators would affect diets, nutrient deficiency, and burden of disease in Kenya, Haiti, and Nepal, where incidence of nutritional diseases is high and access to nutrient supplements or replacement foods is limited. We use: (1) dietary consumption data, (2) ecological information on the effect of pollination on crop yields, and (3) country-specific food composition tables to test the effects of pollination reduction on burden of disease. Pollination was important in all countries although the effect on nutritional health varied as a function of diet. Broadly, results suggest that while pollination is clearly important for food yields and security, its affects on nutritional health are location-dependent.

**Elloitt, Lee,** *University of Missouri;* **David Diamond**, *University of Missouri*

**Conservation status and hotspots of enduring features by ecoregion for the conterminous USA**

Climate patterns, species distributions, and ultimately ecosystem structure and function will change in novel ways in coming decades. Enduring features (EFs) provide the stage on which these processes will take place, and are appropriate as conservation targets. In the USA, several efforts (LandFire; standardized terrestrial ecosystem mapping) have provided GIS coverages of EFs. We assembled and analyzed these data using GIS software. Data quality varies across the country, with landforms generally well-represented, but variation based on soils at finer resolution often lacking. Local efforts have provided finer-resolution data in some regions (e.g. the NE USA; parts of Arizona in the SW; Missouri). Overall EF diversity varies across the landscape, so we analyzed data by ecoregion. Public lands data were overlain with EFs to identify un-conserved EFs, and hotspots of EF diversity were also identified. Mountains and breaks within plains ecoregions are areas of high EF diversity, and unique soils (sands, saline) and wetlands add to local diversity within individual ecoregions. The un-conserved EFs and EF hotspots we identified can be incorporated as targets into overall conservation assessment and planning, together with biological targets and information on landscape context.

**Elphick, Chris,** *University of Connecticut;* **Michael Reed**, *Tufts University;***Christopher Field,** *University of Connecticut*

**Complex statistics and stakeholder engagement: Is a better analysis always a good idea?**

Engaging stakeholders is crucial to successful conservation, but can be hampered when quantitatively complex and hard-to-explain modeling underlies scientific conclusions. Simultaneously, the use of complex analyses could improve engagement by making it easier to incorporate data that would compromise more traditional analyses. To explore the need for quantitative sophistication, we used a large 20-year data set to estimate survival rates for the Hawaiian stilt, an endangered island endemic. We used Markov chain Monte Carlo methods to fit hierarchical models and construct the complete data likelihood for both adult and sub-adult survival rates. Using data augmentation to estimate missing values and incorporate auxiliary data that were not collected during formal sampling allowed us to use all of the available data, much of which was collected via ad hoc sampling over many years by volunteers, agency biologists, and other stakeholders not initially involved in the study. We compared our results to those used in an exploratory population viability analysis, based on only two years of sampling in the 1990s. Surprisingly, we found little difference in average survival estimates, despite considerable variation in sub-adult survival among cohorts. In contrast, the ability to use all of the data in the new analyses provides much better information about variation and uncertainty. For some questions analytical complexity is clearly helpful, but it may not always be needed.

**Enciso, Marco A.,** *University of Sao Paulo & Centro de Ornitología y Biodiversidad (CORBIDI);* **Germán Chávez**, *Centro de Ornitología y Biodiversidad (CORBIDI);***Paloma Alcázar,** *Centro de Ornitología y Biodiversidad (CORBIDI);* **Diego Vásquez**, *Centro de Ornitología y Biodiversidad (CORBIDI);* **Vilma Duran**, *Centro de Ornitología y Biodiversidad (CORBIDI);* **Silvana Alvarez,** *Centro de Ornitología y Biodiversidad (CORBIDI);***José Malqui**, *Centro de Ornitología y Biodiversidad (CORBIDI)*

**Chytridiomycosis in two endangered Telmatobius species at the southern Andes of Peru**

The genus Telmatobius (Anura: Ceratophryidae) is suffering a drastic declines on populations of most of their species, caused by many factors, one of them is the infection by the fungus Batrachochytrium dendrobatidis (Bd). Herein, we report dead larvae and adult individuals of Telmatobius jelskii and adult T. marmoratus that were found in two localities at the departments of Apurimac and Cusco, up to 3000 m.a.s.l. during May to December 2012. The diagnosis by histopathology was positive for chytridiomycosis caused by Bd, unlike other studies that used PCR. Were identified oral and cutaneous chytridiomycosis, with zoosporangia in different stages: immature, mature with zoospores, empty and collapsed. This report added T. jelskii as species affected by Bd, and discusses the interaction of the two Telmatobius species with the agriculture and mining development in the southern Andes of Peru.

**Engelhardt, Katharina,** *University of Maryland Center for Environmental Science, Appalachian Lab;* **Maile Neel**, *University of Maryland College Park;***Brittany West,** *University of Maryland College Park;* **Michael Lloyd**, *University of Maryland College Park*

**The consequences of genetic and functional diversity on sustainability of V. americana patches**

Reduced diversity of populations can have far-reaching consequences on ecosystem functioning and resilience when individuals within populations have lost the capacity to adapt or acclimate to changing environmental conditions. We focus on the effects of genetic and functional diversity on the performance and sustainability of Vallisneria americana, a freshwater submersed aquatic macrophyte species that is common in the Chesapeake Bay, USA, but that has witnessed catastrophic declines. We genotyped individuals from 14 populations and cultured them to conduct greenhouse experiments that tested the effects of genotype richness on the growth, productivity and reproductive potential of individuals and populations. Individuals varied greatly in terms of allocation to lateral spread versus vertical growth and between asexual and sexual reproduction, which has implications for tradeoffs between persistence at a site versus dispersal among sites. The presence of flowers and the frequency of both sexes flowering in the same population increased with genotype diversity. The response we observed was a classic allee effect; more genotypes increase the chance that genotypes that flower more frequently are selected and that both sexes are represented. These observations have tremendous consequences for population genetic structure and sustainability because they show that the genetic and functional characteristics of populations determine whether adaptation and acclimation are possible.

**Epanchin-Niell, Rebecca,** *Resources for the Future*

**Integrating Adaptive Management and Ecosystem Services to Improve Natural Resource Management: An Exploration of Benefits, Challenges, and Approach**

Resource managers must make effective decisions about broad-scale ecosystem processes with complex interactions, numerous competing stakeholder interests, and highly uncertain outcomes. Adaptive management is a decision-process that focuses on "learning by doing" and incorporating what is learned into ongoing management. In contrast, an ecosystem services approach is an analytical framework that accounts for the values that ecosystems provide to humans. Both are recognized as important approaches to natural resource management, but have largely been applied independently. In this talk I will explore these approaches' complementarity -- examining how their integration into a common framework may improve natural resource management outcomes. My talk will address the questions: How can application of ecosystem service analysis within an adaptive decision-process improve the outcomes of management while also advancing understanding of ecosystem service identification, production, and valuation? What does this integration look like? What are the constraints and challenges to this integration? I will draw on several case studies to illustrate the integration and its benefits and challenges. This talk directly addresses the meeting theme by applying an interdisciplinary perspective to natural resource management -- bringing together economics, ecology, and policy to consider the connections between human and natural systems and the values that ecosystems provide to stakeholders.

**Epler-Wood, Megan,** *Cornell University;* **Mark Milstein**, *Cornell University*

**Community Enterprise development strategies for tourism in protected area buffer zones**

Efforts to improve benefits from tourism and arrest poor enterprise designs for communities living in buffer zones outside protected areas have frequently failed due to a poor understanding of tourism markets. Techniques to improve supply chains with a wide variety of local tourism products are well understood but usually not financed. Capacity building solutions cannot help communities who cannot reach the marketplace without more support from tour operators, hoteliers, or other major players due to the complexities of the international tourism marketplace. The authors will supply a variety of tested approaches to improving enterprise development in buffer zones. New approaches to connect local community products to tourism buyers could be highly successful if the existing marketplace is simply financed for the cost of performing local community enterprise development during the period of support from donors. This presentation will provide examples of how socially and environmentally responsible tourism businesses can help develop and boost local community businesses in buffer zones without massive capital infusions but rather with technical support funding for innovative procurement strategies and community development partnerships with local, regional and international tourism buyers.

**Epstein, Larry,** *Environmental Defense Fund*

**Increasing the Effectiveness of Marine Protected Areas in Belize**

The Mesoamerican Barrier Reef in Belize is recognized as one of the most magnificent marine ecosystems in the world. To protect the reef and its fisheries, the Government of Belize has established a national network of marine reserves. The reserves though have not eliminated the overfishing threat facing Belize’s fisheries and the nearly 15,000 Belizeans dependant on fishing for their livelihoods. Over the past four years EDF, in partnership with government and NGOs, has led a process that aims to improve the effectiveness of marine reserves and no-take zones in their protection and restoration of fisheries by implementing territorial use rights for fishing (TURFs) at Port Honduras and Glover’s Reef Marine Reserves. The results are impressive. Under the TURF system, fishermen are acting as stewards and protecting the resource:

• Over 80% of fishermen are reporting their catch. Before managed access there was no reporting.

• 70% of fishermen report better catches.

• There has been a drastic reduction in reported illegal activities including undersized catch, violations of seasonal closures, and fishing in no-take zones.

Over the last two years this partnership has catalyzed a major paradigm shift. By proving the concept of the ground, the government is increasingly confident in the potential for TURFs to improve the performance of marine reserves and is now working with its partners in the NGO and conservation community to expand managed access to eight additional sites.

**Erez, Elana,** *Tel Aviv University;* **Rakefet Sela-Sheffy**, *Tel Aviv University;***Avi Bar Massada,** *University of Haifa-Oranim;* **Uri Shanas**, *University of Haifa-Oranim*

**Public participation in the process of declaring a biosphere region: cultural and ecological perspectives**

Megiddo Regional Council is a rural area in northwestern Israel, comprising thirteen agricultural settlements and having roughly 90% of its land as an open space. An intensive process, led by the council and involving its residents, culminated in 2011 in UNESCO's Man and Biosphere Programme declaring the region as the Ramat Menashe Biosphere Region. We aim to compare how and whether the values of the residents, as manifested in the final decisions on the location of core areas, concord with biological data. We conducted interviews with residents who took part in the process. Using discourse analysis methods, we recognize a "rural identity" which the residents value as a symbolic and a political capital. We show that this identity was the motive that pushed forward the creation of the Biosphere Region. Based on species observations within the council's area, we created species distribution models using MaxEnt for ten iconic vertebrates. We identified biodiversity hot spots by overlaying and averaging the predicted distribution maps, and found that they are not sufficiently captured by the actual core zones of the biosphere region. Using the two perspectives above, we highlight the biosphere-reserve concept: the chosen core zones, which do not best reflect the biodiversity of the region, have a major role in the residents' identity. As such they might get a better chance of being preserved over the years, but might not encompass preservation for the entire fauna and flora.

**Estes, Anna,** *Penn State University;* **Brooke Bateman**, *University of Wisconsin-Madison;***Herman Shugart,** *University of Virginia;* **Volker Radeloff**, *University of Wisconsin-Madison*

**Using Species Distribution Models and Remote Sensing to Predict Hotspots of Human-Elephant Conflict: Implications for Conservation and Management**

Human-elephant conflict (HEC) is a major threat to elephant conservation and rural livelihoods, and is increasing throughout sub-Saharan Africa as agricultural expansion erodes former elephant habitat. Analysis of HEC frequently focuses on how farm-based factors affect the distribution and timing of HEC, and does not consider how other ecological factors may influence these dynamics. The goal of our study was to look for ecological correlates of conflict that may help understand HEC within a landscape context. We used elephant telemetry data with remotely-sensed habitat indices in species distribution models to predict high-quality elephant habitat in the greater Serengeti ecosystem of Tanzania. Elephant distribution was strongly influenced by level of protection, and within the protected areas, land cover, distance to rivers and NDVI were the most important predictors of elephant habitat suitability. Notably, model prediction of the highest quality elephant habitat inside the protected area coincided almost exactly with measured hotspots of HEC just outside the protected area boundary. This indicates that underlying ecological correlates of elephant habitat suitability could in large part be driving HEC dynamics in surrounding areas. Knowledge of the underlying factors that bring elephants into conflict with humans is critical to applying appropriate interventions, and our study shows that we must consider the role of habitat in planning effective mitigation strategies.

**Estes, Lyndon,** *Princeton University;* **Lydie-Line Paroz**, *NA;***Bethany Bradley,** *University of Massachusetts;* **Jonathan Green**, *Princeton University;* **David Hole**, *Conservation International;* **Stephen Holness,** *Nelson Mandela Metropolitan University;***Guy Ziv**, *Natural Capital Project;* **Michael Oppenheimer,** *Princeton University;* **David Wilcove,** *Princeton University*

**Using Changes in Agricultural Potential to Quantify Future Climate-Induced Risk to Conservation**

Most biodiversity-related climate change impacts research focuses on direct effects to species and ecosystems. Little attention is given to the potential ecological consequences of human climate adaptation, which may equal or exceed the direct effects on biodiversity. Agriculture adaptation may have particularly large biodiversity impacts. As farmers respond to changing climates, they may seek to convert new lands while leaving others as agricultural suitability changes. We quantified how the agro-economic potential of South African conservation areas may be altered by climate change. We assumed that the probability of an area being farmed is linked to the economic benefits of doing so, using crop productivity as a proxy for production benefit and topographic ruggedness as a proxy for production costs. We simulated current and future maize and wheat productivity in key conservation areas using the DSSAT4.5 model and 36 crop-climate response scenarios. Most conservation areas currently have, and will continue to have, low agricultural potential because of their location in rugged terrain. We highlight several areas that may gain in agricultural value and thus face greater risk of conversion to cropland. Several areas are likely to lose agroeconomic potential and may prove easier to protect from conversion. Our study provides an approximate but easily applicable method for incorporating potential human climate change adaptation responses into conservation planning.

**Evans, Greg,** *Virginia Tech Center for Leadership*

**Can a human dimension focus help reducing black bear/human conflicts?**

Human development patterns and a growing American black bear (Ursus americanus) population are accelerating human/bear conflict situations and today’s wildlife managers have to consider impacts of bear management policies on both the bear and an increasingly diverse public. One consequence is a growing disparity between what the broader public and the professional wildlife management community considers acceptable bear management options. Wildlife managers and policy officials increasingly must deal not only with the issue of bears habituated to human presence, but also with the public’s reaction to traditional solutions. Today’s wildlife manager must be knowledgeable about both the biological science and the sociological drivers influencing today’s society. Furthermore, (s)he must balance responses supporting agency policies with public interest in co-management. To identify current best practices, a literature review on human/bear conflicts at the edge of urban/suburban areas and national, state, provincial, protected areas in the U.S. and Canada was conducted. Since most discussions of wildlife habituation are concerned in part with human activities that lead to positive and negative changes or responses in wildlife behavior, a second literature review is being conducted of human dimension management considerations to develop ideas on how policy and management could affect the human bases for wildlife habituation and apply them to bear management practices.吠⁯摩湥楴祦挠牵愀‬‬‬‬‬‬

**Evans, Karl,** *University of Sheffield*

**Factors shaping urban bird assemblages.**

Not Provided

**Fagan, Matthew,** *Columbia University;* **Ruth DeFries**, *Columbia University;***Steven Sesnie,** *US Fish and Wildlife Service;* **J. Pablo Arroyo-Mora**, *McGill University;* **Wayne Walker**, *Woods Hole Research Center;* **Carlomagno Soto,** *McGill University;***Robin Chazdon**, *University of Connecticutt;* **Andres Sanchun,**

*FUNDECOR*

**Protecting forests outside parks: land sparing after a deforestation ban in northern Costa Rica**

The expansion of export-oriented cropland potentially causes habitat destruction in the absence of forest protection policies. Using satellite imagery, we tracked agricultural expansion from 1986 to 2011 in the lowlands of northern Costa Rica, a region protected by a 1996 deforestation ban, in order to evaluate whether forest land was spared as cropland area tripled. We found that, after the ban, mature forest loss decreased from 1.98% to 1.24% per year, and the proportion of cropland derived from mature forest declined from 16.1% to 1.8%. The rapid post-ban expansion of pineapples and other crops largely replaced pasture, exotic tree plantations, secondary forests, and native tree plantations. Overall, there was a small net gain in forest cover due to a shifting mosaic of regrowth and clearing in pastures, but cropland expansion decreased dynamic turnover of forest regrowth in pastures, "hardening" the landscape. We conclude that forest protection efforts in northern Costa Rica may have slowed mature forest loss and succeeded in re-directing expansion of cropland to areas outside mature forest. Our results suggest that deforestation bans may be more effective with mature forests than with forest regrowth and may be better at restricting clearing for large-scale crops than with pasture clearing.

**Farnsworth, Matthew,** *Conservation Science Partners, Inc.;* **Ericka Hegeman**, *Conservation Science Partners, Inc.;***Luke Zachmann,** *Conservation Science Partners, Inc.;* **Kelly Herbinson**, *Pioneer Ecological Consulting;* **Thomas Jackson**, *Kaweah Biological Consulting;* **Brett Dickson,** *Conservation Science Partners, Inc.*

**Differential space use patterns by translocated, control, and resident Mojave desert tortoise (Gopherus agassizii) in the Ivanpah Valley, CA, USA**

The need for renewable energy sources in the U.S. has led to a dramatic growth in the development of solar energy, which frequently occurs in locations inhabited by the Mojave desert tortoise, Gopherus agassizii. The translocation of desert tortoises has become a common conservation tool for this federally threatened species. To understand how space use differed between approximately 400 translocated, resident, and control groups of tortoises in the Ivanpah Valley, CA, USA, location data were collected using radio tracking on an approximately weekly basis. At each encounter, information on tortoise habitat use (e.g., in burrow, cover type) was noted by field biologists. From a suite of demographic and environmental variables, we developed a candidate set of statistical models to 1) compare occurrence probabilities for each habitat type at individual and group levels, and 2) identify which environmental and demographic variables most strongly influenced those probabilities. We found that space use patterns differed for translocated tortoises when compared to the resident and control groups. Our results suggest that newly translocated tortoises spend more time above ground than resident or control groups, possibly while establishing new home ranges. As translocation activities increase, it remains important to identify the effects of translocation on tortoise space use patterns, and, ultimately, how those patterns influence survival in a region of rapid energy development.

**Farrell, Laura,** *University of Vermont;* **Daniel Levy**, *University of Vermont;***Terri Donovan,** *University of Vermont;* **Kim Royar**, *Vermont Fish and Wildlife Department;* **Mark Freeman**, *university of Vermont;* **C.William Kilpatrick,** *University of Vermont*

**Present and future landscape connectivity for bobcat and lynx in the northeastern United States**

The objectives of this research were to investigate the landscape characteristics essential to use of areas by lynx and bobcats in northern New England, map a habitat availability model for each species, and explore connectivity across areas of the region likely to experience future development pressure. A Mahalanobis distance analysis was conducted on location data collected from 16 bobcats in western Vermont and 31 lynx in northern Maine to determine which variables remained most consistent across locations using local, daily distance moved, and home range scales. The model providing the widest separation between habitat and the landscape for bobcats suggests that they cue into landscape features such as edge, availability of cover, and development rather than specific habitat types. The selected lynx model contained natural habitat, cover, elevation, and shrub scrub habitat?where their preferred prey was most abundant?was represented at the daily distance moved scale. Cross validation indicated that outliers had little effect on models for either species. A habitat value was calculated for each 30 m2 pixel across Vermont, New Hampshire, and Maine for each species and used to map connectivity between conserved lands within selected areas across the region. Projections of future landscape change illustrated potential impacts of anthropogenic development on areas lynx and bobcat may use, and indicated where connectivity for bobcats and lynx may be lost.

**Fauchald, Per,** *Norwegian Institute for Nature Research;* **Vera Hausner**, *University of Tromso*

**Indigenous subsistence harvest in the Arctic: a sustainable socio-ecological system?**

The harvest of wildlife is an important ecosystem service in small resource dependent communities worldwide. In some regions, this harvest is also considered among the greatest threats to biodiversity. Here, we investigate how subsistence-based communities in the circumpolar Arctic tundra region fit to three distinct models of the socio-ecological system. The conservation model predicts that population growth, new hunting technology and poverty will result in increased hunting pressure, and that a biodiversity crisis only can be avoided through poverty alleviation and stronger regulations. Under the stewardship model, the hunters regulate the productivity of the system through active management. Lack of sustainability is related to poor knowledge and governance, and adaptive co-management is advocated as a solution. According to the indigenous model, hunters and wildlife have co-evolved to form resilient socio-ecological systems. The hunters do not control the resource; they adapt to the natural fluctuations, and the management authority should be transferred to the local communities. We used population statistics, harvest data, management reports and literature review to evaluate the evidence for the three models. The harvest is poorly regulated by the governments. There is little evidence that the subsistence hunting affect biodiversity and the communities have evolved a range of adaptations to a variable resource. Our study does therefore support the indigenous model.

**Fay, Gavin,** *NOAA NMFS NEFSC, Woods Hole, MA*

**Incorporating climate change scenarios into models for Ecosystem-Based Management**

An essential component of marine Ecosystem-Based Management (EBM) is the recognition of the role of environmental pressures on ecosystem dynamics. Direct and indirect effects of species responses to climate drivers can result in interactions that complicate system level predictions, and alter the response of management tools such as reference points or ecosystem indicators to human pressures (e.g. fishing). An understanding of the ecosystem consequences of climate change scenarios is required to assess tradeoffs among key ecosystem services (e.g. fishery yield, conservation of protected species, sensitive habitat, etc.). Simulation frameworks using ecosystem models can be used to evaluate the effects of changes in system dynamics. We apply an End to end system model, Atlantis, to the Northeast US continental shelf marine ecosystem to demonstrate methods for assessing system-wide consequences of including climate change related impacts. We focus on the responses of upper trophic level groups that are the primary targets of fishing activity in the region, and expected changes in the values for systemic indicators. Scenarios exploring the effects of increases in temperature and ocean acidification identify robust management strategies that minimize the inability to achieve objectives across numerous tradeoffs. Most of these strategies are suboptimal than when focusing on any one objective, but show the utility of novel evaluations among a suite of ecosystem indicators.

**Feaga, James,** *Mississippi State University;* **Francisco Vilella**, *USGS Cooperative Fish & Wildlife Research Unit*

**Winter Waterbird Use and Food Resources of Aquaculture Facilities in Mississippi**

The conversion of wetlands and bottomlands to aquaculture provided alternate aquatic habitat for a variety of waterbirds. In response to the 2010 British Petroleum oil spill, the National Resource Conservation Service (NRCS) enacted the Migratory Bird Habitat Initiative (MBHI). The NRCS partnered with landowners and managers through easements to provide additional habitat for migrating waterbirds. Eligible lands included aquaculture and farm land, which provided mudflats and shallow water. In addition to easements, the NRCS sponsored research to evaluate the MBHI relative to avian response and food availability in the Mississippi Alluvial Valley (MAV). Our study area included 12 idled and production aquaculture sites throughout the Mississippi portion of the MAV. Our objectives were to: (1) assess winter waterbird abundance and diversity in aquaculture ponds during winters of 2011-2012 and 2012-2013, (2) compare current winter waterbird use of aquaculture ponds with historical data, and (3) estimate invertebrate and seed abundances in aquaculture ponds. Production sites exhibited less dynamic fluxes in bird abundance than idled sites, with peak use in mid-December 2011. Idled sites had similar peaks in mid-December 2011 and late January 2012. While conditions provided by aquaculture are not a substitute for restoration and management of natural wetlands, our results suggest these environments provide important migration and wintering habitat for a diverse waterbird community.

**Feinberg, Jeremy,** *Rutgers University;* **Catherine Newman**, *Louisiana State University;***Gregory Watkins-Colwell,** *Yale Peabody Museum;* **Matt Schlesinger**, *New York Natural Heritage Program;* **Brian Zarate**, *New Jersey Division of Fish and Wildlife;* **H. Shaffer,** *University of California, Los Angeles;***Joanna Burger**, *Rutgers University*

**The unexpected discovery of new cryptic frog in the urban northeastern US: A summary of the discovery and conservation considerations.**

The Rana pipiens (=Lithobates pipiens) complex has long been a source of taxonomic uncertainty due to cryptic variation between phenotypically similar and morphologically conservative congeners. We review the pending diagnosis and taxonomic description of a new cryptic leopard frog species, Rana sp. nov., from the northeast and mid-Atlantic US. Our research employed several lines of evidence including genetic data (nuclear and mitochondrial), bioacoustic signals (pulse number, call length, call rate, dominant frequency), and morphology to diagnose the new species and compare it to similar congeners. Despite a coastal distribution almost entirely endemic to the I-95 corridor, this frog remained undetected for hundreds of years in one of the most well-studied and heavily populated urban areas on earth. This unique and unexpected discovery poses conservation concerns and underscores the potential for future 'hidden' species in post-glaciated and urban locales rarely associated with contemporary species discovery. This discovery will also create challenges for wildlife agencies as the new species is incorporated into at least seven states, some of which already protect various leopard frog species. Lastly, this discovery demonstrates at least one non-disease risk associated with species relocations and reintroductions that is applicable to all taxa for which cryptic species may exist.

**Fernandez, Miriam,** *Pontificia Universidad de Chile*

**Large-Scale Ecosystem Analyses of the Easter Islands Archipelago: Implications for Increased Marine Protection**

Currently my research projects concentrate, on one side, on studies of the latitudinal distribution of modes of development of marine invertebrates, and the consequences of the potential for dispersal of marine species for fisheries management and conservation. On the other side, we are trying to understand the evolutionary context that favored the great diversity of modes of development that we observe among marine invertebrates.

**Fernando, Prithiviraj,** *Centre for Conservation and Research;* **Jennifer Pastorini**, *Centre for Conservation and Research*

**Elephant conservation and human-elephant conflict mitigation in Asia: the need for an integrative approach**

Asian elephants are endangered, with some populations critically endangered. Human-elephant conflict (HEC) is the biggest threat to their survival. HEC has continued to grow in severity and extent across the Asian elephant range of 13 South and Southeast Asian states and is now a major socio-economic and political issue. Across the range, HEC mitigation and elephant conservation are almost the sole responsibility of conservation agencies. In Sri Lanka, as in the rest of Asia, elephant conservation and HEC mitigation has been based on limiting elephants to protected areas. We conducted island-wide surveys of elephant distribution and HEC, based on a 25 km2 grid. We found that the majority of elephant range lay outside the protected areas. A few thousand elephants and a few million people shared the same space, leading to innumerable possibilities of encounters and interactions, and an annual death toll of over 200 elephants and 70 humans. Continued planned and unplanned development resulted in loss and fragmentation of elephant habitat. Confrontational HEC mitigation led to a vicious cycle of increasing HEC, as elephants became more aggressive and tolerated higher levels of conflict. Given the genesis, progression, scale and extent of the issue, mitigating HEC while conserving elephants, requires all stakeholders of HEC, especially those living in areas with elephants, administrative and regulatory authorities, developers and funders, to be also stakeholders in HEC mitigation.

**Ferrol-Schulte, Daniella,** *Leibniz Centre for Tropical Marine Ecology;* **Sebastian Ferse**, *Leibniz Centre for Tropical Marine Ecology;***Marion Glaser,** *Leibniz Centre for Tropical Marine Ecology*

**Exploring drivers of natural resource overexploitation in tropical coastal communities**

It is no secret that livelihoods in developing countries, including in areas of high biodiversity and endemism, often depend heavily on natural resources. Understanding not only what these livelihoods are, but their dynamism within social-ecological systems, is one of the many keys to truly effective and equitable natural resource management. This project focuses on one of the driving aspects of coastal and marine resource-dependent livelihoods in Zanzibar and Indonesia, namely patron-client systems in small-scale fishing households. Using questionnaires and interviews under the Sustainable Livelihoods Framework, we can determine what role these systems play in shaping the character and extent of natural resource dependence. We can also identify where the key drivers of exploitation originate from. In the case of Zanzibar we can see that growing tourism interacts with patron-client systems to push fishermen into unsustainable practises. In Indonesia, patrons are found to be a crucial link between foreign markets and local fishermen, resulting in devastating sequential resource over-exploitation. The lesson for natural resource managers and conservationists is that social networks, household livelihood security and individual actors can play determining roles in local knowledge transfer, values and exploitation patterns in areas of poverty and/or high natural resource dependency.

**Fierro-Calderón, Eliana,** *Asociación Calidris*

**Distribution and conservation status of two endangered bird species in the Chocó Biogeographic**

The Long-wattled Umbrellabird (Cephalopterus penduliger) and the Baudó Guan (Penelope ortoni) are threatened and endemic birds that inhabit forests of the Chocó Biogeographic on the Pacific coast of Colombia and Ecuador. We have scarce knowledge of the distribution and ecology of these species and it has hindered their study and the development of actions for their conservation. By using GIS tools and ecological niche modeling, I determined the potential distribution of these species, their remaining distribution and their conservation status in the Chocó Biogeographic. The predicted distribution for Baudó Guan was 107,199 km2, 27% is considered remaining distribution because it was found in wooded areas, and protected areas only included 8% of it. The predicted distribution for the Umbrellabird was 101,387 km2, 17% was found in wooded areas and 11% of the remaining distribution was within protected areas. I also found that around 70% of the remaining distribution for both species was in areas of medium and high anthropogenic risk, that means within 10 km from main roads and urban areas. The remaining 30% was found in low risk areas, in a distance greater than 10 km from human settle. If the Umbrellabird and the Baudó Guan occur in the predicted areas, we may correctly assess the threats that species are facing in the Pacific coast, and develop conservation actions that correspond with the environmental and social features of different areas.

**Figel, Joe,** *University of Central Florida*

**The Development of the Palm Oil Industry in Mesoamerica and Potential Impacts on the Jaguar Corridor**

Extending from northern Mexico to northern Argentina, the range-wide Jaguar Corridor is one of the largest working models for wildlife conservation in the world. One of the most proximate threats to the Jaguar Corridor is the burgeoning palm oil industry, advancing the development of expansive plantations at key linkages in the corridor. My study sites in the Magdalena region of Colombia and north coast of Honduras have the highest conservation priority anywhere within the Jaguar Corridor, in part due to their geographic location and projected palm oil expansion. Jaguars can cross and even use small agricultural patches but extensive acreages of oil palm mono-cropping may present a formidable barrier to movement. My ongoing study uses camera-trap and interview data on jaguars and their prey to evaluate the habitat characteristics and configurations in oil palm plantations that predict jaguar presence and could potentially support their persistence. Study results will guide the implementation of better land use planning and zoning measures, both of which are crucial for improving the connectivity value of oil palm landscapes within the Jaguar Corridor.

**Filardi, Christopher,** *American Museum of Natural History;* **Tia Masolo**, *Solomon Islands Ministry of Environment*

**Islands in the Sky: science, symbolism, and the conservation impact of montane expeditions across tropical Pacific islands**

Pacific island arcs comprise some of the world's great natural laboratories. Most of the famed scientific influence of these systems is based upon data gathered nearly a century ago on world-renowned expeditions. Despite the impact of early expeditions, numerous upland areas have never been rigorously explored. At the same time, montane areas are under increasing threat from direct and indirect impacts of climate change, timber extraction, and recent upsurge in regional mining activity. Montane areas across the Pacific are characterized by high species endemism and are of primary cultural and ecological importance to myriad island peoples, the original custodians of the richness of Pacific island biodiversity. Contemporary biodiversity expeditions focused on montane endemism can provide scientific, practical, and symbolic opportunity to improve regional conservation efforts for currently under-studied and threatened high-elevation ecosystems. This presentation describes key dimensions of expeditions to survey these islands in the sky as a means to advance biodiversity science and conservation. By combining long-term investment in landholder engagement and governance with scientific training, public outreach, and field natural history, collaborative expeditions are reviving the potency of basic natural history to improve conservation prospects across southwest Pacific islands.

**Findlay, C. Scott,** *University of Ottawa*

**Using Student Power to Asses the Status of Species Recovery Under the Endangered Species Act**

**Fisher, Joshua,** *The Earth Institute, Columbia Univ.*

**Conflict-sensitive protected area management in the Peruvian Amazon: applied and empirical research**

The Peruvian Amazon holds some of the world’s most biologically important forests in terms of endemism and species richness. In 2001 the Peruvian government established an innovative forest governance mechanism called conservation concessions to manage these landscapes. Concessions have proven to be effective at managing what would otherwise be de facto open-access forests. However, these areas exist at the intersection of multiple pressures including the need to conserve biodiversity and system functioning, traditional livelihoods uses, large-scale resource exploration in buffer zones, and illegal mining. As these pressures grow, access to forest resources is increasingly a source of low-level conflict, which simultaneously erodes conservation gains, inhibits economic development, and creates barriers to social cooperation. In this study we piloted the Conflict-Sensitive Conservation methodology in order to map conflict drivers, actors, and system dynamics in Peru’s Los Amigos Conservation Concession. Based on that mapping, we identify a series of social considerations to include in conservation concession management and governance throughout the region to mitigate the drivers of conflict. We likewise collected baseline data on social perceptions of conservation managers, and designed and delivered targeted conflict-prevention trainings to conservation managers. In a longitudinal study design, we will collect future iterations of data to monitor change in the system.

**Fitzgerald, John M.,** *Counsel to SCB*

**SCB's Policy Symposium, Policy Program, Recommendations to the Obama Administration, Climate Leaders & Others**

This presentation will provide an overview of the symposium and highlight key questions that will arise throughout the day. First, we will demonstrate how SCB members can participate in this Policy Symposium and in our Policy Program, how they can use SCB’s “Recommendations to the Obama Administration 2.0”, become “Ambassadors of Science” in the climate debate, and take other initiatives to bring the best available science to policy makers globally, nationally and locally. We will describe some of the most powerful but underused elements of international and domestic conservation law, and some of the key terms which, if better defined in light of modern science, could become more effective tools for conservation and for helping to ensure that science drives the decision-making and regulatory processes. We will explore how agencies funding expert participation in the rulemaking process could improve the final agency decisions. We will also propose an approach that can empower proactive conservation and climate policies in the arena of international trade.

**Fitzpatrick, Beth,** *University of Wyoming;* **Melanie Murphy**, *University of Wyoming*

**Planning Future Restoration for Long Term Persistence of a Declining Species**

In the intermountain west, energy development is a large driving force of landscape change that could be limited by potential listing of a species: the Greater-Sage Grouse. Our goal is to understand how habitat amount, configuration, and quality influence distribution and connectivity of sage-grouse leks in Northern Wyoming. We predicted lek distribution across the study area using 460 leks, 81 pseudo-absences, and important environmental (i.e., topography, percent sagebrush) and anthropogenic (i.e., well density) characteristics. To assess connectivity, we collected DNA samples from 68 sites and estimated genetic distance. We present a lek distribution prediction and population network model based on relating 2012 field data to limiting factors across the landscape. Both amount and configuration of disturbance surrounding leks decreases probability of lek occurrence. Connectivity of sage-grouse leks is positively associated with undisturbed areas of contiguous sagebrush habitat and negatively associated with disturbance. Clumped configuration of development reduces connectivity of leks. The lek distribution and population network model will be used to predict changes in lek occurrence and functional connectivity in the face of different scenarios of landscape change. Our research will provide a scientifically-based decision-making tool for prioritizing development, protection, and restoration that will drive stakeholders to work together for a successful outcome.

**Fleischman, Forrest,** *Dartmouth Environmental Studies;* **Claudia Rodriguez-Solorzano**, *Dartmouth College*

**What influences how internationally adjoining protected area managers in the Americas respond to land use change?**

What influences decisions by protected area managers? In this paper we examine the responses that protected area managers make to land use change within their protected areas. Theories from public administration and political science suggest two primary types of influences: policy networks and constraints, such as political pressures or budgets. We test these alternative hypotheses utilizing a unique dataset of internationally adjoining protected area managers in North, Central, and South America. An emphasis on policy networks would lead us to predict that managers of adjoining protected areas, particularly those that have international cooperation agreements, would behave similarly. In contrast, an emphasis on constraints would lead us to predict that managers of protected areas which face similar constraints would behave similarly. Important constraints, such as political pressures and budgets are determined independently from international boundaries, by political processes internal to individual countries. We examine the responses that protected area managers make to land use change, and find that constraints play a more important role than networks. This implies that creating resources for protected area managers may be a more effective conservation tool than creating exchanges between them.

**Foresta, Massimiliano,** *University of Molise;* **Mita Drius**, *Univerity of Molise;***Maria Laura Carranza,** *University of Molise;* **Agostino Giannelli**, *University of Molise;* **Anna Loy**, *University of Molise*

**A multispatial and multispecies approach for the optimization of Natura 2000 sites management. The coastal dunes in central Italy**

We used a multicriteria algorithm to identify the irreplaceable areas for the conservation of biodiversity (habitats and species) of the Molise coastal region, specifically focusing on Natura 2000 sites (CEE 43/92). The three SAC, including a 27 km of seashore and an area of 2444 ha, are representative of the Adriatic coastal dunes (host 20 habitats, 48 species of fauna and 4 species of plants relevant for conservation - CEE 43/92). We divided the area into 100x100 m cell grids (PU, planning units). Each PU was assigned the cadastral cost and a value corresponding to the conservation targets, i.e the surface of habitats to be preserved within each PU. Surfaces of EC-habitats and suitable areas for animals to be preserved were fixed based on risk of extinction, ecological functional role, rarity and phenology. The Simulated Annealing algorithm (MARXAN) was used to assess how many and which PUs are necessary to achieve the existing conservation targets and to identify their best location in the landscape. Such analysis was performed for each site individually and globally for the entire Natura2000 network of coastal sites, for 100 iterations. We identified the 91,6% of the area in need of different conservation degree corresponding to three management zones (A,B,C), and the best management units configuration. As the solutions for single sites resulted unsatisfactory, the analysis of the Natura2000 sites as a network gave many different optimal and suboptimal solutions.

**Forman, Richard,** *Harvard University*

**The Netway System: Recovering Lost Ground, Reconnecting the Land, and Solving Big Transportation Problems**

Our massive road-vehicle transportation system, a central catalyst for society, has diced the land into fragments with ramifying ecological and human effects. Road ecology principles and solutions, barely a decade old, are producing accelerated successes. Yet worldwide, increasing rates of both road construction and vehicle use far outstrip our mitigations. Transportation also now faces huge problems (fuel, CO2, congestion, accidents, bridges, funds). Could a significant portion of the land covered (e.g. >1% of USA) and ecologically degraded (>15% USA) by road corridors be recovered, and the rest of the land reconnected, quickly? A transportation system, based on renewable-energy electric-induction-transported pods under automated control on narrow elevated-to-sunken ways, with flexibility permitting efficient individual driving on ground-level roads, is outlined for the immediate future. No driving, no accidents, no fossil fuel use, no greenhouse gas or unhealthful pollutant emissions, more efficient relaxed travel. No roadkills, no wildlife barrier, no traffic-noise effect, new trail networks, market-gardening space, extensive recovered land, reconnected nature. The last transformation of surface transportation leaped from horsepower on dusty muddy roads in 1900 to motorized vehicles on black-top surfaces in 1925. It is time for the next 25-yr step pronto. Reverse our downward spiral, and create a multi-goal success for both nature and society.

**Forrest, Jessica,** *World Wildlife Fund - US;* **Sharon Pailler**, *Clark University;***Michael Mascia,** *World Wildlife Fund - US;* **Siti Zuraidah Abidin**, *WWF Malaysia;* **Mara Deza**, *WWF Peru;* **Roopa Krithivasan,** *World Wildlife Fund - US;***Juan Carlos Riveros**, *WWF Peru*

**Implications of protected area downgrading, downsizing and degazettement for reducing emissions from deforestation and forest degradation (REDD)**

Protected areas (PAs) have historically formed the cornerstone of conservation strategies, by assuming that ecosystems therein will be sustained indefinitely. Simultaneously, guidance for reducing emissions from deforestation and degradation (REDD) prioritizes areas at high risk of carbon loss from land use change. These conflicting paradigms set PAs at odds for receiving carbon financing. A recent study challenged this paradigm, documenting a global phenomenon in which PAs are subject to downgrading, downsizing and degazettement (PADDD). Here, we quantified the amount and value of carbon already lost and at future risk in PADDD areas. First, we documented all historic and proposed PADDD events in three countries: Malaysia, Peru, and DRC. In Peninsular Malaysia and Peru, we assessed carbon change from 2000-2010 using freely available land cover products and a global carbon map. In both countries, PADDD areas experienced rates of carbon loss exceeding rates in areas that had never experienced protection, and far exceeding carbon loss rates in PAs. We found that about 1.5 million Mg of carbon was lost in both study areas during this period, valued at $4 to $70 million. If trends continue to the year 2100, PADDD areas in Malaysia could experience a further $6 to $276 million in lost revenues, while PADDD areas in Peru could experience $69 million to $7.7 billion in lost revenue. Findings suggest that carbon in PAs is at risk, and should be eligible for REDD funding.

**Forrester, Tavis,** *Smithsonian Institution;* **Roland Kays**, *North Carolina Museum of Natural Sciences;***Bill McShea,** *Smithsonian Institution;* **Robert Costello**, *Smithsonian Institution;* **Megan Baker**, *Smithsonian Institution;* **Arielle Parsons,** *North Carolina Museum of Natural Sciences*

**eMammal - A solution for broad-scale, long-term monitoring of wildlife populations**

Nearly 20% of mammals are threatened or endangered, yet we have no long term, broad scale abundance and distribution data for these species. eMammal is a new initiative that integrates camera trap data from researchers with a growing citizen science effort to increase the spatial and temporal scale of survey data. We launched the citizen science camera trapping effort in the mid-Atlantic region of the USA. Volunteers are trained to set camera traps, receive instructions from the eMammal website, deploy cameras in protected areas, and identify and upload pictures using custom software. eMammal uses a cloud based workflow that includes a volunteer website, remote photo upload, expert review of photo ID to ensure data quality, and storage of photos and meta-data in a Smithsonian digital repository. Around 2 million researcher camera trap images from projects around the world are being entered in the same repository, which will soon be publically accessible. In 2012, 85 volunteers deployed cameras to 750 sites in for 15,750 trap days in 12 protected areas, and collected hundreds of thousands of pictures. We are initially using this data to test hypotheses about the effect of hunting and hiking on wildlife populations. eMammal is a framework for citizen scientists and professional researchers to build publically accessible, frequently updated, landscape scale wildlife datasets to enable conservation and education in today's rapidly changing world.

**Forys, Elizabeth,** *Eckerd College;* **Jenna Sciarrino**, *Eckerd College;***Kirsten Poff,** *Eckerd College*

**Floating Nesting Platforms for Least Terns: A possible antidote to sea level rise and loss of gravel rooftops**

The Least Tern (Sternula antillarum) is a small, colonial nesting seabird which breeds along portions of both the eastern and western coasts of North America. In addition to nesting on open-beaches, Least Terns have adapted to nesting on gravel rooftops. Currently, gravel rooftops are declining because of changes to state building codes and the open beaches that are left are experiencing higher levels of overwash due to sea-level rise. Our research explored the effectiveness of floating nesting platforms for Least Terns by deploying two rafts (~14m2 each) in the lagoon of Ft. De Soto County Park, Florida where Least Terns had previously attempted to nest. During the first 2 years, only a few Least Terns attempted to nest and the birds quickly abandoned. In the third year of the study, 20 pairs nested on the rafts (10 on each) and fledged at least 14 chicks. This level of productivity is greater than any other ground colony in the Tampa and Sarasota Bay regions monitored during the past 10 years. Two of the birds nesting on the rafts were banded birds who had hatched on nearby rooftops. While this study was relatively limited in time and number of birds, it indicated that rafts should be considered as a management strategy to provide nesting areas as gravel rooftops are phased out.

**Foster, Sarah,** *Project Seahorse, Fisheries Centre, The University of British Columbia*

**Trawler trash: recognizing the impacts of shrimp trawling on small fishes**

We know next to nothing about the impacts of tropical shrimp trawlers on the vast majority species found at the bottom of their nets - the small fishes. The wide range of potential impacts makes it hard to predict how a species may respond to trawling, but the few studies that have applied data-poor approaches to fisheries assessment suggest that at least some small fishes - those with specialised life histories, or whose reproductive peak overlaps with peaks in trawl effort - show potential for overfishing. These studies call for a re-evaluation of the status of small species which have generally been considered resilient to fishing pressures. But even these methods are too data intensive to be viable for the hundreds of small fishes captured in hundreds of shrimp trawl fisheries, and too inconclusive to confirm impact. Thus, it may be necessary to apply precautionary methods to avoid potential effects of indiscriminate trawling. The perceived economic importance of shrimp fisheries in tropical countries means that lessening the problem requires pragmatic approaches that consider both socioeconomic and ecological goals. I argue that seasonal or regional closures to trawling may be the most pragmatic, practicable ways to reduce bycatch of small fish species globally. Finally, I present several research questions related to shrimp turned 'trash' fisheries that need immediate attention, lest the small fish bycatch issue become even more challenging to address.

**Fovargue, Rachel,** *University of Tennessee Knoxville;* **Paul Armsworth**, *University of Tennessee Knoxville;***Michael Bode,** *University of Melbourne, Australia*

**Size and Spacing Rules for Marine Protected Areas: Useful or Not?**

Can size and spacing rules provide guidelines for marine spatial planning? The complexity and temporal variability of the coral reef systems make predictions for spatial planning challenging. General guidelines offer a solution if they predictably deliver benefits. However, are general guidelines, such as rules for the size and spacing of protected areas predictable and distinguishable enough to be useful? Using a population dynamics model of coral trout on the Great Barrier Reef, I test simulated marine protected areas varying across size and spacing rules. The model imitates realistic dispersal conditions using results of biophysical dispersal models. With each simulation, we track two long term outcomes: average annual catch (a fishery objective) and remaining abundance on the reef (a conservation objective). Our results indicate that although size and spacing guidelines can reveal tradeoffs in management objectives, the overall usefulness of general guidelines in this example is diminished because the noise of the system drowns out clear differences between the outcomes of particular sets of rules. This may provide evidence that simple guidelines are less useful for complex, dynamic marine systems.

**Fox, Helen,** *WWF-US;* **Robert Pomeroy**, *University of Connecticut Avery Point Campus;***Gabby Ahmadia,** *WWF-US;* **Arun Agrawal**, *University of Michigan;* **Xavier Basurto**, *Duke University;* **Louise Glew,** *WWF-US;***Michael Mascia**, *WWF-US;* **Nasser Olwero,**

*WWF-US;* **John Parks,** *Marine Management Solutions LLC*

**Solving the mystery of marine protected area (MPA) performance: linking governance, conservation, ecosystem services, and human well being**

As awareness of the importance of marine ecosystem services grows, so too does the recognition that better governance of social-ecological systems (SES) is critical to sustainability. An interdisciplinary team is unpacking the links between marine protected area (MPA) governance and ecosystem structure, function, and services, drawing upon the seminal work of Elinor Ostrom and building on existing efforts. With a cross-disciplinary theoretical framework and a common analytic platform (i.e., database) we will document the social and ecological impacts of MPAs at local, regional, and global scales by synthesizing existing interdisciplinary monitoring data from many MPAs. These datasets have been collected by MPA managers and scientists, with different levels of methodological rigor, but their collective power and emergent insights for both science and policy have not yet been tapped. Moreover, we are addressing a critical but under-recognized obstacle to adaptive management: the absence of a platform to turn raw MPA monitoring data into actionable information. MPA managers often struggle to effectively store, manage, process, and analyze monitoring data - especially in developing countries. Widespread adoption of an open-source MPA monitoring database would establish a new standard for increasingly rigorous monitoring of MPAs, empowering MPA managers and fostering adaptive management.aptive management.

**Francis, Wendy,** *Yellowstone to Yukon Conservation Initiative*

**Doing together what we can't do alone: Connecting people, organizations, wildlife and landscapes across the Yellowstone to Yukon region**

"Large landscape conservation" is the recommended prescription for combating the twin threats of habitat fragmentation and climate change. Few efforts anywhere are practicing conservation at the scale of the Yellowstone to Yukon Conservation Initiative, an organization that promotes connectivity across the mountainous landscape stretching 1.3M square kilometers from Yellowstone National Park in the U.S. to north of the Arctic Circle in Canada's Yukon Territory. The Cabinet-Purcell Mountain Corridor Project, a regional effort within the larger Yellowstone to Yukon strategy, will be presented as an example of a successful large scale, trans-boundary conservation collaboration. More than sixty government agencies, private land conservancies, indigenous tribes and non-government organizations are coordinating efforts to secure core areas on public lands, protect wildlife connectivity across private land, mitigate the impacts of highways, remove and restore obsolete forestry access roads, augment endangered grizzly populations, and reduce conflicts between people and wildlife. Collectively, these efforts are restoring functional connectivity between source populations of large animals in Canada and recovering populations in western Montana and northern Idaho.

**Frascaroli, Fabrizio,** *University of Zurich*

**The contested link between Western Christianity and conservation: ecological and cultural values of shrines and pilgrimage sites in Central Italy**

Over the last years, the relation between spiritual values and conservation has received growing attention by ecologists and practitioners. Not the least, a clear connection between sacred areas and biodiversity has been highlighted in a number of instances throughout East Asia and Africa. Such a link, however, remains vastly underexplored in Western Christian contexts, probably also due to a dominant view of Christianity as essentially anti-naturalistic and Western societies as entirely secularized. Here, I rely on first-hand ecological data to demonstrate that, on the contrary, also Catholic sites in Central Italy play an important role for the conservation of biological diversity. Further, although the sites in question are no longer crucial for the livelihoods of local populations, they remain fundamental for maintaining social cohesion, cultural traditions, and as sources of local identities.

**Freeman, Elizabeth,** *George Mason University;* **Jordana Meyer**, *Freewalker Volunteer & Adventure for CharityFreewalker;***John Addendorf,** *South African National Parks;* **Bruce Schulte**, *Western Kentucky University;* **Rachel Santymire**, *Lincoln Park Zoo*

**Scraping behavior of black rhinos (Diceros bicornis bicornis) is related to age and fecal progestagen metabolite concentrations**

Black rhinoceros (rhinos) defecate in latrines and frequently use sharp kicking motions to scatter their feces in conspicuous scrapings. Although these fecal markings are believed to be advertisements to conspecifics, the type of information they encode has not been investigated. Due to the secretive nature of black rhinos, camera traps were used to identify individuals scraping their feces in Addo Elephant National Park (AENP), South Africa. Fecal samples (n=137) were collected (July '09-Nov '10) from known individuals (captured on photo). Data about fecal scrapings (e.g. length and location) were gathered and samples were analyzed for progestagen and androgen metabolite (FPM, FAM respectively) concentrations. We predicted that scraping parameters would vary with respect to sex, age and hormone concentration. Lengths of scrapings increased with age for both sexes and were negatively related to FPM concentrations for females. Males scraped more than females, which were more likely to scrape next to a bush. These fecal markings may advertise the territories of males and the sexual state of females. Much is still unknown about black rhino ecology due to their elusive and solitary nature and field studies are costly and logistically difficult. Thus, any information about black rhino that can be collected non-invasively (e.g. fecal scraping and endocrine data) could enhance knowledge about populations and potentially guide conservation management of this endangered species.

**Fujitani, Marie,** *Arizona State University;* **Eli Fenichel**, *Yale School of Forestry & Environmental Studies;***Joshua Abbott,** *Arizona State University School of Sustainability*

**Using changes in recreational angler site demand to infer the cost imposed by a marine reserve in the central Gulf of California, Mexico**

Marine reserves regulate people by adjusting costs and incentives to alter the behavior of human users, for example by reducing fishing visits with a fine. Understanding how a reserve alters the landscape of human use provides insight into how the reserve is functioning mechanistically and can assist passive adaptive management. I use a novel dataset that is a complete census of recreational fishing trips taken by a large recreational angling community in the Gulf of California, Mexico, over nine years. I use discrete choice models to show that the creation of the marine reserve only temporarily decreased visitation to the reserve site. I determine the actual additional travel cost (in expected enforced trespassing penalties) the anglers perceived the reserve imposed upon them. This value is very small, especially compared to the total cost of travel to the reserve site. Such a small cost increase likely had little effect on behavior, and would explain why the reserve was unable to reduce visits in the long term. I use the model to project the different "fines" that would be necessary to reduce site visitation by a given percentage. I find this relationship to be non-linear, such that eventually the fine to reduce each additional percent of site visitation skyrockets. If a small amount of reserve non-compliance is deemed acceptable to reserve goals, these results suggest for this system a data-driven level of fine that should be both effective and not undesirably high.

**Fulfrost, Brian,** *San Francisco Bay Bird Observatory*

**SF Bay Tidal Marsh-Upland Transition Decision Support System: Site Prioritization for Conservation Delivery**

Restoration of the tidal marsh ecosystem in San Francisco Bay is a regional priority for natural resources managers. Existing documents do not fully describe transitional habitats, quantify the amount needed to aid species of special concern while allowing for SLR, nor prioritize specific sites for protection and restoration. Our inventory, and site ranking of these transitional zones, integrated into a wider MARXAN planning framework and delivered through easy to use web mapping tools, will provide the resources needed to help planners consider both current and predicted needs of the tidal marsh ecosystem in the face of sea level rise and land use pressures. We will provide a summary of the process for developing and utilizing the DSS. We have taken a a strategic approach towards decision support, accounting for the landward migration of the ecosystem in response to predicted sea level rise (SLR). The first phase will define and characterize transitional habitats with an advisory committee of regional specialists. Utilizing the definition developed in the first phase, the second phase will inventory and map the current (and potential historic) extent of these transitional habitats within the SF Bay estuary.  Then utilizing the characterization developed in phase one, the third phase will identify criteria (e.g. ecological function) to rank and prioritize sites for refuge managers based on both ecological needs and management goals.

**Gal, Adiv,** *1Kibbutzim College of Education, Technology & the Arts,;* **Amir Arnon**, *Ramat Hanadiv Nature Park.;***Tal Gaiger,** *Kibbutzim College of Education, Technology & the Arts;* **Iris Rainer**, *Kibbutzim College of Education, Technology & the Arts,;* **Liat Hadar**, *Ramat Hanadiv Nature Park.*

**Identifying potential wildlife corridors to improve the connectivity between a Mediterranean nature park and its surroundings, using camera traps**

Preventing habitat fragmentation is one of the means in wildlife conservation. This challenge is greater in a small country with rapid development, where conflicts between conservation and development are on decision makers' agenda daily. We examined ways to prevent isolation of a 500-hectare nature park in the Mediterranean region of Israel, extremely rich in fauna; It is monitored routinely as part of an LTER monitoring program to define the management that best conserves the local biodiversity. The park is surrounded by building, industry, railways and a quarry. The park's connectivity to nearby natural habitats is threatened by a significant widening of the road along its eastern border and the expansion of an adjacent industrial area. In order to identify passages most used by wildlife in and out of the park, we mapped and characterized potential passages along the park's eastern border. In the 18 best ranked ones we set camera traps and monitored their use for a whole year. Data from the camera traps was related to different sections of the border and to a roadkill survey conducted along the road nearby. While the proportion distribution of crossings by animals varied between sections, one section was favored by most species. This section, through which around 70% of all crossings occurred, was also adjacent to a roadkill hotspot. We therefore recommend that to preserve viable populations, a wildlife corridor should be created at that section.

**Gallo, John,** *The Wilderness Society;* **Amanda Lombard**, *Nelson Mandela Metropolitan University*

**LandAdvisor: A "living" decision support system supporting cost-effective and connected allocation of different management approaches on the landscape**

In an increasingly dynamic and uncertain world due to climate change and other stressors, it is important to have decision support systems (DSS) that are living, flexible, transparent, and integrated. LandAdvisor DSS does this as a framework and tool to help organizations decide where to conserve, how (i.e. acquisition, stewardship, etc.), and why. It uses a "return on investment" approach to blend the objectives of NatureServe Vista, Marxan with Zones, and CorridorDesigner. A site valuation process combines with an algorithm allocating a variety of land management options in near-optimal solution sets while considering factors such as contiguity, representation, naturalness, management quality, and connectivity. The connectivity algorithm prioritizes not only paths within a linkage, but also linkages within a landscape. LandAdvisor is available as an open-access ArcGIS Toolbox. A consensus-based approach to setting some weights was a means for stakeholder collaboration. An assumptions sensitivity analysis evaluated the impact of various conservation planning assumptions made in the last two decades. Surprisingly, the biggest influence was properly valuing the contribution of private conservation areas to the conservation network. Meanwhile, assumptions affecting optimal representation had relatively low influence. LandAdvisor is an exciting new application for conservation planning and management, and also a framework for exploring the science of conservation.

**Gallo Santos, Jenny,** *Fundacion Ecodiversidad Colombia*

**Project Golden Frog Supatá: An Example in Conservation.**

The golden frog is an amphibian Supatá which was discovered in 2007. Since this event began the project "Golden Frog Supatá" thanks to its ecology studies have concluded that one of the most ameanzados amphibians to extinction in Colombia. The project's objective is to make the local community appropriates their preservation. For over five years, the foundation has implemented Colombia ecodiversity Management Plan and Conservation with various environmental activities and scientific research including community activities. The most outstanding achievements are 1.) This amphibian was declared a Natural Heritage of the municipality in 2008. 2.) Institutionalized the Golden Frog Festival which is now in its fifth version, 3.) 250 children have been trained as environmental leaders, whose overall objective is to develop a local conservation initiative that contributes to the conservation of amphibians in this county. 4.) Sustainability of the project was held in the town's first athletic career, these resources allow revegetation make a day in the habitat of this amphibian.

**Galvan, Victor,** *PUNTACANA Ecological Foundation;* **Diego Lirman**, *Rosenstiel School of Marine and Atmospheric Science;***Jake Kheel,** *PUNTACANA Ecological Foundation*

**Active Restoration Efforts of the Endangered, Acropora cervicornis Corals in the Dominican Republic.**

People living in coastal tropical communities depend on the social, ecological, and economical services that coral reefs offer for all or part of their livelihoods. Nonetheless, coral health worldwide continues to decline due to a variety of natural and anthropogenic factors. These declines threaten the ecosystems services reefs provide. One example of a drastic coral decline is the loss of >95% of the Acropora cervicornis corals over the last 40 years, prompting their listing for protection under the ESA in 2006. In the Dominican Republic, we are mitigating this problem by utilizing an active restoration technique called "Coral Gardening" to promote the propagation of A. cervicornis for reef restoration. To date, 6 coral nurseries have been established totaling >1.1 km of linear tissue in >1,300 staghorn fragments from 21 distinct genotypes; representing the largest genotypic diversity being tracked for A. cervicornis in the Caribbean excluding Florida. Outplanting activities in 2012 saw the establishment of 20 plots in 15 sites at 3 nursery localities resulting in >1,200 Acropora fragments and > 1 km of live tissue returned to denuded natural reefs; representing one of the largest restoration attempts for this species in the Caribbean to date. Outplanted corals have been observed to grow as well, or better than protected nursery corals, which provides reasons for optimism for the recovery of this species through active restoration.

**Game, Eddie,** *The Nature Conservancy*

**The death of strategic conservation?**

Opportunism is a driving force in conservation spending. Failure to acknowledge the important role of opportunism in modern conservation has consigned many conservation plans to the graveyard for type III errors; good answers to the wrong question. I argue that we have entered an era where conservation will inevitably be even more opportunistic. Is it even possible to be strategic and opportunistic at the same time? I discuss the role of conservation planning in this brave new world, and how the discipline can change do to help navigate the complex terrain of opportunism. I conclude with a discussion about how the concept of opportunism can be integrated into conservation opportunity assessments.

**Gardiner, Mary,** *Cleveland State University*

**Vacant land conversion to community gardens: influences on generalist arthropod predators and biocontrol services in urban greenspaces**

Due to economic decline and the recent rise in home foreclosure, many cities in the United States are faced with managing large acreages of vacant land. Interest in local food production on this land has the potential to dramatically reshape the composition of green space within urban landscapes and the beneficial arthropods which utilize these areas. In the cities of Akron and Cleveland, OH, we examined how the conversion of vacant land to community gardens influenced arthropod generalist predator populations and their ability to support biocontrol services. We found that the abundance of the majority of arthropod predators and levels of biocontrol services were either conserved or enhanced within community gardens established on former vacant lots. However, predators such as Dolichopodidae, Linyphiidae, and Opiliones declined within community gardens which may have implications for pest management. Based on these findings, we discuss the potential of the urban landscape to support generalist predators and sustainable community gardening and farming.

**Garner, Trent,** *IoZ, ZSL*

**The European Threat Abatement Plan for chytridiomycosis: a work in progress**

Batrachochytrium dendrobatidis is arguably the most important infectious disease posing a threat to wildlife today. Despite the ability of this fungus to cause amphibian decline and species extinction, and its listing by the OIE, national and international plans to combat the threat of chytridiomycosis are thin on the ground. In Europe, lethal chytridiomycosis was first identified in 1997 and by 2005 infection had been detected in 5 countries. In response, a consortium of institutions acquired EU funding through the BiodivERsA scheme to better determine the scope of the problem in Europe and developed the European Threat Abatement Plan (ETAP). This project (R.A.C.E.; Risk Assessment of Chytridiomycosis to Europe’s amphibians) completes in 2013 and I will report some of the findings that will be incorporated into the ETAP. These include: 1) evidence in support of introduction of infection through human activities; 2) the unpredictability of temperature as a factor influencing transmission, disease and mortality, and; 3) a preliminary risk assessment of species susceptibility

**Gascon, Claude,** *Amphibian Survival Alliance*

**Moderated discussion linking examples from this session to best conservation practices in non-amphibian systems.**

For this workshop we have managed to gather some of the best examples of amphibian conservationists doing work on the ground and advancing amphibian conservation from many different angles such as habitat conservation, combating infectious diseases, captive breeding efforts, building capacity in tropical countries, communicating with the public, etc. In this session we will hold a moderated discussion with all panelists and explore the overlaps between amphibian conservation and other large issues in the conservation agenda (e.g., freshwater management, land planning, ecosystem services, climate change, etc) with which it is necessary to strengthen ties and develop further collaboration.

**Gatica, Alejandro,** *University of La Serena, Institute of Ecology and Biodiversity;* **Carolina Vega**, *University of La Serena, Institute of Ecology and Biodiversity (IEB);***Claudia Fernández,** *University Catholic of North;* **Patricio García**, *University of La Serena, Institute of Ecology and Biodiversity (IEB);* **Ramiro López**, *University of La Serena, Institute of Ecology and Biodiversity (IEB);* **Lorgio Aguilera,** *University of La Serena, University Catholic of North;***Carlos Gaymer**, *University Catholic of North, Institute of Ecology and Biodiversity (IEB);* **Francisco Squeo,**

*University of La Serena, Institute of Ecology and Biodiversity (IEB), Center of*

**Impacts of human activities and conservation priority in coastal wetlands of the Chilean Atacama Desert**

Wetlands are the habitats for a diversity of plants and are also zones of feeding, resting and breeding for a large numbers of birds. However, these ecosystems are being threatened by habitat loss due to human activities. In the coastal fringe of the Atacama Desert, Chile, there are an important number of wetlands which are influenced by the increase in industrial activities and urban growth. Yet, little is known about these wetlands and the scarce information is highly dispersed. Our aims were: a) to describe the biodiversity and conservation status (IUCN) of plants and birds; b) to quantify, through photointerpretation of satellite imagery, the area impacted by human activities in the wetlands; and c) to prioritize the protection of wetlands by a habitat loss index (HLI) which considered nine variables (e.g., wetland size, road length, urbanized area). We found 611 plant species (180 native, 326 endemic, 105 alien), and 188 species of birds (53 visitors and 135 residents). The impacts of the most common human activities were construction of roads, proximity to urban centers, crops, and industrial activity. The most threatened wetlands were those which are inserted in urban zones, and we consider these as a priority sites for conservation. This type of information can provide valuable assistance to local decision makers and may allow better regulation of human activities in areas of high biodiversity.

**Gedan, Keryn,** *University of Maryland, UCSC;* **Autumn-Lynn Harrison**,

**A historical perspective of Chesapeake Bay wetlands, water quality, and watermen**

The Chesapeake Bay is one of the world’s largest, most culturally treasured, and most productive estuaries—a scale that challenges and provides opportunities for conservation and management. Recent decades have been hard on Chesapeake Bay ecosystems and the people who depend on them. The wild oyster fishery that once shaped the region’s cultural identity has collapsed, a seasonal dead zone plagues the Bay mainstem, and there is heavy dependence on the blue crab fishery. We will review the history of the ecology and culture of this ecosystem as an introduction to the symposium, Despite what you’ve heard…Conservation success in the Chesapeake Bay.

**Geldmann, Jonas,** *Center for Macroecology, Evolution and Climate;* **Lucas Joppa**, *Microsoft Research and UNEP? World Conservation Monitoring Centre;***Neil Burgess,** *Center for Macroecology, Evolution and Climate*

**The human footprint 1995-2010: Spatial and temporal changes in human threats to wild nature and impacts on protected areas**

The 'Human Footprint' index, published in 2002, was a static map widely used as a surrogate for human impacts on wild nature around the world. We have developed a spatially explicit and temporal map of the human footprint that is applicable globally at a resolution of 5 km2. This map is based on a comprehensive evaluation of nine different categories of threat to biodiversity and comprises the two global threat-layers which could be compared spatially and temporally. This map estimates not only accumulated global human pressure, but also shows how this has changed across geo-political regions and in protected areas. Over 15 years we find little support for the common perception of protected areas assigned less strict IUCN categories (V and VI) are always worse, and we also find great continental differences in protected area performance. These findings are discussed in relation to the effectiveness of protected areas at conserving habitat and species; the limitations of our approach are also elaborated and ways forward outlined.

**Gendron, Andrée,** *Environment Canada, Centre St-Laurent;* **David Marcogliese**, *Environment Canada, Centre St-Laurent;***Sean Locke,** *Environment Canada, Centre St-Laurent;* **Jonathon Forest**, *Concordia University;* **Daniel McLaughlin**, *Concordia University*

**Range expansion of the Asian fish tapeworm in the Great Lakes-St. Lawrence River ecosystem**

The introduction of non-native pathogens has become a serious conservation issue. A prime example is the worldwide spread of the Asian tapeworm Bothriocephalus acheilognathi. This cestode causes mortality in fish hatcheries and compromises the recovery of threatened fish populations. In just a few decades, it has colonized every continent except Antarctica, and now infects as many as 200 fish species. Its spread in the Great Lakes-St. Lawrence River (GLSL) basin has also been rapid. Only 10 years after the first report in the Detroit River, it was discovered 1000 km downstream in the St. Lawrence River in 2012. To assess its distribution in the GLSL basin, a survey was launched in 2009. More than 1500 fish collected in the field or obtained from bait dealers were examined. So far, the Asian tapeworm has been found at 15 of 18 localities, where it infected up to 43% of fish. Published molecular data suggest that this parasite is a complex of morphologically indistinguishable species, some of which are limited to certain fish families. In the GLSL basin, we found B. acheilognathi exclusively in cyprinids (minnows) and our own molecular work indicates it is a single species, which is morphologically and genetically distinct from native Bothriocephalus species. The spread of this pathogen within the GLSL basin can hardly be halted, but its introduction in surrounding water bodies may be prevented through rapid, concerted efforts by fishermen, bait dealers and other stakeholders.

**Geoghegan, Claire,** *University of Pretoria South Africa*

**Implementing transdisciplinary and health-conservation projects in rural and under-resourced areas.**

Natural resource conservation and the health of people and animals are often seen as conflicting priorities, especially in areas with increasing human populations. Using an example from South Africa, this paper illustrates the utility of combining human, animal and environmental health for the benefit of conservation and communities in rural and under-resourced areas. We demonstrate that by recognising the links between land use, community health, livestock-based livelihoods, and the survival of protected and free-roaming wildlife populations, programmes can improve natural resource conservation while simultaneously reducing the risks of emerging disease. Using a combination of clinical, environmental and social data, we describe the process and benefits of encouraging expertise while implementing a trans-discipinary appoach to tackle emerging zoonotic and food-borne pathogens across traditionally separate health sectors, conservation services and spatial boundaries. Finally, by identifying the incentives and priorities of multiple-stakeholders, we argue that collaborative interventions may be developed to include community-led solutions as well as stimuulating policy-level change for improved human, animal and ecological health.

**Gerrard, Michael,** *Columbia Law School Climate Law Ctr*

**The Clean Air Act and related Domestic Laws - Opportunities for Progress**

Congress has not enacted a major new environmental statute since 1990, and the current divided government means there is little prospect for a change in the coming several years. Thus it is necessary to focus on use of the existing statutory authorities. The principal such authority is the Clean Air Act (CAA). The U.S. Supreme Court ruled in 2007 that the CAA authorizes the U.S. Environmental Protection Agency to regulate greenhouse gases, and since the inauguration of President Obama in 2009, EPA has been using that authority. However, EPA can go considerably further. Using the CAA, EPA can regulate existing sources of GHGs, such as coal-fired power plants (and not just new ones); it can strengthen the GHG review of more categories of new sources; it can explore the use of market mechanisms in cooperation with the states; and it can regulate more classes of engines. The federal government can also use existing statutes to impose or tighten energy efficiency standards for more classes of equipment; to ease the siting and construction of renewable energy facilities; to require federal agencies, contractors and grant recipients to use energy efficient technologies, and to make preparations to adopt to anticipated climate change. This talk will explore these and other available legal techniques.

**Ghazaryan, Astghik,** *Yerevan State University;* **Tigran Hayrapetyan**, *Yerevan State University;***George Papov,** *Yerevan State University*

**Unknown status of Sicista armenica in Armenia**

There are 34 species of rodents dwelling in Armenia. Among them one is endemic species Sicista armenica (Armenian birch mouse) for Armenian plateu, which is listed in IUCN Red List as endangered species. According to literature data last time 3 individuals of Armenian birch mouse were captured from Hanqavan province in 1986 by Sokolov and Baskevich. We started our study this summer tried to find the Armenian birch mouse in Hanqavan. During our researches we have caught 331 animals, (mainly shrews and voles) but no Armenian Birch mouse in both Pambak and Tcaghkuntanc ridge. We find data in old literature where described places for Siscista cacuasica: Sevan and Zangezur. We believe that animals were coated in Zangezur and Sevan and listed in old literature as Siscista cacuasica actually were Sicista armenica. Referring to this information we are going to continue our studies in Zangezur and Sevan.

**Giakoumi, Sylvaine,** *Hellenic Centre for Marine Research and The University of Queensland;* **Christopher Brown**, *The University of Queensland;***Stelios Katsanevakis,** *European Commission, Joint Research Centre;* **Hugh Possingham**, *ARC Centre of Excellence for Environmental Decisions, School of Biological Sc*

**How and Where to Act for Seagrass Conservation: The Case of Posidonia oceanica**

Among the world's most vulnerable marine ecosystems are seagrasses. Although seagrass ecosystem services are highly valuable, their level of protection is inadequate, with multiple anthropogenic and natural stressors causing seagrass declines at high rates. There is a broad literature documenting threats on seagrasses, however few papers report specific actions linked to threat mitigation and none to our knowledge that associate seagrass conservation actions to their cost. Using the case study of Posidonia oceanica, an endemic seagrass to the Mediterranean Sea, we propose how to efficiently prioritize actions in space for seagrass conservation. We first distinguished between acute (e.g. trawling) and chronic stresses (e.g. effluents) and between direct actions on threats and indirect actions (avoidance of areas where chronic threats occur). Then we constructed a prioritization model for the selection of which conservation action(s) to take and where in order to achieve our conservation goal with minimum cost. The area selection is based on the intensity of threats at any location and the cost of potential conservation actions. This novel approach facilitates seagrass conservation decision-making as it explicitly accounts for cost. The approach is transferable to other seagrass ecosystems across the globe.

**Gibbs, Samantha,** *U.S. Fish and Wildlife Service*

**Seeking refuge: wildlife health and conservation across a patchwork of protected lands**

The National Wildlife Refuge System protects fish and wildlife habitats across a patchwork of 150 million acres of land and water. Home to 700 species of birds, 220 species of mammals, 250 reptile and amphibian species and more than 1,000 species of fish, the refuges also welcome more than 45 million human guests each year. Expanding anthropogenic activities on the surrounding landscapes are placing increasing pressure on refuges to provide recreational opportunities as well as food resources and breeding grounds for wildlife. This draws animals in to close contact with one another, with domestic animals, and with humans, exceeding the carrying capacity of protected areas and sometimes exacerbating annual disease cycles. Mortality surveillance and disease diagnosis have been conducted on Refuge lands for over 35 years, allowing identification of areas with emerging and chronic disease issues. Armed with historical and contemporary disease diagnostic information, it is now time to place increased emphasis on adjusting wildlife management strategies to prevent disease.

**Gilbert, Sophie,** *Institute of Arctic Biology, University of Alaska Fairbanks;* **David Person**, *Alaska Department of Fish and Game;***Kris Hundertmark,** *Institute of Arctic Biology, University of Alaska Fairbanks;* **Christine Hunter**, *university of alaska fairbanks*

**Population dynamics of a forest ungulate respond to winter severity and timber harvest**

Changes to habitat and climate can strongly influence wildlife population dynamics, including species of high ecological, economic, and cultural importance such as ungulates. We examine the effect of timber harvest and variable winter weather on deer in the coastal temperate rainforest of Southeast Alaska. Sitka black-tailed deer (Odocoileus hemionus sitkensis) are the dominant herbivore, and a vital protein source for subsistence hunters. Timber harvest plans for the Tongass National Forest incorporate deer density into management goals, but exclude environmental variability from calculations. We derived vital rates from life history data for 63 adult and 154 juveniles, and population growth rates from matrix-based life table response experiments. Timber-harvested areas produced a lower population growth rate than unharvested areas (λ = 1.06 and 1.12), explained primarily by variability in juvenile survival and adult female fecundity. Variability in winter severity produced population growth rates ranging from 1.20 to 0.84, driven primarily by variability in juvenile survival and young adult fecundity. Climate models predict increasing winter severity and stochasticity; along with continuing timber harvest this may reduce future deer populations. Our results suggest that future timber harvest plans in the Tongass National Forest should incorporate stochastic climate into deer population models.

**Gill, Jacquelyn,** *Brown University*

**Rapidly changing actors on the stage: climate change, megafaunal extinctions, and novel plant communities at the Pleistocene-Holocene boundary**

The transition from the last ice age to our current interglacial was a time of widespread environmental upheaval, including the arrival of humans to North America, warming temperatures punctuated by rapid climatic events, melting ice sheets, and the extinction of 34 genera of megafauna. Meanwhile, plant species underwent extensive individualistic shifts in their ranges and abundances in response to these global changes. This talk approaches “conserving the stage” (e.g., using geophysical units in conservation) from a paleoecological perspective, using a case study of the formation of widespread novel communities in the Great Lakes region from 14,500 to 12,500 BP. To test the role of the end-Pleistocene extinctions in the formation of “no-analog” plant associations, we present several lake sediment records of fossil pollen and charcoal to reconstruct vegetation and fire history. The timing of megafaunal collapse is established using spores from the dung fungus Sporormiella preserved in sediments. Our results show that novel climates and the loss of keystone megaherbivores gave rise to widespread novel plant associations and altered fire regimes. The natural experiments of the past reveal that communities assemble and disassemble frequently in response to global change, and that such transitions may be rapid (i.e., <50 years). Our work speaks to the need to consider keystone species and novel communities in developing conservation frameworks during a period of global change.

**Gleason, Christine,** *George Mason University;* **E.C.M Parsons**, *George Mason University*

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

Commercial whale-watching began in 1955 and today engages over 9 million tourists in 87 countries. The Dominican Republic has the largest whale-watching industry in the Caribbean. This study investigated the conservation knowledge and opinions of whale-watching tourists in Samaná, Dominican Republic through 485 questionnaires collected from January 26 to March 10, 2009. Specifically, the knowledge and opinions of tourists viewing the northwest stock of humpback whales (Megaptera novaeangliae) were assessed 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. 13% of respondents stated they had some knowledge regarding conservation issues and the majority (82%) of respondents believed public education was 'important' or 'very important'. Tourists selected specific whale-watching trips based on whale sightings (68%) and educational opportunities (50%). Respondents' answered general knowledge questions correctly but the percentage of accurate responses decreased with more detailed questions. 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 in the Dominican Republic. The data collected will help refine these education programs.

**Glennon, Michale,** *Wildlife Conservation Society*

**Exurban Development and Wildlife: Lessons from the Adirondacks**

The Adirondack Park is often hailed as one of the great experiments in conservation, a place that appears to contain ample habitat for both humans and wildlife. Where these habitats converge, however, impacts to ecological systems and communities can be significant. Low density exurban development is often perceived as benign. Because houses are spread out and the matrix remains in the original ecosystem type, effects to wildlife are assumed to be minimal. A growing body of work suggests the opposite. We have engaged in a number of studies to understand the impacts to wildlife from exurban development in the Adirondacks. Across various scales and taxa, we have explored the size of the ecological impact zone that surrounds exurban homes, the difference between ecological communities in subdivisions and control areas, the changes to wildlife communities that occur after a new home has been constructed, and how these impacts vary between the heavily forested Adirondack landscape and more open landscapes of the Rocky Mountain West. Our results suggest that, although the physical footprint of exurban development is small, effects to wildlife can extend up to 200m into surrounding forest, occur quite rapidly, result in similar impacts to varying taxonomic groups, and result in similar changes in disparate ecosystems. We collaborate actively with regional and local planners to translate this and other science to improve land use planning and policy in the northeast.

**Glew, Louise,** *World Wildlife Fund*

**Moving beyond myth, anecdote, and conventional wisdom: evaluating conservation impacts amid real world constraints**

Policymakers need salient, legitimate and credible evidence on the social and ecological impacts of efforts to conserve global biodiversity. Fuelled by calls for increased rigor in documenting the impact of conservation interventions, a cohort of quasi-experimental studies has begun to quantify the impacts of conservation. The breadth and scope of these studies remains limited, focusing on data-rich geographies, indicators and interventions. To lay the foundation for evidence-based conservation across a suite of real-world contexts we, describe a pragmatic approach to impact evaluation, grounded in theory and ongoing experience that simultaneously provides scientific insights and site-level guidance. Key characteristics of this approach include the use of research designs that enable causal inference but which are robust to limited secondary data, the broad definition of outcome metrics to capture both intended and unintended impacts and the ability to explore variation in impacts across social groups and spatiotemporal gradients. This approach is sufficiently robust to inform efforts to document and explain social impacts across myriad interventions, sociocultural and biogeographic settings. In so doing, it offers a mechanism for generating salient, legitimate and credible insights on the impact of conservation efforts to inform policy and practice.

**Goad, Erica,** *Colorado State University;* **Liba Pejchar**, *Colorado State University;***Richard Knight,** *Colorado State University;* **Sarah Reed**, *Colorado State University*

**Life on the Fringe: Mammalian habitat use along a gradient of exurban housing density in Northern Colorado**

Since the 1990s the American West has been one of the fastest growing regions in the United States, with "exurban" development occupying nearly five times more land than urban and suburban development combined. Few studies have addressed conservation issues associated with this widespread and rapid conversion of natural and agricultural lands to rural residential development. Understanding the effects of exurban development on biodiversity has important implications for public policy, conservation practice, connectivity, and land use planning. To assess exurban housing density impact on mammalian habitat use, wildlife cameras were placed along a housing density gradient in a rapidly growing rural region of Colorado. Species occupancy was measured in summer and winter seasons and these data were analyzed in conjunction with a novel, acoustic-based approach to assessing human presence. Impacts of exurban housing density varied by species, with some species showing decreased activity and occupancy levels at higher housing densities, whereas others occurred more frequently in these areas. In particular, some species appear to use greenbelts in exurban areas, which suggest that the configuration of homes may be as important as density. This study demonstrates that the impacts of housing density are species -dependent and that incorporating open spaces into development projects may be critical to supporting wildlife in a region that will likely see continued exurban expansion.

**Godinho, Wander,** *Macquarie University;* **Jane Williamson***, Macquarie University*

**Connectivity of cryptobenthic fishes in Australian Marine Parks**Cryptobenthic reef fishes (CRF) comprise diverse families of marine teleost. Their ecological traits are an advantage to inhabit different marine systems along extended latitudinal gradients. Although highly diverse and presenting crucial symbiosis with other fishes they are not considered key species for marine fish conservation. The subtropical coast of Australia presents four main Marine Protected Areas (MPAs) that aim to establish connectivity among fish populations. However, there is no study evaluating the connectivity of CRF in MPAs. Self-recruitment, short home range, upwelling and depth are the main boundaries likely limiting gene flow among fish populations. I herein present the genetic structure of the most abundant species of cryptobenthic fishes found along the NSW marine parks, based on mtDNA regions. Results suggest that the MPAs have been providing high connectivity among the populations of the three species, despite of the numerous biogeographic boundaries found along the Eastern coast of Australia, and the ecological features of the species. There is, however, a strong difference in the genetic diversity among species, showing a very homogeneous population of Australian endemic fishes along the entire NSW coast. Genetic diversity and population structure of the CRF are important to evaluate the efficiency of marine protected areas in maintaining population connectivity and investigate the phylogenetic trends of mtDNA among different species of fish.

**Goldberg, Caren,** *University of Idaho*

**Designing efficient monitoring programs using environmental DNA**

Participants in this session have advanced that agenda and will discuss the triumphs and pitfalls of managing nutrients, fisheries, and habitats in the Chesapeake Bay. Nutrient management plans for the Chesapeake watershed are some of the strictest in the nation. Fisheries managers are facilitating a shift from wild harvest to bivalve aquaculture and embarking upon one of the largest marine restoration projects ever. Stakeholders from crabbing and farming communities steward conservation activities to preserve the Chesapeake cultural legacy. Finally, the session will include a presentation about the Bay Game, a data-intensive, educational simulation game that incorporates the diverse stakeholders and complex issues of the Bay.

**Golden, Rachel,** *University of Maryland;* **Roopa Krithivasan**, *World Wildlife Fund;***Michael Mascia,** *World Wildlife Fund;* **William Fagan**, *University of Maryland*

**Protected Area Downgrading, Downsizing and Degazettement (PADDD) in Yosemite National Park and the Sierra Nevadas**

Traditionally, protected areas (PAs) are considered fail-safe means to conserve biodiversity and provide cultural resources. Although conservation practitioners and policy makers typically assume that PA boundaries are permanent, evidence suggests otherwise. Efforts to document 'protected area downgrading, downsizing, and degazettement' (PADDD) suggest that legal changes have been enacted since 1900 which have changed the size and strength of protected areas worldwide. We reviewed peer-reviewed and grey literature to document and analyze causes, trends, and patterns of PADDD in the United States. Over 2,000 PADDD events have been enacted or currently proposed in the United States from 1900 to the present, and have occurred in every decade across all federal agencies which manage public lands. In addition, we conducted a focused analysis of the landscape-level impacts of PADDD events on Yosemite National Park and the surrounding Sierra Nevada WWF ecoregion. Despite its high profile, Yosemite experienced two downsize events and one downgrade during its early history, the impacts of which can be measured today. In particular, these downsizes opened up 23% of the park's original area to infrastructure, forestry, and other industrial activities. Overall, the magnitude and pervasiveness of PADDD across space and time implies that even the most iconic protected areas should not be regarded as permanent fixtures on the landscape, but instead recognized as dynamic systems.

**Golding, Jessie,** *University of Montana;* **Victoria Dreitz**, *University of Montana*

**A Comparison of Two Avian Survey Methods and the Implications for Conservation Monitoring in Arid Environments**

Avian communities are becoming increasingly important in conservation monitoring. As concerns over the loss of biodiversity continue, the demand for widespread and accessible taxa for monitoring programs has grown. In addition to broad-scale efforts, avian communities have been adopted in many smaller land management monitoring efforts. Birds are identifiable to a variety of stakeholders and they can provide information on both common and rare species in the same survey effort. Point counts are the most common method used to monitor avian communities. They offer many advantages, including comparison with long-term data sets and minimal field effort. Recent studies on point count surveys indicate that they may be heavily biased and not reliably representing avian communities. Double observer transects have emerged as an alternative that avoids many of the biases in point counts. We initiated a study in 2012 to compare these methods in sagebrush habitat. Our results suggest that the probability of detecting an individual was higher using double observer transect than point counts. These results are important when using avian communities to monitor management actions in sagebrush habitats where species abundance can vary widely between years and species richness is generally low. Even broad-scale land management in this habitat can result in fine-scale changes in species abundance and richness, so it is essential to have a reliable method to detect these fine-scale changes.

**Gonçalves, Lucas,** *PUCRS Brazil;* **Eduardo Eizirik**, *PUCRS Brazil*

**GIS modeling of the geographic distribution of melanism in leopards (Panthera pardus): a baseline tool for the conservation of phenotypic diversity**

Biodiversity conservation includes preserving adequate representation of existing variability and phenotypic diversity is prevalent among most life forms. Melanism is a common phenotypic polymorphism in wild felids, occurring naturally in 13 of 36 species of the group and still little is known even about its frequency, geographic distribution and environmental adaptation. In leopards (Panthera pardus) we have recently identified its molecular basis, induced by a mutation in the ASIP gene. To further investigate the evolution, ecology and design conservation strategies, this study focuses on its spatial distribution throughout the species' range. We analyzed 428 individuals (45 melanistic and 383 non-melanistic) obtained from captures, camera-traps and pelts, using vegetation maps and protected areas as layers in a GIS model, aiming to assess association between landscapes and the phenotype presence. Melanism was recorded in low frequencies in Africa and Iran, in high frequencies in India, Bhutan, Sri Lanka, Malay Peninsula and Java Island and was absent in the Arabian Peninsula and in far eastern Asia. If affirmed, this pattern may reveal significant association to some habitats, possibly influenced by adaptive processes. Therefore, the analysis of the geographic distribution and relative frequency of polymorphic phenotypes may be more important for biological conservation assessments and useful to setting priority areas for endangered wild cats conservation.

**Goodall, Amy,** *James Madison University;* **Rachel Frischeisen**, *James Madison University;***Erica Nordgren,** *James Madison University;* **Kyle Schwizer**, *James Madison University*

**Urban Garden for Butterfly Biodiversity and Monitoring**

Urban green spaces serve many functions, including provision of habitat for resident birds and insects. Green spaces also enhance the human community through aesthetics and the opportunity for people's interactions with nature. The purpose of this project was to develop an urban habitat for native butterfly and bird species and to develop a citizen science monitoring program. We designed and implemented a habitat garden in April 2012 at an elementary school located within a diverse ethnic neighborhood in Harrisonburg, Virginia, USA. We designed learning tools for children and their parents and began a butterfly monitoring program in August 2012. We summarize our garden program and the results of the 2012 fall butterfly survey. We present the most commonly observed species from the butterfly families Pieridae (Whites and Sulphurs), Nymphalidae (Brush footed Butterflies), and Hesperiidae (Skippers) as well as children's interests in observing a diversity of plant and animal species in the garden. We present our methods for collecting butterfly information from a student population that speaks 41 languages.

**Gore, Meredith,** *Michigan State University*

**Rethinking corruption in conservation crime: insights from Madagascar**

Corruption affects biodiversity conservation. Mechanisms that more effectively reform corruption and mitigate negative effects of corruption on conservation are needed, especially in biodiversity hotspots such as Madagascar. Local definitions of corrupt behavior, attitudes about reforms and motivations for noncompliance may generate deeper understanding about corruption, which in turn may advance the conservation community's thinking and invite new solutions. We conducted in-depth interviews with Malagasy residents living adjacent to the Makira/Masoala Conservation Area, querying perceptions about regional corruption, rules in use (i.e., social norms or rules in action), rule breaking and mechanisms for reform. Most participants framed noncompliance with conservation rules as a deficit/absence (e.g., lack of knowledge of rules), defined local corruption more as an omission of duty than a commission of crime, and discussed poverty, unfairness, and diverse rules in use related to corruption. Traditional framing of corruption singularly as a lack or absence of honesty and morality or as a normative phenomenon does not seem wholly accurate at reflecting, or for thinking about, the local context. Data herein allude such inaccuracy may be most noteworthy at the level of corruption reform. Rethinking corruption in conservation crime as a blend of dimensions may liberalize the suite of reform mechanisms available to conservationists.

**Goyenecha, Alejandra,** *Defenders of Wildlife*

**Making policies that tackle spread of amphibian disease in the US and international amphibian trade.**

CITES is the only international wildlife convention with regulatory authority, including through banning the international trade of a species. All trade transaction of CITES-listed species must be recorded and accompanied by a CITES permit. For amphibians, this method has been key and the only one to record their international trade at the species level and in specific numbers. The United States has a national system that records the imports/exports of amphibians [at the species level?], but it is often not accurate. The European Union does not record trade at the species level. Before a party to CITES issues a permit for a species, it must study the biological status of the species and other pertinent data. Unfortunately for amphibians, there is no information on a CITES permit to inform whether the species in trade carries spreadable diseases. What is the role of CITES in combating amphibian diseases? What are the responsibilities of a CITES party receiving specific species of infected animals? Which international organizations should be looking into this issue? These and other questions will be presented and discussed at the panel.

**Gracey, Kyle,** *Co-Chair SCB Treaties Task Force*

**Are We Conveying the Big Picture to Decision-Makers? Implementing the Convention on Biological Diversity's Strategic Plan and other commitments**

Several international efforts have, in recent years, tried to introduce expanded environmental valuation into policymaking around biodiversity use and conservation. The Convention on Biological Diversity’s Strategic Plan, for exampled, calls on Parties in multiple ways to develop better indicators of biodiversity state, pressure, and response, adding more economic accounting of the biodiversity's value. Most parts of the plan are voluntary, however, so implementation has varied dramatically, with relatively large success in a few countries and more limited progress in many others. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) is designed to provide an additional tool to evaluate and communicate these values to decision-makers, and outcomes from its first plenary session provide hints of the challenges and opportunities to achieve this. Efforts by the United Nations Statistics Division to harmonize environmental-economic accounting provide another opportunity, and we review progress and barriers to its implementation.

**Gracey, Kyle,** *SCB Treaties Task Force Co-Chair*

**International Agreements Affecting Conservation: Top Issues in CBD, CITES, IPBES, Trade and Investment**

International agreements affecting the conservation of biological diversity include six core conventions, more specialized agreements, and others that have major impacts on conservation but were not negotiated as conservation agreements. In a globalizing world, it is essential that commerce, investment, and aid be sustaining of living natural resources or restorative, rather than depleting. We will discuss the major issues being addressed in the implementation of the Convention on Biological Diversity and the Convention on International Trade in Endangered Species. We will note the rising tide of responsible investment aided by United Nations’ bodies such as the UN Principles for Responsible Investment, the UNEP Finance Initiative and the Rio+20 agreements. We will flag some of the tools and roadblocks present in trade law. We will explore how the newly established Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services can bring new understanding to decision-makers in these and other bodies to better inform core terms of art in these and other agreements, both old and new.

**Grammer, Laura,** *Stevenson University;* **Kimberly Tucker**, *Stevenson University;***Katie Mistretta,** *Stevenson University;* **Hadassa Guttman**, *Stevenson University*

**Identification of Microbial Biodiversity and Community Structure in the Baltimore Harbor**

The Chesapeake Bay is the largest estuary in the United States with more than 150 rivers within its watershed, spanning across six densely populated states. Anthropogenic activity has affected the ecology of the Bay. For over a century, the Baltimore Harbor has been a major port of industry and commerce. On a macroscopic scale, it is apparent that the biodiversity has decreased over time; however, microbial communities have not been thoroughly studied in the Harbor. Studying microbial biodiversity is important when trying to understand the ecosystem as a whole, as they play important roles, contributing to nutrient cycling, population dynamics, and other processes. This research utilizes a combination of culture-independent methods to examine microbial biodiversity in the Harbor. Light microscopy is being used to observe the abundance and biodiversity of zooplankton and large phytoplankton. Epifluorescence microscopy is being used to observe the abundance of bacteria and viruses. Finally, DNA techniques are being used to examine microbial eukaryotic, prokaryotic, and viral communities. Residents and industrial operations occupying these areas influence the overall health of the Bay, and communication with these groups is necessary. Understanding the biodiversity of the microbial communities can increase our knowledge of the species that can degrade harmful pollutants, affect the seafood population, drive evolutionary processes, and cause disease in humans and animals.

**Granados-Dieseldorff, Pablo,** *Texas A&M University;* **William Heyman**, *Texas A&M University;***James Azueta,** *Belize Fisheries Department*

**Persistence and management of the mutton snapper (Lutjanus analis) aggregating fishery at Gladden Spit, Belize**

Several artisanal fisheries across the Caribbean have historically targeted recurrent massive fish spawning aggregations (FSA) of valuable snappers and groupers, sometimes to the point of collapse. Artisanal fishers have harvested mutton snapper (Lutjanus analis) from the Gladden Spit FSA site in Belize since the 1950s, with catches contributing considerably to national finfish yields. The Government of Belize partnered with stakeholders from Southern Belize to co-manage the area, declaring a multi-use marine reserve at Gladden Spit in 2000. We engaged with stakeholders to evaluate the status of the fishery and re-construct its historical development (1950-2011), including evaluation of all existing quantitative fishery data (1991-2011). Catch per unit effort (CPUE), individual size, and sex ratios have been relatively constant throughout the fisheries' history. Annual landings fluctuated over time in correlation with fishing effort, while CPUE remained relatively constant. The fishery has persisted for over 60 years, with yields highly dependent on external socio-economic factors. The life-history strategies of mutton snapper are distinct from most vulnerable groupers and may confer the species more resistance to stressors, including fishing. Based on its ecology, we suggest that the mutton snapper fishery at Gladden Spit can persist so long as the local fishing dynamics and stakeholder-centered conservation and management continue.

**Grange, Zoe,** *Massey University;* **Brett Gartrell**, *Massey University;***Nicola Nelson,** *Victoria University of Wellington;* **Laryssa Howe**, *Massey University;* **Please Delete**, *Delete;* **Mary van Andel,** *Massey University;***Nigel French**, *Massey University*

**Investigating translocation mediated bacterial spread between isolated populations of endangered takahē, using a network approach**

Human mediated relocation of vulnerable species poses the potential risk of susceptibility and transmission of disease. However, our understanding of the epidemiology of bacterial transmission within populations is limited. Since human colonization and subsequent introduction of invasive animals, New Zealand has had a high rate of species extinctions with many native fauna still vulnerable. As a consequence, intensive management and translocations have become increasingly common practice. We collated records of translocations of an endangered endemic flightless rail, the takahē (Porphyrio hochstetteri) and applied social network principles to describe connectivity of the movement network. Our analysis has identified locations acting as potential hubs, sinks and sources for bacterial dissemination and evolution within takahē. These locations are ideal priority targets for disease surveillance, with individuals tested from the sites likely to be representative of the population. We then collected fecal matter from over a third of the takahē population encompassing individuals from key locations and are testing each sample for the presence of common pathogens and commensals, with the intention of determining biogeographical patterns of prevalence. Translocation networks have the potential to provide epidemiological guidance to aid conservation decisions when considering a translocation and increase our knowledge of how potential pathogens could spread within a population.

**Grantham, Hedley,** *Conservation International;* **Daniel Juhn**, *Conservation International*

**Novel approaches for integrated assessment and planning that incorporate biodiversity and ecosystem services**

With greater recognition of the biodiversity, food and water security and climate crises; green economic development becoming a central development policy; and rapidly increasing markets for sustainable products; there is growing demand for integrated assessment and planning methods that underpin decision-making that considers biodiversity and ecosystem services. Delivering this, requires coordinated inputs from disciplines ranging from natural sciences (e.g., ecosystem delineation, environmental flows, species modeling), economics (e.g., tradeoffs, distribution of benefits and costs, market failure), business (e.g., reputational/operational risks, public-private partnerships, emerging green markets) and geography (e.g. participatory spatial planning, systematic conservation planning). There is also increasing pressure to get this information to decision-makers faster and cheaper than ever before. Systematically designing integrated assessments and plans that incorporate the values of ecosystems into land/sea resource use plans, supply chains, development plans and into business models are a huge opportunity for conservation. Here we discuss several approaches we are developing and trialing at Conservation International.

**Gratwicke, Brian,** *Smithsonian Conservation Biology*

**Building in-country capacity for ex-situ conservation in Panama**

One of the major limiting factors in the global amphibian crisis is a lack of capacity in terms of full-time staff and facilities dedicated to mitigating threats to amphibians. I will review basic methods in organizational capacity-building for conservation and explain how we are expanding facilities, infrastructure, and staff on the ground in Panama as part of the Panama Amphibian Rescue and Conservation Project. Our country-level strategic plan establishes ex-situ assurance colonies of up to 20 amphibian species threatened with extinction from chytridiomycosis and researches potential disease-management tools that will ultimately position us to re-establish populations of these species in the wild. This presentation provides a detailed glimpse behind the scenes of a single ex-situ conservation project working under the umbrella of the global Amphibian Ark program and the Amphibian Survival Alliance. These basic species management actions cannot be implemented without substantial organizational capacity-building and strong connections between disciplines, stakeholders and systems.

**Graves, Tabitha,** *Colorado State University;* **Richard Chandler**, *US Geological Survey Patuxent Wildlife Refuge;***Andy Royle,** *US Geological Survey Patuxent Wildlife Refuge;* **Paul Beier**, *Northern Arizona University;* **Katherine Kendall**, *US Geological Survey Northern Rocky Mountain Science Center*

**Estimating landscape resistance to dispersal for connectivity planning**

Resistance is the cost of dispersal across natural and anthropogenic features and underlies all connectivity planning efforts. However, no formal methods exist for estimating the influence of landscape attributes on dispersal distances, although dispersal can affect population viability through its influences on gene flow and metapopulation dynamics. We develop an approach to model dispersal distance that allows for formal statistical inference about resistance as well as the influence of individual traits such as sex. The model requires only origin and settlement locations, such as might be obtained from mark -recapture studies or parentage analyses, and maps of the relevant habitat features. A simulation study, using 3 kinds of environmental variables (categorical, patchy, and trend) indicates that maximum likelihood estimators of resistance and individual trait parameters are approximately unbiased with moderate sample sizes. We apply our method to a family tree of grizzly bears in northwestern Montana and discuss considerations for the use of this method for natural populations. Our approach is the first to provide unbiased estimates of landscape resistance to dispersal. It can be used to test hypotheses about dispersal ecology and can inform connectivity planning efforts.

**Green, Kevin,** *Rare;* **Amielle DeWan**, *Rare;***Nigel Asquith,** *Fundacion Natura Bolivia;* **Keith Alger**, *Rare*

**Payments for watershed services as a driver of climate compatible development: What works and why?**

Payments for watershed services (PWS) schemes have received considerable attention for their potential to deliver hydrological services in addition to biodiversity conservation objectives. With that success has followed additional hypotheses about co-benefits such as 'climate compatible development' (CCD), a construct designed to locate synergies between climate change mitigation, adaptation, and development. PWS has been widely popularized as a key nexus between diverse stakeholders and disciplines; however, there are many approaches to PWS that differ in structure and implementation. Locally-led reciprocal agreements seem more likely than national schemes to promote CCD. Epitomized by initiatives in Bolivia and Ecuador, these schemes (known locally as Arreglos Reciprocos por Agua, or ARAs) are locally-implemented and build on local social norms. In order to systematically evaluate contributions to climate compatible development, Rare and partners have developed a CCD index that captures the critical indicators of development, adaptation, and mitigation in the context of PWS. Initial results from an evaluation across a range of PWS types suggest that differing PWS project characteristics correspond to substantially different climate-compatible development outcomes, a key finding for stakeholders with varying objectives. We will present the CCD index methodology as a novel approach to co-benefits assessment and will discuss these initial findings from our evaluation.

**Green, Stephanie,** *Oregon State University;* **John Akins**, *Reef Environmental Education Foundation*

**Fishing derbies for invasive lionfish: A tool for building awareness and affecting population control**

Indo-Pacific lionfish (Pterois volitans/ P. miles) have rapidly established dense populations throughout the Western Atlantic, Caribbean, and Gulf of Mexico. This marine predator invasion is now among the most destructive in history, and resource managers across the region are now scrambling to devise strategies to suppress their populations. A strategy that is proving effective at increasing local awareness of the invasion is the creation of lionfish fishing derbies or tournaments, but whether derby events are an effective means to control local lionfish populations, and the area over which they may affect control, remain unknown. We evaluated the magnitude and scale of lionfish population suppression achieved during two lionfish derbies in 2012; the first in Green Turtle Cay, Bahamas and the second in Key Largo, Florida, using a combination of pre- and post-derby in-water assessments of lionfish density, measurements of derby catch, and surveys of derby participant fishing effort and location. Derby participants affected a greater than 60% reduction in lionfish densities within the derby area, compared with pre-derby levels. Crucially, population suppression was isolated to the area in which the derby occurred. Our work indicates that these single day events can be an effective strategy for suppressing the invasion at a local scale. The results of this effort may be used to better inform resource managers and lionfish control programs throughout the region.

**Greenwald, Noah,** *Center for Biological Diversity*

**Forty years of implementation of the Endangered Species Act**

The U.S. Endangered Species Act is one of the strongest laws for protecting biodiversity of any nation. But the effectiveness of this landmark law is ultimately dependent on implementation by the U.S. Fish and Wildlife and National Marine Fisheries Services. We compiled data on species listing, critical habitat designation and recovery plan development to assess implementation of the Endangered Species Act. A total of 1511 U.S. species are currently listed as threatened or endangered. On average, 35 species per year have been listed over the past 40 years, but there has been considerable year to year variation with both litigation and presidential administration contributing to this variation. Species have routinely experienced delays of more than 10 years in receiving protection. Existing data suggests there are roughly an additional 2,100 species in the United States that may warrant protection. Of listed species, 659 (44 percent) have critical habitat. A greater proportion (80 percent) of species listed in the last ten years have had critical habitat designated concurrently with listing. A majority of listed species have recovery plans (85 percent), but 79 percent are more than ten years old and 26 percent are more than twenty years old. In the next 40 years, adequate funding and robust implementation of the Endangered Species Act will be necessary to meet the growing challenges to species survival from climate change and an increased human footprint.

**Gregory, Andrew,** *Northern Arizona University;* **Paul Beier**, *Nortehrn Arizona University*

**What is a Conservation Corridor Good For?**

The idea of the conservation corridor arose in the 1970's with the proposal that linked habitat fragments have greater conservation value than isolated fragments. This notion is entirely based on theoretical considerations from island biogeography. Widely embraced by the conservation community; today dozens of corridor initiatives are currently being implemented worldwide. For the past year-and-a-half, as part of an ongoing project to investigate corridor efficacy, we have had the opportunity to travel the world and meet with conservation practitioners implementing corridors. At the time of this abstract, we have visited 27 countries on six continents and met with > 40 organizations working to implement corridors to conserving biodiversity in light of ongoing human land use and climate change. From these travels, we have learned that the concept of what a corridor is has expanded greatly. Indeed, the word 'corridor' itself has different meanings to different people and organizations, or in other instances, a smorgasbord of terms are used to mean the same thing. However, in our travels we have noted four general uses of the corridor concept: 1) The traditional corridor model, 2) corridors as temporary dispersal habitat, 3) corridors as organizational entities for conservation, and 4) corridors as trans-boundary conservation cooperatives. In this talk, we discuss the value of corridor thinking in each context and offer some suggestions for common terminology.

**Gregory, Tremaine,** *Smithsonian Conservation Biology Institute;* **Farah Carrasco Rueda**, *Smithsonian Conservation Biology Institute;***Jessica Deichmann,** *Smithsonian Conservation Biology Institute;* **Joseph Kolowski**, *Smithsonian Conservation Biology Institute;* **Alfonso Alonso**, *Smithsonian Conservation Biology Institute*

**Evaluating fragmentation mitigation effects of natural canopy bridges for arboreal tropical forest mammals in pipeline construction**

Despite the increasing abundance of natural gas and oil pipeline right-of-way (RoW) clearings in tropical forests, little is known about the extent to which primates and other arboreal mammal populations are isolated by the resulting linear canopy fragmentation. In the Lower Urubamba Region of Peru, we are collaborating with Repsol Exploración Perú to study the effects of the construction of a natural gas pipeline on arboreal mammals and the effectiveness of natural canopy bridges (connections left between canopy branches which span the pipeline clearing) in reducing the pipeline's fragmentation effects. We are evaluating mammal use of the RoW and surrounding areas before, during, and after pipeline construction in areas with and without natural canopy bridges. Data from before to during construction indicate a reduction in primate encounter rates within one kilometer of the RoW. However, canopy camera traps in natural bridges have revealed over 60 individuals of 11 species of arboreal mammals, including three primate species, utilizing the bridges in the four months since they were exposed. Results will be used to shape recommendations for industry "best practice" protocols. This study highlights the value of partnerships between conservation organizations and development industries and demonstrates that while stakeholders in corporate partnerships may ultimately have different priorities, common ground can be found and conservation goals can indeed be met.

**Grogan, Kathleen,** *Duke University;* **Christine Drea**, *Duke University*

**Using next-generation sequencing to investigate genetic health in a threatened primate**

Genetic diversity in vertebrates is linked to various health parameters, survivorship, and reproductive success. Notably, genetically diverse individuals have low parasite loads, high survivorship, and produce many surviving offspring, whereas the opposite is true in individuals that lack genetic diversity. Low genetic diversity can also be detrimental at the population or species level, and is a major threat to conservation efforts. At the interface between genetic make-up and fitness, the Major Histocompatibility Complex (MHC) controls the immune system's ability to recognize pathogens, playing an essential role in an individual's survival, as well as that of its offspring. Using as a model the ring-tailed lemur (Lemur catta), a threatened primate species, we have characterized functional diversity at the MHC-DRB locus, using next-generation parallel tagged sequencing (NGS) of over 90 captive lemurs. Despite generations of captivity and documented inbreeding depression, we uncovered a high degree of genetic diversity, including over 20 unique alleles and 30 unique genotypes. These data, in comparison with measures of survival and health status derived from long-term, life history records for each individual, enable us to evaluate the fitness consequences of functional genetic diversity at the MHC. This project highlights the use of NGS as a rapid and cost effective tool to assess functional genetic diversity for conservation planning.

**Groom, Martha,** *University of Washington Bothell;* **Eleanor Sterling**, *Center for Biodiversity Conservation, American Museum of Natural History;***Ana Porzecanski,** *Center for Biodiversity Conservation, American Museum of Natural History;* **Adriana Bravo**, *Center for Biodiversity Conservation, American Museum of Natural History;* **Nora Bynum**, *Duke University;* **Barbara Abraham,** *Hampton University;***John Cigliano**, *Cedar Crest College;* **Lilana Dávalos,**

*Stony Brook University;* **Carole Griffiths,** *Long Island University;* **David Stokes,** *University of Washington Bothell*

**Cultivating Critical Thinking Skills Among Conservation Biology Students**

To be effective in conservation, students need to develop sophisticated understandings of conservation problems and problem-solving approaches, which derive from advanced critical thinking skills. Here, we present results of an experimental study aimed at fostering students' critical thinking skills and comprehension of complex conservation issues. Faculty from six institutions, led by investigators from the Center for Biodiversity and Conservation at AMNH, designed a multi-year experiment that applied novel instructional and assessment materials under two different instruction modalities, individual reflection vs. intensive classroom discussion. We found that use of the instructional materials improved student performance in two independent assessments of critical thinking (N=42-78), while also showing gains in their content knowledge (N=26-46). In particular, students improved in their abilities to select and use evidence in constructing arguments, and in understanding the influence of context and assumptions on conclusions drawn from evidence. However, we did not find that student self-confidence in their critical thinking abilities increased (N=38-42). We are currently assessing whether the intensity of the teaching intervention influenced student gains in critical thinking. Our results show that critical thinking skills can be improved within a single course through strategic instructional techniques across a wide range of institutions and classroom settings.

**Groom, Rosemary,** *African Wildlife Conservation Fund;* **Peter Lindsey**, *African Wildlife Conservation Fund*

**A multi-disciplinary approach to conservation: the value of education and community engagement in landscape level conservation of endangered species**

Conservation programs for endangered species need to take a holistic approach and encompass a variety of disciplines. For large carnivores that utilize large home ranges often extending beyond protected areas, a multi-disciplinary approach with strong community engagement is critical. We have been working in the 16,000km2 landscape that comprises the Zimbabwean part of the Greater Limpopo Transfrontier Conservation Area for eight years, using the African wild dog (Lycaon pictus) as a flagship species for landscape level conservation. We work in and around both private and state land and take a multi-faceted approach to conservation, combining management-driven research, hands-on conservation, policy dialogue with decision makers and education and outreach. We have 123 schools in the education program in five districts, involving over 16,000 students and 500 teachers. We also engage with 37 communities (defined by wards). Experience indicates that low literacy levels can be a stumbling block for school based programs and literacy programs may need to be run concurrently. Whilst policy issues are critical, preliminary insights indicate that education efforts and community involvement in projects give the most successful outcome on the ground. Proper evaluation of all education and outreach efforts is imperative.

**Grosholz, Edwin,** *University of California; Davis;* **Adam Lampert***, University of California;* **Alan Hastings,** *University of California*

**Conservation conflicts with the recovery of endangered California clapper rails, the eradication of invasive cordgrass and rising sea levels**  
Conflicts often occur in complex ecosystems with multiple management goals. However, despite the growing number of eradication programs for invasive species, only rarely do eradication programs impinge upon endangered species recovery programs: only two well documented examples of this type of conflict currently exist. Here I present field data and the results of a model that attempts to balance the conflicting goals of eradication of hybrid cordgrass (*Spartina alterniflora x foliosa*) and the recovery of the federally endangered California clapper rail (*Rallus longirosrtis obsoletus*) in San Francisco Bay, CA. To date, eradication has successfully eliminated the majority of the hybrid cordgrass in the bay, however, this also resulted in the loss of breeding habitat and associated declines in clapper rail populations. The eradication program has since been modified to avoid core clapper rail habitat, but concerns about are still present. There is also concern that delaying the eradication program will undermine the program's success. In addition, eradication of invasive cordgrass has resulted in additional loss of marsh habitat due to erosion following plant removal. Erosional processes may interact with projected sea level rise to further limit the habitat available for restoring native salt marsh and by association clapper rail habitat and discuss how these conclusions may apply to similar conflicts in the future.

**Groves, Craig,** *The Nature Conservancy;* **Edward Game**, *The Nature Conservancy*

**Challenges and Opportunities in implementing Regional Conservation Plans on Private Lands and with the Private Sector**

The Nature Conservancy (TNC) has invested heavily in Ecoregional Assessments, a form of systematic conservation planning, to help guide the geographic focus of our conservation work, especially in the United States. The systematic process and scientific analyses and information contained within these plans gives the Conservancy credibility to work with public agencies, industry sectors, and private landholders in implementing these plans. Implementation is often guided and influenced by funding sources, conservation opportunities (e.g., policy), enabling conditions, diverse stakeholder interests, and the urgency of threats to particular landscapes or seascapes. The search for conservation’s silver bullet of multi-site strategies that could leverage conservation efforts over large areas is often an overriding implementation concern. Although all of these factors can represent challenges, regional conservation assessments can also provide opportunities for engaging the private sector in such diverse areas as energy development, fisheries and MPAs, and timber or range management to help insure that these activities are conducted in places and a manner that promotes biodiversity conservation and conservation-friendly industry practices. Based on TNC’s success and failures, we suggest some lessons for future systematic conservation planning efforts.

**Grussing, Valerie,** *National Marine Protected Areas Center*

**Characterizing Tribal Cultural Landscapes for Resource Preservation and Protection**Understanding the types and locations of significant cultural resources is essential to their preservation and protection during planning processes for coastal and ocean uses. The National Oceanic and Atmospheric Administration is working with the Bureau of Ocean Energy Management (BOEM) and west coast Native American tribes to develop a proactive approach to characterizing areas of tribal significance that should be considered in the planning process. Using a holistic cultural landscape approach that integrates science with historical, archaeological, and traditional knowledge, this project will develop a tool describing best practices for tribes to identify and convey areas of significance, and case studies from three tribes demonstrating this tool. Project activities include archival research, field investigations and site visits, community outreach, and oral histories. Workshops will bring together federal and tribal partners to identify best practices and resources significant to tribal communities. An Analysis Guide will describe the process, including common terminology, and case study databases will be created and managed by each tribe. This project will provide a transferable and transparent method to document places and resources significant to coastal tribes. Coastal planning decisions, and the required impact assessments, can be made more appropriately and efficiently, minimizing conflicts, legal challenges and delays. Funding for this effort is provided by BOEM.

**Guenther, Carla,** *Penobscot East Resource Center*

**Community Fisheries Action Roundtable: Methods for fisheries stakeholder engagement including outreach strategies, design, communication, and learning**

We have seen and heard of the successes of effective stakeholder involvement in developing conservation strategies. Too often, however, stakeholder involvement 'early and often' comes in the simple form of informational meetings. In this session, we will share several case studies from Maine emphasizing the methods used to facilitate collective learning among resource users and managers. A central method we will share is called Community Fisheries Action Roundtable, or C-FAR, which we have used in several marine fisheries projects. We will present the projects, how we used C-FAR , and the communication and facilitation theory that supports how and why these methods work. In these projects, we seek to move beyond informational meetings that convey knowledge from manager to resource user to incorporate resource user's ecological knowledge into conservation and management strategies. We do this by creating meetings designed for multilateral information exchange. We used these methods to develop a new approach to fishery and watershed management, the development of new Maine licensing structures, and collaborative resource monitoring. For the last half of the session we will demonstrate these methods as we facilitate collective learning on this subject drawing from audience experiences in stakeholder engagement.

**Guerrero-Gonzalez, Angela,** *The University of Queensland*

**Social Networks and Planning for Restoration in Large-scale Corridors**

Effective biodiversity conservation usually requires coordinated action between stakeholders operating across local, regional, and landscape scales. A lack of collaboration in the decision making process might result in resources being wasted or uncoordinated on-ground implementation that fail to address the full scope of the conservation problem. In large-scale corridor restoration, the social networks that enable the collaboration necessary for effective action are as important as the ecological networks requiring restoration. Through a case study in Western Australia, we illustrate the ways in which the network of collaborations formed among actors in this area can affect effective conservation. We show how connections between actors can drive coordination across diverse scales of action, and highlight the role that key actors can play depending on how they are connected to the rest of the network. Our study contributes towards understanding of the relationship between social networks and successful biodiversity conservation, and has implications for how conservation partnerships are developed on the ground to increase the likelihood of success of conservation investments.

**Guillera-Arroita, Gurutzeta,** *University of Melbourne;* **Jose Lahoz-Monfort**, *University of Melbourne;***Michael McCarthy,** *University of Melbourne;* **Brendan Wintle**, *University of Melbourne*

**Inferring species occupancy at a site when detection is imperfect: setting minimum survey effort with respect to conservation objectives**

A good survey design for threatened or invasive plants and animals needs to reflect conservation management or scientific objectives. In the design of surveys aimed at inferring species presence or absence at a site, the objective is often to minimize the costs associated with surveying, detecting and missing the species. Whether these costs are borne by a single entity or multiple entities fundamentally affects survey design. Here we analyze approaches to setting minimum survey effort requirements for impact assessments when the costs of detecting and missing the species are borne by two different entities (developers and society). We consider two different design criteria that have been proposed in the literature for impact assessment surveys: 1) setting a target probability of non-detection at occupied sites and 2) setting a target probability of occupancy at sites where the species is not detected. We show how the first criterion has the merit of a straightforward relationship with the conservation management objective of achieving at most a fixed, acceptable loss of occupied sites due to falsely concluding a species absence. The second criterion has a less obvious interpretation but, if properly coupled with management objectives, can lead to reduced overall survey costs.

**Gupta, Kaberi Kar,** *California State University, Fresno*

**Which is the better green space? A comparison of traditional grass lawn and waterwise gardens in a semi-desert urban landscape**

Urban residential vegetation is driven by homeowners’ socioeconomic status, city government policy, and price and availability of water. Water use in a semiarid urban landscape should reflect the natural habitat of the area. Urban vegetation in the Fresno-Clovis Metropolitan Area (FCMA) in Central California, where annual rainfall is 28.5cm, however, is similar to high rainfall areas. Fresno did not have water meters until the end of 2012. With new metering and changes in water prices a few homeowners are transitioning to waterwise yards but most retain traditional grass lawns. We focus on homeowners’ perception of water use, and the effect of residential water use on biodiversity in the FCMA. We mapped all non-grass yards in FCMA using Google Earth imagery. We compared plant, bird and arthropod diversity between waterwise yards and traditional grass lawns (N=20 each). We conducted focus group meetings with a random sample of homeowners in 3 socioeconomic strata (n=18), engaged community members in Audubon and Café Scientifique meetings (n=28), and surveyed parents of 5-6th grade students (n=150). Waterwise yards have more plant species than traditional grass lawns. Bird and arthropod diversities were not significantly different in Fall 2012. Homeowners were unaware of their monthly water consumption. They would change their yards if water prices go up with metering, but lack information about waterwise options. A toolkit for creating low-water yards is under construction.

**Gurney, Georgina,** *James Cook University;* **Robert Pressey**, *ARC Centre of Excellence for Coral Reef Studies;***Joshua Cinner,** *ARC Centre of Excellence for Coral Reef Studies;* **Natalie Ban**, *University of Victoria;* **Richard Pollnac**, *The University of Rhode Island*

**Marine protected areas: understanding social impacts through time in Indonesia**

Marine protected areas (MPAs) are a principal conservation tool but their efficacy is variable. A significant factor impeding MPA success is a lack of consideration of associated human systems. Given that MPAs restrict human activity, gaining local stakeholders' support for management is integral to achieving sustainable outcomes. An understanding of the social impacts of MPAs is thus critical to their successful implementation but remains poorly understood. We address this gap by investigating the long-term impacts of MPAs on human well-being in Sulawesi, Indonesia. These MPAs were implemented during 1997-2003. Using data from more than 2,000 interviews from 1997, 2000, 2002 and 2012, we compared how several dimensions of well-being have changed over time in project and control sites. Our study - one of the first to examine social impacts of MPAs using controls and time-series data (including an ex-post assessment) - found changes in various indicators of well-being relevant to MPA implementation (e.g. property rights, environmental knowledge, community organization). Further, we identified multiple management factors and characteristics of the political and social context, which affect MPA persistence, and lead to negative and positive social impacts of MPAs. Our research thus highlights the need for an integrated approach to MPA management, and may aid managers in designing MPAs to achieve social and biological benefits, thus engendering the support of local stakeholders.

**Guth, Jeremy,** *Woodcock Foundation*

**In Search of the Elusive Private Foundation: Can We Match More Researchers with Private Funding in the Field?**

While more fundamental scientific knowledge may inspire and orient the conservation programs of private foundations, the research they actually support is likely to be directly related to the specific objectives of those programs and foundation values. At the outset, research can inform how a foundation’s grantees can best apply their work and, over time, it can evaluate that work and its products for their effectiveness. Smaller foundations often commission research through intermediaries such as grantees, their environmental networks, and philanthropic advisory consultancies. Foundations may also convene scientific conferences or call for research proposals to address environmental challenges of particular interest to them. Drawing from the example of the Woodcock Foundation’s program to reduce the impact of highways as impediments to wildlife movements, we explore the barriers that exist between foundations and the research community, and ways to overcome these. We also discuss how working within the relatively unfettered, entrepreneurial culture of a private foundation can offer researchers surprising opportunities to create and promote solutions to real threats to the viability of the world’s ecosystems.

**Gwali, Samson,** *Makerere University;* **John Bosco Okullo**, *Makerere University;***Gerald Eilu,** *Makerere University*

**Folk classification and characterisation of shea tree (Vitellaria paradoxa subsp. nilotica) in Uganda: Implications for its conservation and breeding**

Folk classification provides a considerable opportunity for identification and selection of plus shea trees (Vitellaria paradoxa) for conservation and improvement. In Uganda, indigenous knowledge points to differences in morphological and organoleptic traits in shea trees and recognizes various local varieties. However, there is a dearth of scientific information on morphological, chemical and molecular variation among these folk varieties. This study was conducted in the shea tree belt of Uganda to document folk classification and management, examine morphological variation, analyze fat content and fatty acid composition, and assess molecular variation among shea tree folk varieties. Using participatory rural appraisal techniques, 44 folk varieties based on morphological and organoleptic traits were documented. Analysis of variance of quantitative morphological traits as well as chemical (fat content and fatty acid composition) data obtained by near infrared spectroscopy and wet chemistry showed no congruence with folk classification. Nuclear microsatellite analysis showed that 86.90% of molecular variation occurred within individual trees, 8.43% was found among individual trees within folk variety groupings while 4.67% was found among ethno-variety groupings. This indicates that these folk varieties are arbitrarily defined sub-groups of a single randomly mating population. Sampling for conservation/breeding of this species should therefore target the entire population.

**Gyüre, Péter,** *University of Debrecen, Centre for Agricultural and Applied Economic Sciences;* **Lajos Juhász**, *University of Debrecen, Centre for Agricultural and Applied Economic Sciences*

**The migration of the Lesser White-fronted Goose (Anser erythropus) and the Red-breasted Goose (Branta ruficollis) in the Hortobágy (Hungary)**

The Carpathian basin is one of the main migrating and wintering area of Eurasian wild geese. The Hortobágy National Park is a stopover place for birds with mainly grasslands, wetlands and fishponds. The most of the migrating geese are White-fronted Goose (Anser albifrons), but the globally endangered Lesser White-fronted Goose (Anser erythropus) and the Red-breasted Goose (Branta ruficollis) also observed each year. The Greylag Goose (Anser anser) is the only breeding goose species in the area and regular in the migration periods as well. The Hortobágy Fishpond system is the annual migration resting site of the Scandinavian Lesser White-fronted Goose population in autumn and spring. The Red-breasted Goose is an annual visitor in Hungary between October and April. In recent years we observed a significant increase in number of overwintering geese, and we have found several changes in the timing of goose migration caused by climatic factors. Most of the wintering birds are White-fronted Geese, but the two endangered goose species also detected each year.

**Hadidian, John,** *HSUS*

**Conserving urban wildlife: the need for a bridging subdiscipline.**

Although some might argue that there are far higher conservation priorities than any involving what we might call “urban” wildlife, there may be solid ground from which to challenge that notion. While it is true that the majority of species that have adapted to living in urban environments are generalists who face no great threat of extinction, at least some may be rare enough to be of real conservation concern. The tantalizing prospect that entirely new species may be arising with specific adaptations to urban habitats ought to be considered as well. Beyond such things, however, it the human dimension of urban wildlife that is relevant to larger conservation interests. If both positive and negative feelings are generated through direct experiential contact, then the sorts of interactions urbanites have with the wild animals with whom they share their daily lives will assume considerable significance. How conflicts between people and such synanthropes are resolved will be important in shaping attitudes and approaches to conflict resolution in other contexts. Urban wildlife can be visualized as comprising a bridging subdiscipline to link conservation biology and animal protection through an ethical framework that amplifies the values espoused by both.

**Hadj-Chikh, Leila,** *AEGIS Research Fund*

**On the watch for Sasquatch: How the study of charismatic mythofauna can better inform the use of anecdotal observations in citizen science programs**

Data quality is a primary concern in citizen science programs, particularly when the data are derived from opportunistic observations. Very rare or possibly extinct species such as the Ivory-billed Woodpecker (Campephilus principalis) can gain near-mythical status in popular culture, potentially increasing the frequency of false reports at a time when actual sightings of the species are of enormous value. Thus, conservation practitioners must find ways to reliably assess the quality of reports submitted by the public. The Sasquatch/Bigfoot phenomenon is a largely untapped source for anecdotal data that may have surprising utility in tackling this problem. Here I present the methodology behind the Sasquatch Observers' Survey, an Internet-based survey designed to test the hypothesis that reports of Sasquatch submitted by the public represent fabrications and misidentifications. The survey uses a novel approach: it actively solicits fictitious reports and reports of non-target animals (bears) to compare against alleged reports of target animals (Sasquatches). It also collects metadata on participants' interactions with the survey, as well as information on their knowledge, experience, personal backgrounds, and levels of confidence. With this information, the study aims to develop broadly useful indices of data quality, which may be used to improve methods for collecting and analyzing anecdotal observations in citizen science programs.

**Hagell, Suzanne,** *University of Wisconsin Madison;* **Christine Ribic**, *USGS Wisconsin Cooperative Wildlife Research Unit*

**Communication styles and risk attitudes as barriers to climate change adaptation: a survey of wildlife professionals in Wisconsin**

Evidence-based decision making and adaptive management are cornerstones of wildlife conservation and key to confronting climate change. However, these tools require effective integration of the producers and users of science. We conducted a survey of wildlife researchers and managers in the state of Wisconsin to elucidate how differences in communication style and risk perception could impede climate-adaptive resource management. We received surveys from 95 field managers, 54 administrators/policymakers and 75 researchers. All but one respondent agreed that climate change is occurring, but 44% of the sample and 32% of field managers were unsure if it will negatively impact wildlife. All three groups had similar opinions of strategies like translocation, rely on personal experience when deciding when to use a strategy, and agree on what is needed to make good decisions (and that these factors aren't used enough in practice). As expected, researchers primarily communicate through the literature, but managers rely on in-person communication and want information that is relevant to decision-making. Relatedly, only

**Haines, Aaron,** *Millersville University;* **Stephen Webb**, *The Samuel Roberts Nobel Foundation;***David Elledge,** *Iowa Department of Natural Resources (Retired)*

**Spatially Explicit Analysis of Poaching Activity as a Conservation Management Tool**

There are strong concerns about illegal hunting activities such as poaching. Poaching may negatively impact animal populations by causing local extinctions, reducing genetic variability, reducing trophy size and hunting opportunities, and altering sex ratios and age structures. One approach to help mitigate poaching is to identify patterns of reported poaching activity and to document poaching arrests to help facilitate the efficiency of future surveillance for poachers. Our goal of this manuscript was to analyze temporal, spatial, and environmental patterns associated with poaching activity reported for white-tailed deer, based on reports of poaching activity. We analyzed data from 67 reported poaching events from 2000 to 2009 and correlated these events with temporal, spatial, and environmental variables to determine trends in illegal hunting behavior. We found that poachers preferred to be active during the evening in mid to late autumn (primarily Oct-Dec), on days with no precipitation and high visibility, and in areas next to roads, forests, and riparian cover types containing variable topography. We used these results to develop a spatially explicit map depicting hot spots of poaching activity. By identifying patterns of poaching behavior and spatially explicit prediction maps, conservation officers will be able to survey for poaching activity more efficiently.

**Hamel, Nathalie,** *Puget Sound Partnership;* **Scott Pearson**, *Washington Department of Fish and Wildlife*

**Taking the pulse of Puget Sound: Developing indicators for assessing ecosystem health.**

Ecosystem restoration activities in Puget Sound, a region under intense human development in Washington State, are a complex example of deliberate efforts to integrate systems (marine and terrestrial), disciplines (natural and social sciences), and stakeholders (tribes, local, state and federal agencies, non-profits, and businesses). A significant challenge for such large-scale efforts is to develop ecologically defensible indicators to track ecosystem conditions. The process of identifying a few key indicators is complicated by many factors, including uncertainty about cause and effect relationships between ecosystem components. Here, we describe our approach to develop indicators that reflect the health of terrestrial and marine bird populations dependent on Puget Sound. We evaluated species-specific indicators that were 1) ecologically meaningful and Puget Sound-wide and 2) supported by existing time series and data with enough power to detect trends. Because several species meet our criteria, our recommendation included both individual species and functional groups that characterize specific aspects of communities (e.g., interior conifer forest). However, species within the same grouping exhibited inconsistent trends, thereby complicating our interpretation of the response to restoration activities. To be effective management tools, indicators must be matched to the scale of the activities and sufficiently sensitive to reflect short-term responses.

**Hamilton, Debra,** *Monteverde Institute;* **Tim Parshall**, *Westfield State University;***Gregory Goldsmith,** *University of California, Berkeley*

**Optimizing the reforestation of tropical premontane cattle pasture through fertilization and grass maintenance**

To conserve tropical biodiversity, habitat restoration in collaboration with landowners is an important option. Efficiency, cost, and species selection are critical considerations. Current tropical reforestation knowledge lacks information on native species survival and growth rates which is necessary for effective restoration. We studied the effects of fertilizer (single application of NPK at planting) and grass maintenance (cleared 3x annually) on seedling survivorship and growth rates for two tree species: Mauria heterophylla (Anacardiaceae) and Myrcianthes "black fruit" (Myrtaceae). Survivorship at 18 months was significantly higher in maintained (~85%) as compared to unmaintained (~47%) plots for both species. However, fertilization had no effect on survivorship. While maintenance and fertilization treatments had mixed effects on relative height growth rates between the two species, both species demonstrated significantly higher relative leaf production in maintained plots, particularly when combined with fertilization. The results provide key information for the conservation of these tree species and indicate the potential for improved restoration outcomes where resources are available for fertilization and maintenance. However, given finite finances, restoration efforts should not be abandoned given the potential for a higher initial investment (e.g. planting ca. 50% more seedlings, but not pursuing grass maintenance) that results in a similar long-term outcome.

**Hamilton, Matthew,** *Georgetown University;* **Caroline Sheridan***, Georgetown University;* **Nathan Poslusny***, Georgetown University;* **Brent Johnson***, Emory University;* **Sivan Leviyang***, Georgetown University*

**Recent and Historic Samples Show Low Genetic Effective Population Size but No Genetic Bottleneck in Chesapeake Bay Striped Bass (*Morone saxatilis*)**  
Striped bass (*Morone saxatilis*) is the emblematic anadromous fish of the Chesapeake Bay and experienced a precipitous census population size (NC) decline by the 1980s. The genetic effective population size (Ne) describes the strength of genetic drift and provides insight into genetic impacts of demographic events. About 100 individuals from each of 1970, 1978, 1986 and 1991 cohorts in archived scales and young of the year in 1999 and 2006 cohorts were genotyped at seven to 17 loci microsatellite loci. Ne in the recent past was estimated with gametic disequilibrium and two sample temporal estimation methods to be in the tens to low thousands (accounting for overlapping generations and sampling non-adjacent cohorts) and roughly constant since 1970. Longer-term Ne estimates made via coalescent methods were of order thousand to ten thousand and larger than recent Ne. Ne/NC was of order 1x10^-5 based on recent Ne, and 1x10^-4 based on coalescent Ne estimates that apply to longer time scales. Sensitivity analyses showed Ne changed less than three-fold with life table variation. There was no change over time in allelic richness or Ne given confidence intervals. Life history is a stronger determinant of Ne than population size variation over time in this age-structured species. Despite a demographic recovery, low Ne and Ne/NC highlight limited genetic polymorphism in this species.

**Hammerly, Susan,** *University of North Texas;* **Jeff Johnson**, *University of North Texas*

**Surviving in the wild: the role of inbreeding and immunocompetence in post-release survival of the critically endangered Attwater's Prairie-chicken**

Immunocompetence has been shown to be compromised among individuals with reduced genetic diversity; however it is not known to what extent immunocompetence may influence endangered species recovery. The critically endangered Attwater's Prairie-chicken (Tympanuchus cupido attwateri; APC) has been managed in captivity since 1992 and the current population is based on 17 founding individuals. Each year the wild APC population is supplemented with captive bred individuals, yet survival is low (21%), which could be the result of multiple factors including inbreeding. Here we explore the consequences of inbreeding in the APC population by investigating the correlation between neutral genetic diversity and individual fitness-related traits in the captive-release breeding program, specifically focusing on immunocompetence and survival. To evaluate the role of immunocompetence and inbreeding on post-release survival, all birds were sampled at release in the fall of 2011 and 2012 (n=369) and a subset of the surviving birds were re-sampled approximately five months post-release (n=59). Individual inbreeding coefficients were calculated using 12 microsatellite loci, and immunocompetence was evaluated based on multiple techniques used to assess both innate and acquired immune response. Preliminary results using the 2011 dataset suggest inbreeding coefficient and multiple immunocompetence measures at the time of release are both predictors of an individuals' survival post-release.

**Hanauer, Merlin,** *Sonoma State University*

**Biodiversity Protection and Poverty: implications of heterogeneous environmental and social responses to protected areas**

Despite the ubiquity of protected area systems, scienti\_c evidence related to their environmental and social impacts is weak. The dearth of empirical evidence hinders resolution of an important debate: do ecosystem conservation goals conict with poverty alleviation goals in developing nations? Addressing the interplay between environmental and social outcomes requires that empirical studies consider these outcomes jointly. Furthermore, it is important for planners to understand how the environmental and socioeconomic impacts of protected areas vary with observable characteristics. Unlike previous studies that explore heterogeneous impacts of protected areas, we examine impacts on both avoided deforestation and poverty, and we use quasi-experimental non-parametric methods to estimate more informative continuous relationships between observable characteristics and outcomes. Previous studies found that Bolivia's protected areas were, on average, associated with both avoided deforestation and reductions in poverty over the past several decades. We find significant heterogeneity in these outcomes, conditional on biophysical and demographic characteristics. Further, while we find that the type of land associated with the most avoided deforestation is not necessarily the land on which we have observed the most positive socioeconomic responses, we are able to identify, and map, areas in which we might expect positive joint responses in the future.

**Hanna, Emily,** *Australian National University;* **Marcel Cardillo**, *Australian National University*

**Island mammal extinctions are determined by interactive effects of life history, island biogeography and mesopredator suppression.**

Understanding extinction on islands is critical for biodiversity conservation, as islands harbour many vulnerable endemic species, and often serve as the last refuge for otherwise extinct species. But whether island extinction patterns can be explained by simple predictors, or are more complex functions of multiple processes, remains poorly tested. We use generalised linear mixed models and decision trees to show that extinction in 935 Australian island mammal populations is determined by interactions of introduced predators, island biogeography, and life history. In large mammal species (>2.7kg), distance from the mainland is the primary predictor of extinction, consistent with island biogeography theory. For small species (

**Hansen, Lara,** *EcoAdapt;* **Amber Pairis**, *California Department of Fish and Wildlife*

**Building climate change adaptation practice by convening the field. Lessons learned and tips traded at the National Adaptation Forum**

The Inaugural National Adaptation Forum (Forum), which took place in the spring of 2013, was a convening of adaptation practitioners from around the country focused on moving beyond adaptation planning to adaptation action. The meeting proved a successful venue for scientists and managers alike to share information, case studies, methodologies, tools, and more pertaining to climate adaptation across a multitude of sectors nationwide in order to support on the ground implementation. The conference consisted of symposiums and oral and poster presentations in addition to working groups and training sessions on a variety of topics. By pursuing this format, the Forum provided professional development opportunities and contributed to the overall development of a community of practice around climate change adaptation. Development of the conference, results, and lessons learned from the National Adaptation Forum will be presented with a focus on continuing to build a community of adaptation practitioners.

**Hansen, Andrew,** *Montana State University*

**Towards Assessing the Vulnerability of US National Parks to Land Use and Climate Change**

Many protected areas are not functioning to protect biodiversity due to the influences of land use, climate change, and invasive species. The goal of this paper is to illustrate the initial steps in an assessment of vulnerability to land use and climate change across 48 US National Parks. We defined protected area centered ecosystems (PACEs) around each park based on ecological principles. We quantified two components of vulnerability within each PACE for the period 1900-present and forecasted to 2100. Exposure was measured as change land use, invasive plants, and climate. Sensitivity was measured as predicted change in biome type under future climate. We found that PACES differed in exposure and sensitivity. Multivariate clustering revealed PACEs fell into five land use change classes from wildland to urban. The proportion of nonnative plants was positively correlated with land use intensity in the PACEs. Climatic warming since 1900 was highest in wildland PACEs. A few PACEs, experienced rapid increases in land use intensification, invasion and warming. Other PACEs had low levels of change in land use, climate, or invasion. Climate niche modeling under future IPCC scenarios suggests that conditions in 2030 will favor biome shifts across more than 50% of many PACEs but no biome shifts in others. Knowledge of these differences in vulnerability based on exposure and sensitivity provide a basis for crafting PACE-specific adaptation strategies.

**Hansen, Jim,** *NASA*

**The Case for Young People and Nature: A Path to a Healthy, Natural, Prosperous Future**

We describe scenarios that define how rapidly fossil fuel emissions must be phased down to restore Earth's energy balance and stabilize global climate. A scenario that stabilizes climate and preserves nature is technically possible and it is essential for the future of humanity. Despite overwhelming evidence, governments and the fossil fuel industry continue to propose that all fossil fuels must be exploited before the world turns predominantly to clean energies. If governments fail to adopt policies that cause rapid phase-down of fossil fuel emissions, today's children, future generations, and nature will bear the consequences through no fault of their own. Governments must act immediately to significantly reduce fossil fuel emissions to protect our children's future and avoid loss of crucial ecosystem services, or else be complicit in this loss and its consequences.

**Hardesty, Britta,** *CSIRO;* **Chris Wilcox**, *CSIRO;***Tina Lawson,** *CSIRO*

**Estimating sources of debris at a continental scale from coastal surveys**

There is an exponentially increasing amount of human-associated rubbish in our oceans. This marine debris results in a wide range of issues from introduction of adsorbed PCBs into food webs to entanglement and subsequent mortality of threatened seabirds, turtles and mammals in derelict fishing gear. While there has been a major effort afoot to publicize these issues, there remains a paucity of data and scientific research to underpin solutions to the problems. We carried out a rigorous national coastal debris survey every 100km around Australia's coastline to quantify density, types, and potential sources of marine debris. Our aim was to develop a standardized measure of the density of debris along the Australian coastline, to allow comparison of input across regions. We used a statistical model to infer how local conditions such as coastal aspect, slope, and prevailing wind direction affect debris density. We also explored variables such as distance from surrounding cities to understand factors affecting debris distributions. Citizen scientists aided in data collection and results from this work are being used to inform a proposed national container deposit scheme.

**Hardy, Amanda,** *Wildlife Conservation Society;* **Kevin Crooks**, *Colorado State University*

**Compatibility of ungulate viewing opportunities and recreational pathway construction and use in an existing national park transportation corridor**

Expanding transportation corridors in national parks to incorporate recreational pathways can affect wildlife and the visitors' experience. We conducted a Before-After-Control-Impact assessment of elk (Cervus canadensis), pronghorn antelope (Antilocapra americana) and human responses to recreational pathway construction and use in an existing transportation corridor in Grand Teton National Park, USA, before (2007), during (2008), and two years after pathway construction (2009, 2010) in a treatment area with the pathway and a control area without it. Results suggest elk tolerated pathway activities, while pronghorn shifted farther from the road after construction in the treatment. Although bicycle and pedestrian activities increased additively with the opening of the pathway, patterns of human activities were predictable, similar to what was observed prior to the introduction of the pathway, offering a feasible explanation for the coexistence of ungulates and park visitors. Despite direct habitat loss, a wider human footprint, and a shift in pronghorn groups away from the transportation corridor, pathway activities did not appear to greatly impact ungulates or reduce visitor opportunities to see elk and pronghorn in the travel corridor. This study offers baseline ecological, social, and managerial indicators to manage non-motorized recreational transportation modes to protect visitors and wildlife, and maintain wildlife viewing opportunities, in national parks.

**Hardy, Mathew,** *RMIT University;* **Ascelin Gordon**, *RMIT University;***Sarah Bekessy,** *RMIT University*

**The ecological consequences of out-of-kind offsetting**

Globally, biodiversity offsets are becoming an increasingly utilised tool in conservation. Often, offset policies have a "like-for-like" requirement, where any permitted biodiversity loss must be offset by gains in a similar ecosystem close by. In Victoria, Australia, proposed changes to the current offset policy (in place since 2002) indicate a potential shift away from the like-for-like requirement to allow offsets that are out-of-kind and in locations based on multiple biodiversity attributes. However, little is known about the ecological consequences of out-of-kind offsets. A case study was undertaken of Melbourne, Victoria, containing multiple vegetation communities with different threat status. We modeled 3 distinct scenarios 1) strict like-for-like offsets 2) trading-up offsets (i.e. offsets in more highly threatened vegetation communities) and 3) out-of-kind offsets, based on a regional prioritisation over all vegetation classes. Vegetation clearance was concentrated in urban growth areas, and offset sites protected from future development. We analysed how the distribution of vegetation in the different threat categories changes over time under each scenario. Our results show that out-of-kind offsets have a significant impact on the distribution of offset locations and often resulted in losses of vegetation communities. Moreover, trading-up offsets, whilst beneficial for threatened vegetation, may lead to detrimental decline of non-threatened vegetation communities.

**Hare, Darragh,** *Cornell University*

**Recalibrating human-environment relations: Public trust thinking and the role of conservation biology**

Human activities are placing ever more demands on finite natural resources, testing the limits of what our planet can support. Biodiversity is declining. Ecosystems that sustain valuable biotic communities and human livelihoods are threatened by rapid environmental change. Special interests dominate resource management decisions, with grave implications for future generations and other species. A fundamental recalibration of the relationship between humans and the environment is required to provide a coherent framework for conservation. This recalibration must be scientifically informed, ethically grounded and capable of providing clear guidance for urgent issues in conservation such as assisted migration, invasive species management, identifying the appropriate units of conservation and negotiating tensions between social aspirations and ecological imperatives. Conservation biology is crucial in articulating this recalibration and translating it into practice. This poster reports early progress of a long-term, transdisciplinary and interprofessional effort to recalibrate human-environment relations and improve conservation outcomes based on public trust principles. These include: recognition of the physical and ecological limits that bound human activities; common ownership of key resources; and consideration of the interests of all beneficiaries, including future generations, in resource management decisions at all levels of governance.

**Harkness, Mary,** *NatureServe;* **Patrick Crist**, *NatureServe;***Patrick Comer,** *NatureServe*

**Wildlife Connectivity Planning: A Practitioner's On-line Guide**

Maintaining and restoring wildlife connectivity has emerged as a major ecological concern for conservation and natural resource management. The science and practice of assessing habitat connectivity is a rapidly evolving field, making it challenging for conservation planners and resource managers to readily incorporate connectivity considerations into their activities. Recently, NatureServe and North Carolina State University collaborated on two new web resources for habitat connectivity practitioners. The NatureServe site (landscope.org) provides step-by-step guidance for new practitioners to approach the technical tasks of characterizing, assessing, and planning for wildlife connectivity. That guidance is integrally linked to a breadth of resources on NC State University's site (www.conservationcorridor.org), among others, which provides scientific background, library, digests, and examples around assessing connectivity. The landscope.org site also provides a robust online map service to identify connectivity projects and data within a practitioner's region of interest. Together these integrated websites provide an unparalleled resource to understand the issues, approaches, and solutions for maintaining and restoring wildlife connectivity. This presentation will provide a brief overview of the issues around habitat connectivity and will demonstrate the use of the web resources for obtaining information and guidance.

**Harris, Christopher,** *University of Windsor;* **Christine Madliger**, *University of Windsor;***Oliver Love,** *University of Windsor*

**The Use of Corticosterone in Feathers as a Conservation Biomarker**

The field of conservation physiology seeks to use physiological tools to help assess the health and state of an organism as it adapts and responds to its environment. Glucocorticoids (GCs) or stress hormones act at baseline levels to maintain daily energy balance. However, when a prolonged or unexpected event challenges an individual, GC levels increase and their function shifts to help cope with the stressful event. For this reason, they are considered a powerful marker for conservation. While GCs have traditionally been measured from blood, this method can be difficult and invasive. As a result, GC measurement in outer integuments has become increasingly popular. It is currently assumed that corticosterone (CORT) levels in feathers represent a long-term integrated measure of GCs over the time of feather growth. However, recent results call into question the mechanisms by which CORT may be deposited in feathers, complicating the conclusions that can be drawn from interpretation of their concentrations. Here we experimentally show that CORT levels can change over the life of a feather using flight feathers obtained from a free-living breeding population of Tree Swallows (Tachycineta bicolor). Our results will provide considerations for the appropriate interpretation of feather CORT and provide insight into the mechanisms underlying CORT deposition and resiliency in feathers.

**Harris, J. Berton C.,** *Princeton University;* **Martin Breed**, *Australian Centre for Evolutionary Biology and Biodiversity;***Juan Freile,** *Fundacion Numashir;* **Melissa Ocana**, *Stonybrook-Millstone Watershed Association*

**Failure to Account for Surface Area of Species' Ranges May Overestimate Extinction Risk of Montane Birds**

Range size is one of the most important predictors of extinction risk, and it is the most often used measure for IUCN Red List evaluation of birds. Species that live on mountain slopes have ranges that are larger than what is characterized by a flat polygon, but differences between flat area and surface area of species' ranges are apparently unstudied. Given that tropical mountains are hotspots of endemism and species richness, any systematic bias in range size estimates on tropical mountains could have important conservation consequences. We compared flat and surface area of range maps for 15 species of highland Grallaria and Grallaricula antpittas in Central and South America. We made these comparisons with two range characterizations: BirdLife International extent of occurrence polygons for global ranges, and minimum convex polygons made around occurrence records in Ecuador. We found that surface area ranged from 4-12% (mean of 8%) larger than flat area for our study species in both range characterization methods. Our results indicate that the size of montane antpitta ranges are being modestly underestimated by flat BirdLife International extent of occurrence polygons. The importance of this effect will depend on habitat quality of steep vs. flat areas, which is poorly understood in antpittas. We present these results in hopes of stimulating a discussion on the pros and cons of accounting for surface area when evaluating extinction risk.

**Harris, Rebecca,** *Antarctic Climate Ecosystem CRC;* **Greg Lee***, Antarctic Climate Ecosystem CRC;* **Paul Fox-Hughes***, Antarctic Climate Ecosystem CRC;* **Nathan Bindoff,** *Antarctic Climate Ecosystem CRC*

**Projecting changes in phenology using temperature based growing degree days**  
Changing phenology has been identified as one of the most important impacts of climate change on biodiversity. Periodic life cycle events such as emergence, flowering, breeding and migration are important determinants of species distributions, species interactions and the structure and function of all ecosystems. Growing degree days (GDD) are a measure of heat accumulation that can be used to link phenology to the underlying climate drivers that are projected to change over the next century. Using daily maximum and minimum temperatures from a regional climate model for Tasmania, Australia, we demonstrate the changes that are projected to occur in the total GDD for the growing season, the start and end dates of the growing season and the time taken to accumulate GDD. We present results from 6 downscaled global climate models (GCMs) and three future periods, 2020, 2050 and 2080. We also show the shifts in the growing season that have occurred in Tasmania since 1901. We calculate GDD for various base and upper temperatures to account for the different thermal requirements of a range of plants and animals, and relate the projected changes in GDD to several species with known GDD requirements for development, to illustrate the potential for shifts in phenology under climate change.

**Hartl, Brett,** *Society for Conservation Biology*

**Why Guidance Is Not Enough: Regulatory Sideboards On Recovery**

The decision to remove the legal protections provided by the U.S. Endangered Species Act (ESA) because a threatened or endangered species has “recovered” includes both scientific and normative considerations. At its core, this decision represents a policy choice regarding acceptable levels of risk in light of the remaining (albeit substantially abated) threats to protected species. Section 4 of the ESA requires the Fish and Wildlife Service and National Marine Fisheries Service, which implement the ESA, to develop recovery criteria that, when met, indicate a species no longer needs the protections of the ESA. Despite having developed non-binding guidance on recovery criteria, analyses of existing recovery plans for threatened and endangered species indicates that recovery criteria are often set too low to ensure long-term viability post-delisting. Recovery planning for politically-controversial species has also proven problematic. Because recovery planning is inherently linked to other components of the ESA, the term “recovery” itself requires a regulatory definition that fully captures the statutory goals of the ESA. Lacking such a definition, existing agency guidance on recovery planning is not sufficient to meet the objectives of the ESA. To remedy this problem, the Society for Conservation Biology recently proposed to the FWS and NMFS a regulatory framework for recovery planning that can better acheive the overarching goals of the ESA.

**Hartman, Ashley,** *Nicholas School of the Environment, Duke University;* **Gerald Post**, *The Veterinary Cancer Center;***Deborah Gallagher,** *Duke University*

**Champions in the Conservation World: An interdisciplinary examination of conservation entrepreneurship**

Successful conservation interventions are difficult to implement and sustain, due to the complexity of the underlying issues and the scope of the problem. However, the presence of a conservation champion may increase the chances of success. Champions are personally committed to the creation and installation of innovative ideas, and use personal activism and informal networks to ensure their success (Gallagher, 2009). This paper builds upon Gallagher's research on environmental champions and Post's evaluation of tiger conservation in India (2010). Combining the disciplinary lenses of conservation biology and public policy, we undertake a broader examination of how champions for wildlife conservation operate in practice. We surveyed members of The Society for Conservation Biology to gather evidence of champions' work in the field. The goal of the research was to inform our understanding of the phenomenon of the conservation champion more fully. Preliminary results indicate that most champions serve in organizations such as the ministry of the environment or within the context of park management. In addition, most champions utilized both a top-down and bottom-up approach to influence conservation behavior, enforcing the idea of using various interdisciplinary approaches to find a solution. These results emphasize the need to more broadly understand the distinct role of conservation champions as interdisciplinary leaders working to diminish biodiversity loss.

**Hartman, Rosemary,** *University of California, Davis;* **Sharon Lawler**, *University of California, Davis;***Karen Pope,** *USFS Redwood Sciences Lab*

**Using habitat factors and recreational use preferences to inform management for threatened frogs and introduced trout**

Invasive species are one of the leading conservation challenges facing world biodiversity, but many introduced species are intentionally stocked on the landscape despite effects on native species. Non-native trout reduce the probability of occupancy of mountain lakes by the threatened Cascades frog (Rana cascadae). However, some lakes with trout do support breeding populations of these frogs. To facilitate healthy populations of frogs in the area, managers should take both frog habitat availability and angler pressure into account when choosing which lakes to stock. I addressed this by measuring the extent of probable refuge habitat for frogs in 42 lakes in the Trinity Alps Wilderness in California and surveyed recreational visitors to the area. Factors most strongly related to fish-frog coexistence included large areas of emergent vegetation, low bank slope, nearby frog populations, and presence of western toad (Bufo boreas) larvae. I found that only 23% of users were fishing overall, with fishing pressure concentrated at specific lakes. Fishing was seldom the main activity of the trip. Both numbers of anglers and percentage of refuge habitat for frogs should be used to help managers decide which lakes to target for trout stocking or removal when formulating basin-wide management plans.

**Hartmann, Aaron,** *Scripps Institution of Oceanography;* **Kristen Marhaver**, *University of California Merced;***Mark Vermeij,** *CARMABI Foundation*

**Healthy corals contribute disproportionately large numbers of offspring on island-wide scales**

Metrics of coral reef health are important for conservation and management, yet visual measures such as live coral cover often cannot discern when systems are susceptible to or confronting degradation. With coral cover over twice the region-wide average, the undeveloped East Point area of Curaçao is one of the healthiest remaining Caribbean reefs. To examine subtle physiological differences in coral health among reefs, we measured storage lipid content and reproductive output of multiple coral species collected at three sites on East Point and on three "degraded" reefs near the urban center of the island (Willemstad). In the majority of species we studied, colonies from East Point stored greater amounts of energetic lipids and produced more offspring than their Willemstad counterparts. With higher coral cover and greater per-adult fecundity in multiple species, East Point's corals are likely a disproportionately large source of offspring for the entire island. Currently, plans to develop up to 55% of East Point are under government consideration. Given that reef degradation followed development elsewhere on Curaçao, East Point would likely meet a similar fate. By revealing that visually healthy corals can differ in their reproductive output, with undeveloped areas tending to harbor the most fecund adults, our work highlights that a major offspring source population stands to be lost, making conservation of this area critically important to the island as a whole.

**Hasan, Md. Kamrul,** *Biogene Life Care;* **Md. Ariful Haque Mollik**, *Biogene Life Care*

**Status of electrical network hazard investigation for the avifauna within the Bangladesh**

Bangladesh has 628 species of birds, of which 388 are resident, and 240 are migratory. While transport infrastructures for mobility of humans and goods tend to increase with economic development, the functionality of habitat networks for biodiversity conservation tend to deteriorate. The suspended electrical network represents a danger to the birds' wildlife conservation, both because of the possibility of collision and electrocution. Land use and land cover type are strictly related to birds' presence, eating habits, and nesting. This way they are factors that are directly related to collision and electrocution hazards. This investigation was based on the occurrences geographical position and the location of suspended electrical network. The available data were used to create a geographic information system in order to calculate hazard maps. These maps were created by means of geostatistical processes and multivariate analysis. The final results indicate that approximately 48% of the total electrical networks analyzed are classified with the two higher hazard classes in the case of electrocution, and about 39% in the case of collision. The classification maps show that the danger of electrocution is greatest in the central and south-eastern Bangladesh, and the danger of collision is higher especially in the central Bangladesh.

**Hastings, Jesse,** *National University of Singapore*

**A Third Way: Reconciling the community and the ecoregion in 21st century conservation**

Driven by the goals of protect biodiversity and securing human livelihoods, the global conservation community has cycled through various approaches to conservation over the last forty years. These approaches differ in the scale at which they are planned and implemented, the role of science in the site selection process, and the balance between biodiversity protection and human use. There is an emerging recognition that pluralistic multi-scalar approaches are necessary in a globalized, interconnected world; however, there are few explorations of how these approaches can combine strategies from local scale, participation-driven and large scale, science-driven conservation. This presentation illustrates the processes and outcomes of Conservation International's Marine Management Area Science program in Panama, a conservation research and policy initiative lasting from 2005 until 2010. Qualitative data about MMAS was gathered through document review, meeting observation, and semi-structured interviews with 40 key informants in the United States and Panama. Results from MMAS demonstrate that multi-scalar approaches can create a foundation for both biodiversity protection and local participation and input by building upon scalar strengths, creating horizontal and vertical linkages and partnerships, enabling cycles of learning, adaptation, and trust-building, integrating disciplines and knowledge systems, and acknowledging tradeoffs between conservation and development.

**Hausner, Vera,** *University of Tromso;* **Ellen Bludd**, *University of Tromso;***Wolfgang Haider,** *School of Resource and Environmental Management, Simon Fraser University;* **Nigel Yoccoz**, *University of Tromsø*

**Managing human activities and ecosystem services in alpine protected areas in Norway and British Columbia, Canada**

Protected areas coverage has steadily increased the past 20 years, but the effectiveness to meet conservation goals is consistently questioned. Many protected areas have been established for other purposes than conservation, and the prioritization of ecosystem services and the management of human activities tend to vary extensively among sites. Numerous criteria have recently been proposed for comparatively evaluating the effectiveness of protected areas. In this study we used the Gifi systems for optimal scaling on two contrasting alpine protected area networks in Norway and British Columbia (BC) to analyze the consistency in the prioritization of ecosystem services, the restrictions, as well as the alignment of Protected Areas Management to the IUCN guidelines. By analyzing aims and regulations in 38 parks in Norway and 51 in BC we found divergence between the two networks in terms of prioritization of conservation goals, restrictions of human activities and local influence. Norway emphasizes sustainable use, cultural landscapes and livelihood activities, whereas BC prioritizes habitat protection, wilderness and recreation. These differences are reflected by the degree of restriction on resource use, recreation and motorized use. Norway tends to favor local use permits whereas BC prefers time and area restrictions. Finally, there are only minor differences between IUCN category II and V in Norway, and the Ib and II in the provincial parks in BC.

**Hayden, Daniel,** *Rare;* **Marcia Brown**, *Foundations of Success*

**Connecting Human Wellbeing to Conservation Planning in Theory and Practice**

Conservation is inevitably a social undertaking. Humans serve as conservation stewards, they depend on resources for their livelihoods and wellbeing, and they exert threats to biodiversity through unsustainable use or when they fail as stewards. Consequently, many conservation teams feel compelled to consider human wellbeing when developing their projects. To date, however, most teams have not been clear about their ultimate aim or how human wellbeing relates to biodiversity and vice-versa. Likewise, they have been inconsistent in their approaches to defining, describing, and addressing human wellbeing. With this in mind, a team of representatives from many leading conservation organizations (e.g., TNC, WCS, Rare, WCN, and FOS) developed guidelines for addressing human wellbeing in the context of the Conservation Measures Partnership's Open Standards for the Practice of Conservation. This practical guidance has become an important contribution to the Open Standards, as well as to the wider conservation community. This session will: - Outline the need for a structured approach and the importance of clarifying connections among conservation, ecosystem services, human wellbeing, and integrated approaches - Provide real-world examples of how to connect conservation to local stakeholders through this multi-disciplinary methodology - Conclude with lessons to date and suggestions of how the guidance should be updated and improved over time - Solicit feedback and suggestions

**Hayman, David,** *Colorado State University;* **Paul Cryan**, *US Geological Survey;***Juliet Pulliam,** *University of Florida;* **Colleen Webb**, *Colorado State University*

**Environmental conditions inside winter hibernation sites predict white-nose syndrome mortality in bats**

White-nose syndrome (WNS) is an emerging disease of hibernating bats caused by the cold-growing fungus Geomyces destructans (Gd). This fungal disease has been responsible for dramatic declines of bat populations in eastern N. America. Bats infected with Gd that succumb to WNS are typically emaciated. Energy-intensive arousals from hibernation tend to increase in frequency in Gd-infected bats, which is hypothesized to prematurely deplete the fat reserves they require to survive prolonged winter hibernation. In Europe, Gd infects bats without mass mortality, but recent studies suggest that a European isolate of Gd is pathogenic to N. American bats. The reasons why Gd causes high-fatality disease only in N. American bats remains unclear. In this study we built upon a previous energetic model of bat hibernation by integrating the growth dynamics of Gd across a range of temperature and humidity conditions in hibernation sites. Our results demonstrate that WNS mortality may be associated with certain combinations of environmental conditions within hibernacula, and that warmer and wetter hibernation sites may experience higher mortality. Our study predicts the conditions that may help understand site- and species-specific mortality from WNS in both Europe and N. America. Our results highlight the necessity for environmental monitoring during WNS surveillance, and suggest management efforts that warm or increase humidity in hibernacula will be detrimental to the survival of bats.

**Haynes, Michelle,** *U.S. Fish and Wildlife Service;* **Donna Brewer**, *U.S. Fish and Wildlife Service;***Michael Runge,** *U.S. Geological Survey*

**Decision Analysis for Conservation Practitioners: Concepts, Applications and Capacity Building**

We affect our environment through choices, decisions we make about how to allocate resources. Values and science both play an integral role in determining how those decisions are made, but seldom are those distinctions apparent, including defining the roles of scientists and managers. This routinely results in conflict, miscommunication, and suboptimal management of resources. Here we share tools to decompose and overcome obstacles to the decision, avoid errors due to psychological biases, and account for the values and science that go into the decision. This enables clear documentation and increases transparency. Conservation practitioners are increasingly tasked with understanding impacts of a changing environment and making decisions before or while reducing uncertainty. We share local, state, federal, and international examples of how decision analysis has been applied across scales of decisions and degrees of complexity, from one person with one hour to multi-stakeholder, multi-disciplinary, multi-year processes. The U.S. Fish and Wildlife Service and the U.S. Geological Survey have developed a training curriculum to make better decision makers and build capacity of decision analysts. As the demand for these skills grows, the conservation community must equip international conservation practitioners at the undergraduate, graduate, and professional level to use the best available science, including the tools from decision analysis, to make important conservation choices.

**Hayward, Lisa,** *U.S. Geological Survey*; **Samuel Wasser,** *University of Washington*

**Traffic Exposure Increases Corticosterone and Decreases Reproductive Success in Northern Spotted Owl**  
Managing public lands for multiple uses poses a challenge to federal agencies. There are many trade-offs to consider, including the possibility that motorized recreation harms threatened species. Our group assessed the impact of motorcycle traffic on the federally threatened northern spotted owl by enlisting local volunteer riders to expose owls to motorcycle use in carefully controlled field experiments. We measured fecal hormone metabolites before and after exposure, and tracked seasonal reproductive success of owls near low and high traffic roads. Our results suggest that acute exposure to motorcycles represents a significant stressor for spotted owls, and that sensitivity to traffic varies with sex, breeding status, time of year and nutritional status. Long-term traffic exposure also appears to considerably reduce northern spotted owl reproductive success. Despite the adverse effects of traffic exposure, owls near roads showed elevated thyroid hormone concentrations, indicating superior nutritional condition, and suggesting improved foraging efficiency close to roads for this northern California population. The nutritional advantage associated with proximity to roads may exacerbate the negative effects of traffic exposure by drawing owls into areas where exposure is more intense. Therefore we recommend that managers limit traffic on roads within 800m of spotted owl pairs, particularly in May, when females incubate and males appear most responsive to motorcycles.

**Hazarika, Arup,** *Cotton College;* **Prakash Chetry**, Centre for Environment, Education, and Economic Development

**Stakeholder's participation in conservation of Rhinoceros in the Pobitora wildlife Sanctuary: the land of highest density of Rhinoceros in the world.**

Stakeholder's participation is crucial in successful conservation programs. As a consequence, policy prescriptions tend to focus on increasing the number of stakeholders involved in conservation programs. Rhino population in Pobitora now faces multitude of threats, most serious of which is poaching for valuable rhino horn. Our study aimed at examining the empirical support for the pivotal role attributed to stakeholder participation. Survey was conducted in five villages in the buffer zone. Tourists' attitudes as well as their opinions on forest and wildlife conservation were also examined. Finally, stakeholders were engaged in different ways in various stages of the conservation process. Analysis revealed that there are five major stakeholders in Pobitora buffer zone; viz. landless households, farmers, tourism and related sectors, visitors and non-users and Government/NGOs. Each group represents different interests with regard to rhino conservation. The discrete choice experiment conducted confirmed that all stakeholder groups found the proposed management scenarios more attractive than the status quo. Most respondents were in favour of compensation for rhino-related damage, and supported a community development program. The general preference for these compensatory measures peaked at about 50% indicating that either respondent do not require full compensation or they do not believe in higher amounts would be forthcoming. The various stakeholder groups reacted as expected

**Hazen, Elliott,** *NOAA NMFS NWFSC*

**Predicted Habitat Shifts of Pacific Top Predators in a Changing Climate**

It is important to identify species at risk and habitats critical for conservation in order to implement an ecosystem-based approach and to manage marine ecosystems proactively. Climate change scenarios have predicted an average sea surface temperature rise from 1-6° C by 2100 which are predicted to effect the habitat and distribution of many marine species. We used spatially explicit habitat models (generalized additive mixed models) to examine present-day distributions and foraging habitat of 15 top predator species from the Tagging of Pacific Predators (TOPP) project in the Pacific from 2001-2010 as a function of fixed bathymetric variables, sea surface temperature, wind, Ekman pumping, mixed-layer depth, and chlorophyll-a. Consequently we used 1° and monthly resolution climate models from the Geophysical Fluid Dynamics Laboratory to predict potential habitat under future scenarios. We found species winners and losers, oceanographic changes, such as the northward migration of the transition zone coincident with top predator biodiversity throughout the Pacific, while the California current remained a hotspot into the future. Adaptive management approaches may be necessary for already stressed species, as increased migration times and loss of pelagic habitat could exacerbate population declines or inhibit recovery.

**Hazzah, Leela,** *Lion Guardians, Kenya;* **Stephanie Dolrenry**, *Lion Guardians, Kenya*

**Lion guardians: A participatory approach to carnivore conservation in East Africa**

Lion Guardians, a conservation approach operating on communally-owned areas which are heavily impacted by humans and livestock, incorporates the traditional ecological knowledge of previous lion hunters and pastoralist communities to track and monitor persecuted lion populations across broad areas. Keeping in-line with local culture, Lion Guardians, previous lion hunters from the warrior age-set, are hired and given a culturally prestigious job of tracking lions. Traditional practices are used by the program to proactively mitigate conflict by reducing carnivore depredation on livestock and the subsequent retaliatory hunting of lions and other carnivores. We have observed, through the process of participatory monitoring, that the Guardians display great interest in naming the lions and spending time watching them. This has led to a shift in the Guardians’ attitudes toward lions and their desire to protect them. The transformation from lion killer to lion protector is difficult to quantify, but it is evident through their actions; their willingness to get between the spears of their peers and a lion they have been protecting is ample evidence of an attitude-behavioral shift. Furthermore, our research has shown that incorporating local communities into conservation can also provide reliable data on wildlife populations that are difficult to monitor on a broad geographic scale using standard scientific methods. Lion Guardians utilizes a combination of traditional and scientific monitoring techniques to increase community acceptance of large carnivores, which can build trust and ultimately conserve threatened species. Community participation is a powerful approach with broad implications for wildlife conservation in human-altered systems.

**Healy, Erin,** *ICF International;* **Jennifer Pierre**, *ICF International*

**Contaminant Mobilization Associated with Ecosystem Restoration Projects**

Typically, ecosystem restoration involves restoration of wetlands and floodplains that have been diked off for agricultural development, or filled with dredge spoils. Ecosystem restoration results in new habitat and many benefits to aquatic species. However, inundation may also result in mobilization of certain types of contaminants that are relatively immobile in uplands, but can be very mobile, bioavailable and toxic in an aquatic system. Residues of copper, arsenic, pesticides and herbicides may be present in agricultural soils. In some cases, historic contaminants that have been bound to soils, are remobilized under inundated conditions. The potential for mobilization and effects on aquatic resources is dependent on many factors including: the fate and transport characteristics of the contaminants; how they partition in the environment; feeding behavior of aquatic species; metabolic pathways that can lead to accumulation or excretion; and foodchain dynamics. This presentation provides an overview of the risk for increased bioavailability in restored aquatic systems for some of the typical contaminants. Mercury and selenium will be highlighted, based on the author's recent evaluation of contaminant dynamics associated with the Bay Delta Conservation Plan in California. Potential mitigation measures that can be taken to minimize contaminant mobilization will also be presented, with an emphasis on mercury.

**Heck , Nadine,** *Cornell University;* **Richard Stedman***, Cornell University;* **Marc Gaden***, Great Lakes Fishery Commission*

**Integrating human dimensions into Great Lakes fishery management: opportunities and challenges**  
Great Lakes fisheries management is driven by ecological and socio-economic management goals that are sometimes difficult to balance such as the demand of anglers for stocked non-native species and the aims of mangers to restore more native self-sustaining species. This study provides an update of the current human dimensions research theme by the Great Lakes Fishery Commission that seeks to advance the integration of human dimensions into fishery management. To inform the development of this theme, we conducted interviews with Great Lakes fishery managers. The interviews focused on their perception of human dimensions, experience to apply such data to fishery management, and perceived information needs to improve current management. We found that managers listed a variety of social, cultural, and economic values and related desired management outcomes that are not explicitly stated in management goals. Managers also identified a range of ecological and socio-economic drivers for change in Great Lakes fisheries that need to be understood to improve current management performance and enable adaption to future changes. Managers therefore mentioned the need to integrate social science in all stages of the management cycle. At the same time, managers felt ill-equipped and trained to collect, analyze, or apply such data. Our study subsequently outlines and assesses their suggestions to improve applicability of human dimensions information to fishery management.

**Hedges, Simon,** *Wildlife Conservation Society;* **Melvin Gumal**, *Wildlife Conservation Society;***Martin Tyson,** *Wildlife Conservation Society;* **Rasid Samsudin**, *Department of Wildlife and National Parks;* **Nawayai Yasak**, *Department of Wildlife and National Parks;* **Salman Saaban,** *Department of Wildlife and National Parks;***Aris Oziar**, *Wildlife Conservation Society;* **Francis Cheong,**

*Wildlife Conservation Society;* **Zaleha Shaari,** *Federal Department of Town and Country Planning*

**Viability and management of the Asian elephant population in the Endau Rompin landscape, Malaysia**

A 2008 population survey in the Endau Rompin Landscape (ERL) in the southern part of Peninsular Malaysia produced a population estimate of 135 (95% CI = [80, 225]) elephants in the 2500 km2 study area. The population is of clear national and regional significance, and with effective management elephant numbers could probably double. We used data from our survey and other, published, sources to conduct a population viability analysis (PVA) to assess relative extinction risk under several different management scenarios. Our results demonstrate that the population cannot sustain even very low levels of removal for translocation, a method previously used extensively in Peninsular Malaysia to manage human-elephant conflict (HEC). We describe, therefore, an alternative management approach, informed by this analysis, that focuses on (1) in situ management and non-translocation based methods for preventing or mitigating HEC except for populations that are clearly doomed (e.g. they are very small and isolated from other populations); (2) an increase in effective law enforcement to protect the elephants and their habitat; (3) efforts to maintain habitat connectivity between the ERL and other elephant habitat within the country's Central Forest Spine; and (4) an emphasis on continuing to monitor population size and trend with a new focus on adaptive management.

**Hegeman, Ericka,** *Conservation Science Partners, Inc.;* **Matthew Farnsworth**, *Conservation Science Partners, Inc.;***Luke Zachmann,** *Conservation Science Partners, Inc.;* **Thomas Jackson**, *Kaweah Biological Consulting;* **Kelly Herbinson**, *Sundance Biology;* **Brett Dickson,** *Conservation Science Partners, Inc.*

**Exploratory data analysis from a translocation study of Mojave desert tortoise, Gopherus agassizii**

The global increase in large-scale solar electric generating projects has resulted in a growing number of programs involving the translocation of sensitive species, including the Mojave desert tortoise, Gopherus agassizii, which is a federally threatened species. Translocation has become a common management tool for desert tortoises, yet only recently have movement and space use patterns been investigated. Here we describe results from the first year of a ten-year post-translocation monitoring project involving approximately 400 individuals in the Ivanpah Valley of southern California. Goals of this project include determining the effectiveness of translocation as a conservation tool through a comprehensive monitoring program. Estimates of space use were derived from systematically collected radio tracking data and reflected differential patterns of habitat use among translocated, resident, and control groups. Similar to previous studies, we found differences in utilization distribution (UD) size among all groups, with translocated tortoises having larger UDs. We also found differential space use patterns in which translocated tortoises were found more often above ground than in burrows, when compared to both control and resident groups. Ongoing work includes model-based survival analysis that incorporates information on habitat features, as well as tortoise health status, to rigorously evaluate the influence of translocation on survival of this long-lived desert dweller.

**Heilmann-Clausen, Jacob,** *Center for Macroecology and Evolution, University of Copenhagen*

**Citizen science in a megadiverse group - how to make data collection on mushrooms relevant to conservation planning.**

Citizen science is an effective tool to collect loads of biodiversity data, but the impact of data in real conservation is highly dependent on validation and dissemination. This is not less evident when working with organism groups that are species rich, challenging to identify to species and generally neglected in conservation. The Danish Basidiomycote atlas, initiated in 2009, has the bold ambition to collect data on all mushrooms in Denmark (c. 2800 species), and to make this information available for nature managers that normally do not consider fungi in their work. Both data validation and dissemination is managed via interactive web platforms, but with different front ends for volunteer data providers and data users. The project has collected more than 200.000 validated species records, and resulted in the discovery of more than 150 species new to Denmark. Data are increasingly used in conservation planning. By combining user surveys with analyses of submitted data, I analysed how background of data providers influence the quality and novelty of submitted data. The results show that volunteers with a professional background are much more efficient in delivering novel data on red-listed species compared to non-specialist volunteers, which on the other hand are efficient in monitoring known populations of red-listed species. These results are important to consider in spatial conservation planning, by correcting data, not only for collecting intensity but also quality.

**Heller, Nicole,** *Duke University*

**Targeting the geography of climate and climatic changes to increase the resilience of protected area networks**

Conservation planning must take into account climate changes to achieve conservation goals in the future. At the same time, there is great uncertainty in the rate, magnitude, and sometimes the direction of change, as well as the response of ecological communities. Given uncertainty, methods need to be developed to do adaptation planning that do not rely on best guess estimates of how the climate will change or how species will respond. Here I report on an experiment done in collaboration with TBC3.org, which targets spatial and temporal elements of climate on the landscape to improve the resilience of the Conservation Lands Network in the San Francisco Bay Area. I share results from an experiment comparing how different protected area network configurations based on climate types, resolved at the 270 meter scale, or vegetation types, resolved at the 30 meter scale, compare in the representation of climate diversity now and in the future, with the assumption that greater climatic diversity is an asset for biodiversity. Results suggest that vegetation filters function similarly to climate filters in terms of representing climatic diversity on the landscape today and in alternative futures. However differences did emerge in some regions suggesting that targeting climatic elements introduces new information that may aid in adaptation.

**Henning, Bridget,** *University of Minnesota,*

**Aligning global and local ecosystem services: An interdisciplinary examination of forest benefits in lowland Papua New Guinea**

Concern about global change has increased interest in the maintenance of forests for carbon storage and biodiversity but forests also provide important local ecosystem services. This interdisciplinary study used hunting surveys, botanical plots, interviews, and participant observation to examine the co-occurrence of carbon storage and biodiversity with local benefits of hunting success, plant use, and religious practices in the lowland rainforest of Papua New Guinea. Although some local uses may impact global services like carbon storage, many local benefits have minimal impact; therefore I classified local benefits based on their frequency and intensity of use. Local benefits, which require little to no extraction, such as medicine, tools, and religious practices, occurred more frequently in relatively undisturbed, primary forest that also have high carbon storage and biodiversity. However, local benefits extracted in high quantities did not consistently occur as predicted in disturbed secondary forests with lower carbon storage and biodiversity. Fuel sources were more frequent in secondary forests, but building material abundance was not different between primary and secondary forests, and food sources were more common in primary forests. This newly identified ecosystem service bundle of carbon storage, biodiversity, and minimal-extraction resources may find application in land management decisions integrating local and global interests.

**Heppell, Scott,** *Oregon State University;* **Brice Semmens**, *Scripps Institute of Oceanography;***Christy Pattengill-Semmens,** *Reef Environmental Education Foundation;* **Phillippe Bush**, *Cayman Islands Department of Environment;* **Croy McCoy**, *Cayman Islands Department of Environment;* **Bradley Johnson,** *Cayman Islands Department of Environment*

**Behavior, hyperstability, and population declines of an aggregating marine fish**

Collapses of marine fish populations are a global concern. Some collapses are attributed to hyperstability, where catch per unit effort remains stable while the population declines. Hyperstability is difficult to detect until after a population is depleted, thus nearly all such studies on the hyperstability phenomenon are retrospective. Using whole-island acoustic arrays to track an endangered, aggregating reef fish on two Caribbean islands, we demonstrate for the first time behavioral mechanisms that might lead to hyperstability. We show that: (1) every reproductive-aged fish aggregates each year, (2) older, more fecund fish aggregate longer, (3) individuals will visit multiple aggregation sites during the spawning period, yet every fish always aggregates and spawns at a single location, and (4) overfishing extends the time spent aggregating, increasing vulnerability to harvest as the population declines. This latter finding is supported by historic accounts from other aggregation sites throughout the Caribbean. Taken together, our results demonstrate that aggregation sites are a surprisingly complete and persistent geographic bottleneck for aggregating species, and this bottleneck is a feature that intensifies with depletion. Our results highlight both the extreme vulnerability of local populations to harvest but the potential for even heavily harvested aggregations to recover.

**Heppell, Selina,** *Oregon State University*

**Evaluation of population impacts using reproductive value**  
Recovery Plans for U.S. Endangered Species and other planning tools for species conservation often include a list of factors that may impede recovery or continue to negatively impact a population. However, these inventories are often "laundry lists" without prioritization because the relative impacts of different stressors may be difficult to measure. Without a way to measure relative effects, we run the risk of putting too much time and money into conservation actions that are ineffective for population recovery. Because human-caused impacts to populations may be focused on a particular life stage of the species, a "common currency" that relates all mortalities to adult females can improve our assessments of different population impacts. Reproductive values, which can be calculated with a minimal amount of species' life history data, allow us to compare the relative impact of removing animals of different ages from a population, thereby providing a weighted impact factor based on individuals rather than changes in vital rates. This approach has been used to rank threats to sea turtles and applied to shark harvest assessments. Caution must be taken, however, if the basic demographic rates of the population are poorly known. I demonstrate the potential for error in reproductive value calculation that leads to an overestimation of allowable population removals with a simulation model for sea turtles.

**Herron, Sean,** *University of California, Santa Barbara;* **Jamie Afflerbach**, *University of California, Santa Barbara;***Delsin Brunkow,** *University of California, Santa Barbara;* **Sanaz Sohrabian**, *University of California, Santa Barbara;* **Jade Sainz**, *University of California, Santa Barbara;* **Anthony Broderick,** *University of California, Santa Barbara*

**An analysis of bioeconomic tradeoffs in Vaquita (Phocoena sinus) conservation policies for the Upper Gulf of California, Mexico**

Mexico's only endemic marine mammal, the vaquita (Phocoena sinus), is a porpoise widely cited as the most endangered cetacean in the world. With an estimated population of less than 200 individuals remaining in the Upper Gulf of California, entanglement in shrimp and fish gillnets threatens the vaquita with extinction within the decade; recent analyses suggest that mortality from this primary fishing method is responsible for an annual population decline of 9.7%. However, cessation of fishing is not considered a realistic option since it is the principal economic activity for the region. To date, the Federal Government of Mexico has invested an estimated $30 million USD in an attempt to maintain fishing livelihoods while protecting the vaquita, yet current management strategies have failed to halt the continual population decline. We conducted a quantitative tradeoff analysis that assessed total fishery value and projected impact on vaquita population over a 30 year period for a spectrum of different policy scenarios. Using spatially explicit fisheries and vaquita data, we modeled the theoretical effects of combining spatial closures, fishery closures, buyout programs, and varying levels of compliance. While a win-win scenario is unlikely, our findings provide a comparative evaluation of optimal policies to guide future management strategies that will achieve vaquita population growth at a minimal expense to fisheries.

**Hess, Shervin,** *N/A;* **Amir Hossein Khaleghi**, *N/A*

**Conservation of big cats in a politically isolated country, Iran**

Conservation of wildlife in developing nations is often dependent on international funding. In politically isolated nations such as Iran, economic sanctions imposed by other nations have severely reduced the work of conservation research and management by non-governmental organizations. This study measures the conservation implications of economic sanctions are by the progressively diminished foreign financing of Persian leopard conservation efforts over a span of five years, resulting in reduced resources for research, public education and management. As progressively greater restrictions are placed on international financial transactions, foreign funding for projects has diminished. Sanctions also stifle knowledge transfer between international non-governmental organizations, academic institutions and other organizations working in conservation. Persian leopard conservation funding by foreign institutions has declined by 90% since 2007. The subsequent economic crisis has quadrupled the rate of inflation within Iran, stifling domestic funding of conservation projects The deleterious effects of wildlife conservation as a result of political sanctions are quantifiable and must be examined in order to spark conversation about the need to shelter world wildlife heritage from political conflict.

**Higgins, Jessica,** *University of Maryland*

**Two Decades of Change in Environmental Journalism: Comparing Coverage of the Exxon Valdez and Deepwater Horizon oil spills**

Media coverage of environmental issues both reflects and influences public opinion and can have a profound effect on policymaking. Here I compare environmental coverage of the 1989 Exxon Valdez oil spill and the 2010 Deepwater Horizon oil spill. I conducted a review of relevant articles from The New York Times and The Washington Post from within the first month following each spill, excluding short pieces, news briefs, letters, and op-eds. I analyzed articles for source quantity and type, primary concern, emphasis on conflict versus solution, and presence of background or contextual information. My results indicate that the quantity and prominence of environmental coverage was greater for Deepwater Horizon than for the Exxon Valdez spill. In covering both disasters, journalists relied much more heavily on government and industry sources than on scientific sources, which may impact how environmental interests are relayed to the public. In both cases, journalists emphasized conflict versus solutions, which could influence public perception of environmental issues and reduce the impetus for participation in environmental decision-making. Media attention to technology was greater in the coverage of Deepwater Horizon, and the focus on environmental impacts was reduced, suggesting competition between the two for public attention. Media play a large role in setting the public environmental agenda, and coverage of environmental issues has serious implications for conservation.

**Hilgartner, William,** *Johns Hopkins University & Friends School of Baltimore;* **Dorothy Merritts**, *Franklin and Marshall College;***Robert Walter,** *Franklin and Marshall College;* **Michael Rahnis**, *Franklin and Marshall College;* **Jeffrey Hartranft**, *Department of Environmental Protection;* **David Bowne,** *Elizabethtown College;***Aleah Miller**, *Elizabethtown College;* **Candace Grand Pre,**

*Franklin and Marshall College;* **Christopher Bernhardt,** *U.S. Geological Survey*

**Millennial Stability and Post-settlement Burial of Bog Turtle (Glyptemys muhlenbergii) Habitat in Two Piedmont Valleys of Maryland and Pennsylvania**

Paleoecological analyses of macrofossil seeds, charcoal and pollen from two river banks in the Piedmont of Maryland and Pennsylvania were combined with geomorphic data and historical land use records to provide a 5000-yr and 3000-yr history of two valley wetlands. At both sites sedge meadows dominated by Carex stricta (tussock sedge), C. prasina, C. stipata and C. scoparia persisted virtually unchanged for 3-4 millennia until the 18th century, despite major storm events, regional beaver activity, fire, and anthropogenic disturbances. Wetland hydrology consisted of gently flowing water in rivulets and saturated organic soil maintained by springs from valley margins. In the Piedmont of Maryland and Pennsylvania the sedge meadow and associated hydrology is prime habitat for the endangered bog turtle (Glyptemys muhlenbergii). We suggest that these Holocene sedge meadows must have supported bog turtle populations for > 4,000 years. Burial of the sedge meadows happened rapidly in the mid to late 1700s when 1- 2 m of silt and clay sediment from land clearance (legacy sediment) accumulated in mill ponds behind downstream dams. Eventual breaching of the milldams created incised, high-banked channels and upland riparian vegetation not conducive to bog turtles. This study indicates that the current disjunct distribution of the bog turtle is a result of 18th century damming, and that habitat restoration might be accomplished by removing legacy sediment to expose the buried wetland.

**Hill, Jeffery,** *University of North Carolina Wilmington;* **Anthony Snider**, *University of North Carolina Wilmington;***Susan Simmons,** *University of North Carolina Wilmington;* **James Herstine**, *University of North Carolina Wilmington*

**General Framework for Gathering Data to Quantify Annual Visitation on Coastal Reserves**

Protected area management is, in part, an exercise in understanding and addressing visitor use of dependent natural resources. An accurate estimate of visitation allows managers to evaluate visitor use impacts and determine appropriate social and resource management objectives to insure their protection. Despite demonstrable benefits to be gained from accurate visitor use information, many managers rely on ad-hoc or convenience samples. Management entities with a wide diversity of social and biophysical conditions across their sites cannot use a single methodology to estimate visitation, but require a more flexible approach. Nonetheless, given the complexity of developing a sampling protocol unique to each site, a generalized framework for capturing these data and accurately estimating visitor use is essential in providing guidance and consistency at a site level. To that end, a generalized framework for developing site-specific sampling protocols to estimate annual visitation was created. This framework was then prototyped on Masonboro Island, a component of both the North Carolina Coastal Reserve and National Estuarine Research Reserve, in conjunction with reserve staff. Preliminary results from Masonboro Island indicate that the generalized framework has enormous potential benefits for resource managers in generating defensible, statistically-grounded estimates of visitation, particularly at sites with disbursed access to undeveloped resources.

**Hoban, Sean,** *University of Ferrara;* **Scott Schlarbaum**, *University of Tennessee*

**Optimal sampling of plant populations for ex-situ conservation of genetic biodiversity: spatial considerations**

As habitat loss, environmental degradation, and climate change accelerate, there is a pressing need to preserve genetic diversity of plant species in ex situ conservation collections (e.g. seed banks). However, current guidelines for sampling populations to conserve genetic diversity are primarily based on decades-old probabilistic models that do not consider population genetic structure. Population structure, which is common among plants, is an important consideration because it results in alleles or traits restricted to particular populations or regions, which are of high conservation value. We propose a methodology utilizing computer simulations of realistic genetic structure patterns to test the ability of different sampling strategies (spatial distribution) and intensities (number of samples) to capture genetic diversity (especially locally restricted alleles). We simulate three species having different levels of connectivity. We find that spatial strategies strongly differ in performance: sampling one population per region is more effective (~175% more alleles captured) than sampling all populations in one region. The effect is strongest for poorly connected species. Modest sample sizes (~20 samples per population) perform well. We use a case study in the highly threatened butternut tree to argue for samples sizes of 25 trees from 10 states. We conclude that simulations are a valuable tool to help tailor sampling strategy for threatened plants.

**Hobson, Peter,** *Writtle College;* **Pierre Ibisch**, *Eberswalde University for Sustainable Development;***Catherine Norris,** *Writtle College*

**Adopting principles of econics to evaluate the resilience and adaptive capacity of forests**

Econics is an adaptive ecosystem-based approach to management that draws on the theory of non-equilibrium thermodynamics to help understand ecological problems, and promote ecosystem integrity and resilience. Forest ecosystems support higher biomass storage and greater functional diversity, collectively enhancing energy degradation and resilience against uncertain changes. Under human-induced disturbance they can suffer from functional impairment, which reduces their ability to degrade energy. In this study, replicated plots across a chronosequence of forest ecosystems in the UK, Finland, Germany and Ukraine were sampled over twelve months for surface temperature and vegetation characteristics. Analysed data on plant functional traits and proxy indicators for above-ground biomass suggested that old-growth and mature semi-natural forests were characterised by competitor-stress tolerant communities and higher biomass. These factors appeared to contribute significantly to attenuation in surface temperature when contrasted with secondary forests or managed stands. Analysing data at both local and landscape scales revealed similar trends in temperature patterns. The results have important applications for the management of forests undergoing environmental change. Practices that promote higher thermodynamic functionality by mimicking natural processes in forests are more likely to conserve eco-exergy and so enhance resilience of forests facing impacts of climate change

**Hodum, Peter,** *Oikonos Ecosystem Knowledge/Univ. of Puget Sound;* **Erin Hagen**, *Island Conservation;***Valentina Colodro,** *Oikonos Ecosystem Knowledge;* **Veronica Lopez**, *Oikonos Ecosystem Knowledge;* **Christian Lopez**, *Oikonos Ecosystem Knowledge;* **Paola Gonzalez,** *Oikonos Ecosystem Knowledge*

**Engaging local communities to advance conservation of endemic species: A case study from Chilean islands**

The complexity of conserving endemic species can be even greater when local communities interact with focal species. Community participation in, and commitment to, conservation measures greatly enhance long-term chances of success and increase the likelihood that such initiatives will become self-sustaining. As a central part of our long-term conservation program for several endemic endangered land- and seabird species, we have led community-based conservation efforts in the Juan Fernandez Islands and Mocha Island, Chile, for 11 and 3 years, respectively. We have focused community-based efforts on two principal areas: (1) community awareness development through creative artistic and educational activities and (2) capacity building, training and hiring of local residents. For example, we have led writing, painting and drawing workshops and contests, developed active-learning modules for the environmental education programs, established conservation-themed soccer tournaments for island residents and created volunteer programs in monitoring and invasive plant control. Our second focus, local capacity building, has produced teams of local residents (>20) trained and hired to work as field technicians and local coordinators on conservation, monitoring and restoration projects. Bottom-up community-based initiatives, using a suite of activities, have tremendous potential to complement on-the-ground conservation and restoration activities focused on threatened bird species.

**Hoffman, Anne Marie,** *The Nature Conservancy*

**Connectivity between Mangroves, Seagrass and Coral Reefs: Implications for Management in the St. Thomas East End Reserves, U.S. Virgin Islands**

Marine and coastal areas provide the valuable ecosystem services of fish foraging, nursery and protection. The delivery of these services depends on the size, location and proximity of key habitats including mangroves forests, coral reefs and seagrass beds. Ecosystem Based Management (EBA) in the Caribbean should account for the proximity and perceived connectivity of these habitats to support the ontogenetic and diurnal movements of coral reef fish. In the St. Thomas East End Reserves (STEER), a marine protected area in the U.S. Virgin Islands, NOAA's Habitat Priority Planner was employed to assess which mangrove, seagrass and coral habitat patches are highly connected to other habitat types. Results identify coral reef, mangrove and seagrass patches that are more likely to support fish migration. Given that habitat size and quality is decreasing for mangrove forests, seagrass beds and coral reefs on St. Thomas, consistent with other areas in the Caribbean, management recommendations include additional research and protection for mangrove forests and proximate coral reefs and seagrass beds to maximize ecosystem services.

**Hoffman, Matthew,** *New York University*

**Is Education the Sticking Point? Problems of Collective Active in Landscape Conservation**

An effort is underway in a small Vermont town to make a comprehensive plan for the protection of biodiversity. The landscape to which the plan applies belongs to hundreds of private owners whose cooperation is necessary for its success. Supporters of the plan hope to secure landowner cooperation by means of an educational campaign about the importance of protecting biodiversity. But even if most landowners come to favor conservation in principle, it does not necessarily follow that they will actively support the plan, since the shared goals of a group are often undermined by the incentives faced by each individual member. A mail survey of all households was used to investigate whether education is the sticking point, or whether landowner commitment to conservation is undermined by problems of collective action. It was found that most landowners are already in favor of conservation and would be willing to make conservation commitments in the context of a mutually binding agreement with other landowners.

**Hoffman, Tali,** *Mammal Research Institute;* **Robert Millar**, *Mammal Research Institute;***Les Underhill,** *Animal Demography Unit*

**MammalMAP: A mammal monitoring initiative for improved wildlife conservation in Africa that bridges ecosystem, disciplinary, and political divides.**

Limited knowledge of the 21st Century distribution of African mammals strongly inhibits our ability to manage and conserve them. Launched in 2012 by two South African universities, MammalMAP aims to fill this knowledge gap by updating the distribution records of all African mammal species. Through extensive collaboration with scientists, citizen scientists, conservation organisations, and wildlife authorities, we consolidate reliable evidence of current (post 2010) mammal occurrence into an online, open-access digital database, in an exercise with four primary conservation benefits. Firstly, comparisons of current distribution records with historical and future records, and analyses of distributions shifts in relation to changes in habitat and climate, will yield both explanatory and predictive results that can inform species- and continent-level conservation policies. Secondly, by identifying and documenting the threats facing the most vulnerable of African mammal species, these data will provide crucial guidance to the IUCN Red Data Lists. Thirdly, these data will direct landscape conservation regulations for maximum biodiversity protection, and guide the effective spending of scarce conservation resources. Finally, MammalMAP provides a platform for involving Africa's citizens in, and educating them about, wildlife conservation. In short, MammalMAP represents a comprehensive, multi-species conservation initiative that bridges ecosystem, political, and disciplinary divides.

**Hogue, Aaron,** *Salisbury University*

**Bridging the Past and Present: Archaeological, Historical, and Field Evidence for Carnivore Declines on a Mid-Atlantic Peninsula**

Mammalian carnivores (carnivorans) play a key role in the functioning of many ecosystems. Therefore, preserving these species is important to maintaining the integrity of these systems. The purpose of this study was to examine changes in the carnivoran fauna since European colonization on an early colonized mid-Atlantic peninsula. We used archaeological and colonial records to reconstruct the native fauna, and contrasted this with evidence of existing species from field data, museum specimens, and other sources. Ten species were found to be native (Table 1). Of these, four are extirpated, one appears reduced to a single population, and a sixth is restricted to several isolated populations. This indicates 60% of the native carnivorans have either been extirpated or nearly so.

**Holdsworth, Andrew,** *Minnesota Department of Natural Resources;* **Michael Larson**, *Minnesota Department of Natural Resources;***Edward Quinn,** *Minnesota Department of Natural Resources;* **Andrew Carlson**, *Minnesota Department of Natural Resources;* **Clarence Turner**, *Minnesota Department of Natural Resources;* **Jim Manolis,** *Minnesota Department of Natural Resources;***Kathy Doncarlos**, *Minnesota Department of Natural Resources;* **Ann Pierce,**

*Minnesota Dept. of Natural Resources*

**Climate Change Adaptation Strategy Evaluation at a State Natural Resource Agency**

In 2009, the Minnesota Department of Natural Resources (MNDNR) identified climate change adaptation and mitigation strategies as top priorities. The agency established new programs, positions, and teams to integrate climate change strategies into management. Initial efforts focused on synthesizing and communicating scientific information. Now we are sharpening our focus on adaptation. Starting with strategies compiled from the literature and regional adaptation efforts, interdisciplinary expert teams are using a multi-criteria ranking approach to evaluate adaptation strategies for four major systems that MNDNR manages: forests and woodlands, wetlands, aquatic systems, and prairie-grasslands. Instead of only providing an overall ranking of importance, this approach allows land and water managers to sort the strategies by any of the importance criteria (i.e. number of management objectives addressed or temporal applicability of the strategy) or other factors. These strategy worksheets will be key resources for staff to begin using through four eco-regional climate change adaptation workshops being planned for 2013. We will share lessons learned from the strategy evaluation approach and MNDNR's initial adaptation work in general.

**Holzer, Katie,***University of California, Davis;* **Robert Bayers***, University of California;* **Tao Nguyen***, Vietnam National Museum of Nature, Vietnam Academy of Science and Technology*

**Frog-human coexistence in lowland Vietnam: Use of urban areas in a rapidly-changing landscape**  
Urban areas are growing rapidly in the lowlands of Southeast Asia, and the impacts of this growth on wildlife are very little studied. A plethora of amphibians are present in these areas, and their use of myriad urban, suburban, and agricultural water bodies may greatly impact their persistence. We conducted the first comprehensive survey of amphibian species breeding in and around the three largest cities in Vietnam: Hanoi, Danang, and Ho Chi Minh City (a.k.a. Saigon). For each city we examined 20 water bodies each in urban, suburban, and rural landscapes. For urban and suburban water bodies we assessed local and landscape factors that may affect amphibian performance. We found that all frog species present during the survey were breeding in all three land-use types, but that average richness per water body decreased with increasing urbanization. Urban frogs were found breeding in empty lots, park lakes, construction sites, and fountains. The factors that best predicted species richness in urban and suburban areas were: edge type (natural vs. impervious), the amount of surrounding upland habitat, the presence of shallows. This study indicates that no lowland amphibian species in this region are urban avoiders or exploiters. Frogs are able to live and breed in even very large and old cities if appropriate habitat is provided. Management decisions, such as sealing water body edges, can greatly affect the persistence of these species in human-dominated landscapes.

**Honarvar, Shaya,** *Drexel University;* **Gail Hearn**, *Drexel University;***James Spotila,** *Drexel University;* **Michael O'Connor**, *Drexel University*

**Tidal movement, gas exchange and conservation of sea turtle eggs**

Sea turtles bury their eggs up to 70-80 cm deep and sand above the nest is an important resistance to gas exchange. Leatherback eggs have low hatching success. On Bioko Island nest hatching success is 10% and it decreases to 3% in a less productive year. Tidal movements of the water table under the nest can ventilate the nest. To make predictions about factors that control hatching success of sea turtle eggs we measured tidal water table fluctuations in nesting beaches on Bioko Island. Large water table movements suggest that tides can ventilate nests more vigorously. The amplitude and timing of water table fluctuations varied with distance of the nest from the water, with lunar phase, and between successive tides. Amplitude of the tidal water table fluctuations was attenuated with increased distance from the water. Simulations using our measured tidal fluctuations, show the potential to decrease time averaged oxygen deficits and carbon dioxide concentrations by 25-30%. Peak predicted oxygen deficits were also ameliorated, in contrast to predictions with smaller water table fluctuations. Thus, water table movements and potential effects on respiratory gas exchange, metabolism, and developmental rates all increase in nests laid closer to the water. We will predict which beaches will be favorable for sea turtle egg incubation in the face of rising seas and warming temperatures and the effects of human alterations of sand composition on development of sea turtle embryos.

**Horigue, Vera,** *ARC Centre of Excellence for Coral Reef Studies, James Cook University;* **Robert Pressey**, *ARC Centre of Excellence for Coral Reef Studies, James Cook University;***Morena Mills,** *University of Queensland;* **Reniel Cabral**, *National Institute of Physics - University of the Philippines;* **Serge Andrefouet**, *Institut de Recherche pour le Développement*

**Benefits of coordinating efforts for MPA establishment in the Verde Island Passage, Philippines**

Locally established marine protected areas (MPAs) have proven effective in achieving local fisheries and conservation objectives. However, the contributions of these MPAs to broader-scale objectives are limited because they were not designed as ecologically connected networks. In contrast, MPA networks designed with systematic conservation planning (SCP) are assumed to have benefits over collections of local MPAs. However, empirical evidence demonstrating these advantages is lacking, due to poor records of implementing systematic designs. An intermediate scenario for MPA expansion is to scale up local decisions by coordinating local MPA initiatives through collaborative partnerships between muncipalities. We evaluated potential benefits of scaling up local MPAs by simulating seven MPA expansion scenarios in the Verde Island Passage: uncoordinated local establishment, two levels of coordinated expansion by collaborative partnerships, and four scenarios guided by SCP at different spatial scales of governance. We measured benefits through time in terms of achievement of habitat representation in each scenario. We also determined the tradeoffs between achievement of objectives and likelihood of implementation based on spatial scales of governance. Our results provide evidence for the benefits of coordinating MPA initiatives and can assist researchers, natural resource planners, MPA managers, and policy makers to better understand the benefits of scaling up local MPAs.

**Horning, Ned,** *American Museum of Natural History*

**Photo mapping and monitoring using inexpensive low altitude platforms**

There is great and growing potential for using portable digital imaging devices and other sensors on low altitude aerial platforms such as poles, kites, balloons and unmanned aerial vehicles (UAVs) to map and monitor landscapes. With recent hardware and software advances the conservation community and, in fact, the general public can now access the technology required to conduct sophisticated aerial mapping and monitoring projects that were impractical even a few years ago. The goal of this presentation is to raise awareness of and improve accessibility to these inexpensive photo mapping and monitoring hardware and software tools. Strengths and limitations of different systems will be discussed and an overview of important regulations pertaining to aerial platforms and other equipment will be presented. Becoming familiar with these low-cost aerial systems will provide conservation practitioners access to new tools to collect spatial data to support conservation projects.

**Hornung, Elisabeth,** *Szent Istvan University, Faculty of Veterinary Science, Institute for Biology;* **Ferenc Vilisics**, *Faculty of Bio- and Environmental Sciences, Urban Ecology Research Group, Univer;***Zita Kemencei,** *National Institute for Environment;* **Peter Sólymos**, *University of Alberta, Edmonton*

**A scoring method for habitat quality assessment based on occurrence and abundance of soil invertebrates**

Informed conservation and management actions require the assessment of biodiversity. Invertebrates make up a large and underrepresented portion of biodiversity. Locations with similar vegetation might provide different conditions for soil invertebrates depending on availability of microclimatic shelters, disturbance history and landscape context. Therefore we developed scoring methods for Hungarian terrestrial isopods and gastropods to be used in the habitat quality assessment, thus allowing invertebrates part of the evaluation and decision process. Our scoring methods for species (Mollusc Rarity Index, MRI; Terrestrial Isopod Naturalness Index, TINI) combined range size, national area of occurrence, and tolerance to human disturbance. The habitat based index is the average MRI or TINI score for the species found weighted by their local relative abundance. We tested our indices on data collected from managed and unmanaged forests for gastropods and along an urban-rural gradient for isopods to compare habitat naturalness. Our results generally reiterate the positive relationship between measures of rarity at different spatial scales, but we also provide examples where this expectation was not met. Therefore, habitat quality assessment should rely on different and complementary indices. Incongruences of multiple indices might be useful in identifying potentially idiosyncratic biotas.

**Horwich, Robert,** *Community Conservation*

**Community Conservation: A Powerful Solution to Environmental Degradation and Biodiversity Loss**

In a time of environmental crisis, with biodiversity loss and an ineffective conservation record, community conservation is a major solution to environmental degradation. During the past 28 years, Community Conservation (CC) catalyzed communities, in 24 projects in 14 countries, to protect private, community and public lands. CC's flexible formula, based on trust, asked communities for help and encouraged them to form over 40 community-based organizations (CBOs) and federations that monitor and protect forests and wildlife. For example, the Community Baboon Sanctuary in Belize, begun in 1985, is community-owned, protects the black howler monkey and served as a model for 24 community-managed sanctuaries under government policy. The Golden Langur Conservation Project catalyzed a federation of 18 CBOs to protect the Manas Biosphere Reserve and the Indian golden langur population that increased from1500 to 5600 langurs. Tigers and elephants also increased and UNESCO " in danger" label was lifted. In northern Peru, CC partners catalyzed 12 CBOs to gain conservation concessions of over 80,000 hectares of cloud forest habitat of 3 endangered endemic primates. In Papua New Guinea, CC helped clan landowners create the first Conservation Area to protect the Huon tree kangaroo. In Ghana, communities protect the last coastal forests and 3 endangered primates. When treated as equals, rural communities are powerful on-site conservation partners that will protect their forest when asked.

**Hruska, Amy,** *West Virginia University;* **James McGraw**, *West Virginia University*

**Small mammals as potential seed dispersers of American ginseng (Panax quinquefolius L.)**

American ginseng has an unusual form of rarity, as it is found in numerous small populations across a broad ecological niche. These population characteristics, along with its cultural and economic value as a medicinal plant, have made American ginseng a model species for rare plant conservation studies. American ginseng is adapted to local temperature conditions, which places populations at risk throughout its range in a rapidly changing climate in the absence of long-distance dispersal. Small mammals (mice and chipmunks) are potential dispersers, as they have been frequently observed near fruiting plants using wildlife cameras. A feeding study was conducted at three field sites, two in WV and one in NY, to investigate the role of small mammals as potential dispersers and whether or not they preferred ginseng berries over other fruits available simultaneously. Results show high small mammal activity within feeding boxes in New York but limited activity at the West Virginia sites. At the NY site small mammals demonstrated a preference for ginseng fruits. Video recorded during the study also showed that mice are primarily predating ginseng seed in NY. Small mammals, and mice in particular, do not appear to be significant dispersers of ginseng. Songbirds are a more likely candidate for long-distance dispersers of this species.

**Hudgens, Brian,** *Institute for Wildlife Studies;* **Julie Youn**, *Utah State University;***Erin Boydston,** *USGS Western Ecological Research Center;* **Lorraine Flint**, *USGS;* **Alan Flint**, *USGS;* **Jessica Lundquist,** *University of Washington*

**Incorporating climate change into habitat suitability assessments for species reintroductions.**

Reintroductions into suitable sites are powerful conservation tools. While current conditions are critical to reintroduction success, future conditions in the face of global climate change also play an important role. We assess the potential of the Sierra Nevada to sustain a reintroduced wolverine population through the 21st century under differing assumptions of climate change and wolverine ecology. Wolverines were lost from California in the early 1900s, likely due to trapping and poisoning programs no longer practiced in the state. The potential suitability of the Sierra Nevada depends on how spring snowpack is impacted by ongoing climate change. We used down-scaled climate models incorporating cold-air pooling and wolverine demographic models to estimate the number of potential female home ranges available in the Sierra Nevada through the 21st century. We find that there is currently sufficient habitat to support ~170 adult female home ranges in the Sierra Nevada, declining to ~125 home ranges by mid-century and ~70 home ranges by 2100. There was a wide range of predicted changes in suitable habitat, ranging from increases to a >60% loss by mid-century with an 11% to >90% loss by 2100 depending on the climate model and female home range size assumed. While the Sierra Nevada is expected to lose wolverine habitat in the next 50-100 years, it will remain one of the largest habitat blocks and potentially important refuge for wolverines in the southern extent of their range.

**Hund, Kirsten,** *World Bank*

**Forestry, mining and agriculture: managing land use in Central Africa**

Land use planning (LUP) is a tool to organize multiple demands for land while minimizing competition and conflict. Congo Basin countries lack land-use planning and inter-sectorial coordination to ensure sustainable development at the local and national level. Numerous conflicts have arisen between and among conservation priorities, mining and logging concessions, infrastructure development projects, agro-industry and local livelihoods. Comprehensive LUP (which must include assessments of current land use, areas of high biodiversity, and development opportunities, e.g. potential mining sites and transportation corridors) can be challenging and unpredictable, . Countries must collect and analyze a substantial amount of information, must have significant-inter institutional collaboration and transparency, strong political commitment, sufficient technical and financial resources. Some interesting lessons can be learned from similar exercises in resource-rich countries in Latin America. This presentation will look at current overlapping and conflicting land use in Central Africa with a focus on mining and conservation in Gabon, Cameroun and the Democratic Republic of Congo and will identify recommendations to improve planning and coordination to find a balance between conservation and sustainable economic development.

**Hurley, Martha,** *Center for Biodiverity and Conservation, AMNH and Global Wildlife Conservation;* **Raoul Bain**, *Div Vert Zool (Herpetology) and Center for Biodiversity and Conservation, AMNH*

**Conservation Biogeography of the Amphibians and Reptiles of Cambodia, Lao PDR, and Vietnam**

Biogeographic analyses have the potential to guide conservation of the ecological and evolutionary processes underlying endemism and the distribution of biodiversity. We analyzed Indochina's > 600 amphibian and reptile species in a spatially explicit framework to identify ecological correlates of endemism and species richness and identify areas of unique biodiversity. Species richness is highest in amphibians and snakes and peaks in upland, forested areas. Endemic species are more ecologically restricted than non-endemic ones; however, the ecological correlates of endemism differ among amphibians, snakes, lizards, and turtles. We identify two centers of endemism: one spanning the northern Indochina-south China border and one centered on the Annamite Mountains. However, cluster analyses reveal strong divergence in the composition of the Annamitese, suggesting at least three distinct units. Southern Chinese species are an important component of northern Indochina's herpetofauna whereas few purely Sundaic species are present and likely representing relict populations. Overall, species composition reflects a unique evolutionary trajectory influenced by the region's complex geological and climatic history. Conservation priorities include: (1) protecting unique areas of evolutionary novelty; (2) incorporating lineage-specific ecological correlates of endemism into conservation planning; (3) clarifying endemic status; and (4) increasing cross-border taxonomic exchange.

**Iacona, Gwen,** *University of Tennessee Knoxville;* **Michael Bode**, *University of Melbourne;***Paul Armsworth,** *University of Tennessee, Knoxville*

**Measuring the effectiveness of funding biodiversity conservation using a game theoretic framework**

Contemporary biodiversity conservation prioritizes spending on actions that provide the most protection for the money spent. However, it largely ignores strategic interactions between actors (donors, local conservation agencies). In practice, agencies jockey with each other and with donors to enact a conservation outcome. The determination of this outcome can be thought of as a game where each actor maximizes their own objective while considering the strategy of the others. We developed a game theoretic framework to examine biodiversity conservation outcomes in a multiplayer context. Using a model system of a donor and two agencies, we ask, "how do funding decision strategies influence the effectiveness of biodiversity conservation?" Here, the objectives of the conservation agencies overlap to some extent with those of the other agencies and the donor, but there is rarely an exact match. An agency produces a conservation outcome by balancing actions that pursue its own objectives with the need to provide the donor's desired outcome (necessary if the donor is to provide funding). The result can be a conservation outcome somewhere between the pure objectives of the two actors, but often, no amount of actor strategy or additional funding can counteract inefficiencies due to objective mismatch. This outcome supports the idea that mission drift can undermine agency effectiveness, and also suggests that top-down control from a donor is unlikely to improve conservation outcomes.

**Ibisch, Pierre,** *Center Econics & Ecosystem Manage*

**Roadless areas: working towards a comprehensive global assessment**

A systematic approach to mapping and assessing the conservation status of roadless and low-traffic areas is generated by the creation of a Road Disturbance Index. This index takes into account various types of information on road fragmentation as well as traffic intensity and is designed to inform conservation planning and environmental policy making. The quality of the final mapping results is then tested against index measures for a range of proxy indicators not directly related to road data, such as population density or presence of cities. The spatial distribution of the identified roadless areas is assessed according to ecosystem functionality, biodiversity patterns, protected area coverage and selected socioeconomic parameters. Socioeconomic and environmental information, such as population, economic growth or primary production, is used in a risk assessment describing the probability of roadless areas to be disturbed or eliminated by road development.

**Ikeda, Tohru,** *Hokkaido University;* **Mariko Nakai**, *Hokkaido University;***Ken-ichiro Shimada,** *Hokkaido University;* **Takaaki Suzuki**, *Hokkaido Universty;* **Jincao Zhang**, *Hokkaido Universty*

**New initiative for invasive alien raccoon control in Japan**

The raccoon already naturalized all over Japan and has various impacts on native species and ecosystems. The Invasive alien Species Act, enacted in 2005, designated the raccoon as invasive alien species, and countermeasures were promoted since then. Intensive trapping campaigns have begun to exert effect in some regions, but there are a number of remaining problems for raccoon control in Japan. Almost Japanese people pay attention only to agricultural damage and tend to trap only in raccoon high-density areas. In addition, many local governments conduct countermeasures freely and they lack any information sharing systems. We developed a new comprehensive raccoon control project to overcome the current situation. We started information sharing network with all prefectural governments and share valuable information such as successful and failure examples. Then we developed efficient and effective devices under raccoon low-density condition, raccoon detection dog and nest-box trap. Raccoon detection dog can sniff out only raccoon odor and not react to odors of other animals, and this dog could detect radio-collared raccoon precisely in the field. Nest-box trap is based on raccoon's cavity-nesting habit and don't need baits, so we can use this trap at residential area where dangerous brown bear lives. Furthermore we started trap campaign near the shore where sea turtles lay eggs, and this campaign succeeded to create potential interest in conservation for native species.

**Innes, Larry,** *Canadian Boreal Initiative;* **Daniel Oades**, *Kimberley Land Council;***Valerie Courtois,** *Canadian Boreal Initiative*

**How acknowledging Indigenous rights can help conservation: amazing results from Australia and hope for Canada**

The world conservation community has become increasingly aware that their activities and actions can have major, and sometimes unforeseen, impacts on Indigenous peoples. Some conservation organizations and governments have now realized that support of Indigenous rights to manage and control the use of their lands is a social and ethical imperative. Not surprisingly, conservation outcomes that start with the acknowledgement of this premise often greatly exceed the original expectations of conservation organizations. We report here on several Indigenous-led land-use management and planning initiatives in Australia and Canada including Australia’s Indigenous Ranger Program that now employs over 650 Indigenous rangers to manage 360,000 km2 (89 million acres) of Indigenous Protected Areas.

**Iranah, Pricila,** *Montclair State University;* **Pankaj Lal**, *Montclair State University*

**Bridging gaps between policy and action for native forest conservation on Mauritius**

Mauritius is an oceanic island and has a population density of 631/km2. In pre-settlement times, rapid evolution of the island's biota saw its ecosystems develop high rates of endemism (e.g. nearly 40% of the island's angiosperms are single island endemics). In last 4 decades the country saw rapid growth based on agriculture, exports and tourism. Rising population and expansion of human induced land use changes led to a growing environmental concerns, including loss of native habitats and species. Good quality native forest cover (≥ 50% native canopy) has reduced to less than 2% of the island's surface area. Introduction of invasive alien species worsened native habitat degradation, affecting quality and quantity of ecosystem services. Systematic analysis of the island's conservation policies suggests prominence of top-down approach in setting up protected areas and species-centric investments e.g. on Falco punctatus. Fenced and actively-weeded "conservation management areas" were set up with proven success e.g. reappearance of previously "extinct" plant species. However, conservation efforts in privately owned forest lands are limited; mostly due to high initial costs and poor returns. Fragmented forest patches, limited community participation, gaps between planned restoration and actual implementation, incoherence between different government bodies, and inadequate research are resulting in piecemeal conservation policies with limited improvement in ecosystem health.

**Islam, Md. Torikul,** *Practical Academy on Wise Education and Research Foundation;* **Md. Ariful Haque Mollik**, *Practical Academy on Wise Education and Research Foundation*

**Studies on microbial behaviors and physicochemical characteristics of rubber seed oils of different clones cultivated in Sylhet Hill Tracts Bangladesh**

Gentle slopes, rich light soil, a congenial climate and abundant rainfall have made Sylhet Hill Tracts one of the largest rubber producing areas in the world. Rubber seed samples of three different clones viz. PRIM-600, GT-1, and PB-255 were collected from the Sylhet Hill Tracts of Bangladesh. The morphological and phonological characteristics of the seeds were studied for each clone. Oils were then extracted from the seed samples by solvent extraction method. It was then purified by a standard method for each of the samples. The total oil contents of each of the clones were found to be 32.50% (PRIM-600), 29.80 (PB-255), and 41.90% (GT-1) respectively. Physical and chemical properties of the three rubber seed oil samples were studied and compared with those of standard oils. Fatty acid compositions of the oil samples were studied by gas liquid chromatography. Rubber seed oils of the three clones were found to contain the fatty acids viz. arachidic acid, lauric acid, linoleic acid, linolenic acid, myristic acid, oleic acid, palmitic acid, and stearic acid. The seed oil samples of PRIM-600, GT-1, and PB-255 showed the unsaturated fatty acids of 89.03%, 81.59%, and 83.91% respectively. Microbial activities of the oils were also studied against six human pathogenic bacteria and six plant pathogenic fungi.

**Ismail, Sascha,** *ETH Zurich*

**The potential of sacred groves forest for short and long term persistence of the rare timber tree species Dysoxylum malabaricum - an example from Koda**

**Iuliucci, Danielle,** *Towson University;* **Joel Snodgrass**, *Towson University*

**Amphibian productivity in a restored wetland landscape in Maryland, USA**

Wetlands provide habitat, food, and nursery areas for wildlife and have been drained historically to convert saturated soils into farmland. Restoration projects are frequently undertaken to restore the ecological functioning of destroyed or degraded wetland landscapes, but examinations of post restoration function are limited. In 2003, The Nature Conservancy (TNC) restored a 75 ha parcel of farmland within a 255 ha preserve in Caroline County, Maryland. The preserve currently supports more than 40 wetlands that differ in physical features and hydrology, thereby having the potential to support a diverse assemblage of amphibian species. We operated drift fence arrays and pitfall traps around 13 of the wetlands to estimate the relative production of amphibian metamorphosis and evaluate the degree to which the landscape of restored wetlands supported a diversity of amphibian life histories. Preliminary results indicate hydrologic variability is correlated with metamorph production. This study will provide TNC with a ten-year post-restoration amphibian inventory and evaluate the suitability of the restoration as amphibian habitat.

**Iwamura, Takuya,** *Stanford University;* **Eric Lambin**, *Stanford University;***José Fragoso,** *Stanford University*

**Modeling the feedbacks between indigenous people and biodiversity through bushmeat hunting and land-use change in Guyana**

Indigenous people impacts surrounding ecosystem through bushmeat hunting and agriculture, yet they are also dependent on the natural resources in their environment as well. Understanding the complex feedbacks between human and ecosystem is essential to understand the active and passive role of indigenous people, especially when their lifestyles have been influenced more and more by forces outside of their historical boundary. Our research aims to find when traditional hunter-gatherer communities intensify the agricultural effort and increase deforestation. We collected the information on Makushi and Wapishana, indigenous hunter-gatherers in Rupunini region of Guyanan Amazon. Our survey covers all of the 9,900 residents in 23 communities with 47,000 animal observations and 8,000 hunting records. Along with the multiple time series landcover map based on satellite images, we developed a spatially explicit model by using Agent-Based Modeling approach. Our results reveal that the timing of agricultural intensification not only depends on human population but also the availability of animal population. Our simulation can also evaluate conservation impacts of various policy interventions to indigenous communities which affect the sustainability of the ecosystem. We found that the land management for the area surrounding indigenous territory is crucial to maintain balance between human and nature inside of the territory.

**Izzo, Grant,** *Towson University;* **Joel Snodgrass**, *Towson University*

**Investigating the Potential of Adaptations in Stream Salamanders to Road Salt in Urban Watersheds: The Role of Storm-Water Management Practices.**

In recent years, the application of road salt as a deicing agent has increased extensively and the impact it has on stream salamanders has yet to be investigated. Modern stormwater management practices are designed to mitigate the impacts of pollutants associated with roads on stream systems and therefore, should affect the delivery of ions associated with road salts to aquatic systems. We used bioassays and field-deployed data loggers to investigate potential road salt toxicity to two widespread species in the eastern United States, the Northern Dusky Salamander (Desmognathus fuscus) and Northern Two-Lined Salamander (Eurycea bislineata), in streams draining watersheds with and without modern stormwater management practices (primarily stormwater management ponds). Streams draining stormwater ponds force chloride ions into the groundwater, yielding elevated conductivity levels throughout the year. Unmanaged streams did not have increased conductivity peaks during the winter. Stream salamanders were relatively tolerant of road salts, not exhibiting any lethal effects until conductivity levels exceeded 14 mS/cm and conductivity peaks in all streams did not exceed these levels during the winter of 2011-2012. Our results suggest road salts are not having acute lethal effects on salamanders in the streams we studied. However, chronic and indirect effects require further study.

**Jackson, Alexis,** *University of California Santa Cruz;* **Brice Semmens**, *Scripps Institute of Oceanography;***Yvonne Sadovy,** *University of Hong Kong;* **Richard Nemeth**, *University of the Virgin Islands;* **Scott Heppell**, *Oregon State University;* **Giacomo Bernardi,** *University of California Santa Cruz*

**A conservation genomics approach for fisheries management of commercial fishes that form spawning aggregations**

We utilized a conservation genomics approach to address the question of whether Nassau grouper (Epinephelus striatus) spawning aggregations should be managed as genetically distinct units. Spawning aggregations are reproductive gatherings of conspecific fish, whose spatial and temporal predictability makes them vulnerable to overfishing. Assessment of genome-wide levels of genetic variation in single nucleotide polymorphisms (SNPs) will be used to supplement more traditional datasets based on mitochondrial DNA (mtDNA) and microsatellites, to estimate important metrics for assessing the vulnerability of threatened species and delineate fisheries management units. We collected a total of 700 tissue samples from 17 localities throughout the Caribbean Sea between 1999 and 2013. Each sample was genotyped for two mitochondrial markers (ATPase and Cytochrome b), nine microsatellite loci and approximately 2,000 SNPs. While some spawning aggregations were shown to be genetically distinct, significant regional genetic subdivision was observed (Φ-CT, mtDNA = 0.3147; Φ-CT, microsatellites = 0.0140). Regional genetic clusters identified - 1) Belize, 2) The Bahamas, 3) Central Caribbean and 4) Eastern Caribbean - reflect broad-scale oceanographic patterns and regions of high larval retention in the Caribbean Sea. Results are being used to implement marine policy and designate the four fisheries management units identified for Nassau grouper.

**Jacob, Anila,** *USAID;* **Kiersten Johnson**, *ICF International*

**Forest cover associated with improved health and nutrition outcomes in Malawi**

Healthy forests provide human communities with a host of important ecosystem services including the provision of food, clean water, fuel, and natural medicines. Globally, about 13 million hectares of forests are lost yearly, with the biggest losses occurring in Africa and South America. As biodiversity loss and ecosystem degradation due to deforestation continue at unprecedented rates, with concomitant loss of ecosystem services, impacts on human health remain poorly understood. Using 2010 Malawi Demographic and Health Survey data and NASA's satellite remote-sensing data, we show that forest cover is associated with improved health and nutrition outcomes among children in Malawi. Children living in areas with net decadal forest cover loss experienced decreased odds of having a diverse diet and consuming vitamin A-rich foods (19% and 29% reductions, respectively). Children living in communities with higher percentages of forest cover had increased odds of consuming vitamin A-rich foods and decreased odds of experiencing diarrhea. Net gain in decadal forest cover was associated with a 34% decrease in the odds of experiencing diarrhea. These findings raise concerns about the potential short and long-term impacts of ongoing deforestation and ecosystem degradation on community health in Malawi, and support the position that preventing forest loss and maintaining the ecosystems services that forests provide are important factors in improving human health and nutrition outcomes.

**Jacob, Owens,** *Drexel University;* **Gail Hern***, Drexel University;* **Shaya Honarvar***, Drexel University*

**Integrating dietary and intestinal parasite data to improve the conservation strategies of the Bioko Island drill (*Mandrillus leucophaeus poensis*)**  
Despite once ranging across Equatorial Guinea's Bioko Island, drill monkeys (Mandrillus leucophaeus poensis) are now limited by intense bushmeat market hunting to the southern third of the island (550 km2). Within this limited area, drills can be found at elevations ranging from sea level to more than 2200m asl and in corresponding habitats ranging from the monsoon forests of the coast to the montane forests of the Gran Caldera. We investigated the diets and gastrointestinal parasite infections of un-habituated drill groups at higher (montane forest, 900-1100m asl) and lower (monsoon forest, 0-300m asl) altitudes to identify areas of conservation priority for this highly endangered insular subspecies. During three consecutive dry seasons (January-March, 2010-2012) we obtained data on the diet and parasitic infections of drills through opportunistic feeding observations and the collection and analysis of fecal samples. Our results show drills diets to differ significantly with altitude: Low altitude drills ate significantly more fruit (95% mean dry weight of fecal remains), while high altitude drills ate significantly more non-fruit fiber (66.7% mean dry weight). However, we found no difference between the richness or prevalence of parasite infections between these areas. These results, and their implications on drill group size and abundance, indicate the monsoon forests to be of particular importance for the future conservation efforts for this highly endangered species.

**Jacobs, Judy,** *U.S. Fish & Wildlife Service (Retired);* **Tomohiro Deguchi***, Yamashina Institute for Ornithology;* **Kioaki Ozaki***, Yamashina Institute for Ornithology;* **Robert Suryan***, Oregon State University*

**Moving and Rearing Chicks: Efforts to Establish a New Short-tailed Albatross Breeding Colony -- and now what?**  
The endangered short-tailed albatross (Phoebastria albatrus) was nearly exterminated by Japanese hunters before the turn of the 20th century. Now protected, the breeding population has built to about 500-550 pairs, nesting on two islands: Torishima, the main breeding site, is an active volcano. The Short-Tailed Albatross (STAL) Recovery Plan requires establishment of at least one additional breeding colony to achieve recovery. We have attempted to facilitate new colony formation by translocating young STAL chicks and rearing them for 3 months to fledging at a protected site in hopes that they will return to breed at age 5-8 years. The first STAL chick translocation was preceded by 2 years' (2006 & 2007) trials moving chicks of the other two North Pacific native albatross species, Laysan (Phoebastria immutabilis) and black-footed (Phoebastria nigripes). From 2008-2012, we moved and reared a total of 70 STAL chicks from Torishima to Mukojima, an island in the Bonin (Ogasawara) chain. Of these, 69 fledged. The post-fledging movements of a sample of the Mukojima fledglings, followed via satellite telemetry, were comparable to those of their Torishima counterparts. Some chicks from the first 3 translocation years have returned to Mukojima, and performed courtship displays, and other STAL have been attracted to the site, encouraging signs for future colony establishment. We hope the techniques we developed will inform conservation work for other declining albatross species.

**James, Amanda,** *Unviversity of California, Riverside;* **James Sickman**, *University of California, Riverside;***Mark Fenn,** *US Forest Service;* **Edith Allen**, *University of California, Riverside*

**Evaluating Nitrogen Deposition Influence in Invaded California Coastal Sage Scrub Communities**

In California, southern coastal sage scrub (CSS) has declined to 15% of historic distributions due to urbanization, pollution, and exotic invasion. Endangered species such as California gnatcatchers, Stephen's kangaroo rats, and Quino checkerspot butterflies are dependent on dense, highly diverse CSS assemblages. It is hypothesized that increases in nitrogen deposition as a result of urbanization and pollution have stimulated invasive annuals and subsequently reduced CSS diversity. To measure N deposition intercepted by the native and invasive plant assemblages, we are employing the Integrated Total N Input (ITNI) method. ITNI utilizes a plant-substrate-water system in which invasive and native plants act as collection interfaces using the principal of isotope dilution to determine species specific deposition rates. By assigning specific N deposition rates, ITNI will determine the rate of atmospheric N assimilation and detect whether exotics utilize this deposition as a form of artificial fertilization to outcompete natives. Specific N deposition utilization rates will address the hypothesis that N deposition significantly influences the decline of native CSS. Initial ITNI deployments have shown adequate biomass growth in the PLS systems for native and invasive species. Our findings will have important implications by providing rates of deposition that can be used to re-evaluate current critical load estimates for N deposition in relevance to an invasion threshold.

**Januchowski-Hartley, Fraser,** *James Cook University;* **Nicholas Graham**, *James Cook University;***Joshua Cinner,** *James Cook University;* **Garry Russ**, *James Cook University*

**The overlooked role of fish behavior in coral reef fisheries management and conservation**

Fish behavior is often overlooked when describing benefits arising from protection. Here we demonstrate benefits provided by changes in fish behavior resulting from two commonly used management tools, periodically harvested fisheries closures (PHCs) and no-take reserves (NTRs). We surveyed fish flight initiation distance (FID - how closely a fish can be approached before it flees) in a before-after-control-impact-pairs study on periodically harvested fisheries closures (PHCs) in Vanuatu and across the boundaries of permanent no-take marine reserves (NTRs) in the Philippines. In PHCs mean FID for Acanthurids was less than speargun range (suggesting they would be easy to catch), and lower than in fished areas. Post-harvest, mean FID in the PHCs increased to beyond speargun range. The proportion of Acanthuridae in the catch from PHCs was almost double that of normal fishing trips, and catch per unit effort was 96% greater. In the Philippines we found that FID of the fishery-target families (Acanthuridae and Scaridae), was lower inside NTRs, gradually increased across boundaries, and was equal to the mean FID in fished control areas approximately 140 m outside NTRs. This represents greater behavioral spillover, than spillover of fish biomass. In addition to being an important mechanism by which local fishers can benefit from protected areas, changes in fish behavior can alter the vulnerability of fish families in ways that may have ecological consequences.

**Januchowski-Hartley, Stephanie,** *University of Wisconsin*

**Using landholders' perceptions of services and values to inform riverine conservation**

Considering landholders’ perceptions in spatial conservation prioritizations can be particularly informative as implementation-success can depend on landholders’ perceptions of benefits gained. We surveyed landholders along the O’Connell River, Queensland, Australia to identify ecosystem services and landscape values they believed would be generated through conservation actions proposed for their land by their local natural resource management (NRM) group. We generated eight spatial prioritization scenarios to explore the potential for achieving benefits for both groups. All scenarios accounted for the services the NRM group expected to gain, but in six scenarios we varied whether we accounted for landholders’ perceived services and values. To determine differences between scenarios that did or did not account for landholders’ perceptions we compared benefit-cost ratios and the number of landholders that the NRM group would need to engage to achieve nine different conservation targets. We show that it is least cost-effective to accommodate landholders’ perceived values and that with low conservation targets, or less than 4 million AUD, the most cost-effective approach is to invest in actions that return the services the NRM group perceives are gained. We also highlight that to accommodate landholders’ perceptions, it is more important to identify those properties where conservation targets, and benefits for both groups, can be achieved than it is to engage more landholders. We conclude by discussing the implications of these results for conservation opportunity assessment.

**Jenkins, Clinton,** *North Carolina State University;* **Lucas Joppa**, *Microsoft Research;***Stuart Pimm,** *Duke University*

**Global Patterns of Terrestrial Vertebrate Diversity and Conservation**

Identifying priority areas for biodiversity is essential for directing conservation resources. Fundamentally, we must know where individual species live, which ones are vulnerable, where human actions threaten them, and their levels of protection. We mapped priority areas for vertebrates using newly updated data on all mammals, amphibians, and birds. For each taxon, we identified centers of richness for all species, small-ranged species, and IUCN listed threatened species. Importantly, all analyses were at a spatial grain of 10x10km, one hundred times finer than previous assessments. Fine scale is a significant methodological improvement, for it brings mapping to scales comparable with regional decisions on where to place protected areas. We also mapped recent species discoveries, for they suggest where as-yet unknown species might be living. To assess the protection of the priority areas, we calculated the percentage of them within protected areas using the latest data from the World Database of Protected Areas. While the priority areas do have more protection than the global average, the level of protection is still insufficient given the high importance of these areas. We also found substantial differences between our priorities areas and the leading map of global conservation priorities, the biodiversity hotspots. This suggests a need to reassess the global allocation of conservation resources to reflect today's improved knowledge of biodiversity and conservation.

**Jenkins, Lekelia,** *University of Washington;* **Richard Pollnac**, *University of Rhode Island;***Wallace Nichols,** *California Academy of Sciences;* **Patrick Christie**, *University of Washington;* **Michael Vina**, *New Mexico State University;* **Nancy Benitez,** *New Mexico State University;***Mark Mizrahi**, *University of Washington;* **Nikita Gabor,**

*University of Rhode Island*

**New Challenges for Improving International Adoption of Circle Hooks and TEDs: Importation and Distribution**

This year, for the first time, the U.S. government has identified a nation for violating a law against bycatch of protected species by foreign fishing fleets. Under this law, a nation could be required to adopt circle hooks in its longline fisheries, a situation reminiscent of the controversial requirement that foreign shrimping fleets use turtle excluder devices (TEDs). Despite two decades of extension activities by the U.S. abroad, rumors abound of poor use of TEDs by some foreign fishing fleets, which have even led to embargoes. Is the technology transfer model used to TEDs effective and appropriate for use with circle hooks? We sought to understand why U.S. promotion efforts yielded better acceptance of TEDs and circle hooks in some countries than in others. We conducted interviews and surveys in the U.S., Costa Rica and Ecuador and analyzed the data using a grounded theory approach and multivariate statistics. Our findings reveal that a large-scale adoption of circle hooks could be hindered by a lack of supply due to high costs of importation, inability to manufacturer circle hooks in-country, and limited ability to distribute circle hooks into smaller fishing towns. This suggests that unlike the TED case, efforts to promote the use of circle hooks abroad, may need to expand beyond education about the bycatch problem and traditional technology transfer, to include diplomatic efforts to facilitate the importation and distribution of circle hooks.

**Jenkins, Peter T.,** *Center, Invasive Species Prevention*

**Current Status of Federal Invasive Species Policy in the United States - and Proposed Reforms.**

Invasive, non-native species are one of the three most important causes of loss of native biodiversity worldwide, together with habitat loss and global warming. They cause extensive environmental degradation, economic harm and disease outbreaks. However, U.S. Federal budget cutbacks, combined with anti-spending and anti-regulatory trends in conservative Members of Congress, and further combined with a passive, overly-cautious approach by the Obama Administration, have blocked any significant progress on invasive species prevention in the United States. U.S. NGO responses have dwindled rather than becoming stronger. Reforms have stalled and invasions by animals, weeds, plant pests, pathogens and other groups continue unabated. Global warming will exacerbate all of these threats and in some cases muddy what species should be considered native versus non-native. Numerous international examples exist, e.g., from Australia and New Zealand, of successful policy reforms to prevent further invasions resulting from the intentional import trade, both for the plant and animal trades, which the United States should emulate. This talk will address desirable outcomes and the role that committed SCB members can play with respect to specific reforms needed for both the live animal and plant import trades.

**Jenks, Kate,** *Minnesota Zoo;* **Nucharin Songsasen**, *Smithsonian Conservation Biology Institute;***Mourad Gabriel,** *University of California Davis Veterinary Genetics;* **Ellen Aikens**, *Smithsonian Conservation Biology Institute;* **Naris Bhumparkpan**, *Kasetsart University;* **Sawai Wanghongsa,** *Thailand Department of National Parks, Wildlife, and Plant Conservation;***Warawidjh Wajwalku**, *Kasetsart University;* **Budsabong Kanchanasaka,**

*Thailand Department of National Parks, Wildlife, and Plant Conservation;* **Todd Fuller,** *University of Massachusetts;* **Peter Leimgruber,** *Smithsonian Conservation Biology Institute*

**Serological survey and movement tracking of domestic and wild canids at Khao Ang Rue Nai Wildlife Sanctuary, Thailand**

Domestic dog diseases may be a primary threat to endangered dhole (Cuon alpinus) populations. Our camera-trap studies in Khao Ang Rue Nai Wildlife Sanctuary (KARN), Thailand, show that dholes and domestic dogs come into direct and indirect contact increasing the potential for disease transmission. We evaluated the potential for these disease spillovers around KARN by collecting demographic data on dog populations (n=244 dogs), analyzing blood samples for disease prevalence (n=80), and tracking the movements of a dhole, jackal (Canis aureus), and dogs (n=19). There was an average of 2.4 dogs per household with an annual adult mortality of 17%. Thirty-two percent of dogs were vaccinated for rabies, but none for other infectious diseases. Initial serological survey results (n=27) indicate 11% of dogs positive for canine distemper virus and 52% of dogs positive for canine parvovirus. The radio-collared dhole pack stayed within forest cover inside KARN, whereas the jackal had a more extensive range with the majority of time spent in agricultural areas outside the sanctuary. Dogs had small home ranges central to their households with the farthest travelling distance into KARN of 4 km. While there may be less threat from direct contact of dogs with dholes, there remains potential for disease transmission through wide-ranging species, such as jackals. Data from this research is being used to develop vaccination programs for dogs around Thailand's protected areas.

**Jennings, Megan,** *San Diego State University;* **Rebecca Lewison**, *San Diego State University;***Erin Boydston,** *United States Geological Survey;* **Kevin Crooks**, *Colorado State University;* **Lisa Lyren**, *United States Geological Survey;* **Robert Fisher,** *United States Geological Survey*

**Connectivity Under Fire: The Importance of Incorporating Changing Fire Dynamics into Connectivity Assessments**

Landscape connectivity has been recognized as a critical component to protecting ecosystem function and species viability. In urban areas, connectivity is threatened directly by anthropogenic landscape alteration and indirectly by fragmentation-related of changes to natural disturbance regimes, most notably wildfire. We used telemetry data from bobcats and coyotes to evaluate the impacts shifting fire frequencies on connectivity in an urbanized landscape in southern California. We developed habitat models for each species to generate a connectivity assessment and found that, without incorporating data on observed and predicted change to fire-return intervals with respect to historic patterns, characterizations of landscape connectivity may be inaccurate. In particular, we found connectivity for bobcats was reduced substantially when habitat maps included these changes in fire-return interval. Given their sensitivity to habitat fragmentation, bobcats may serve as a bellwether of synergistic changes in landscape connectivity under shifting conditions. In an urbanized landscape already constrained by roads and development, increasing fire frequency may increase landscape resistance for carnivores and other species. Our results suggest that we must account for shifting disturbance dynamics in connectivity assessments to generate more accurate estimates of landscape permeability and adequate conservation planning efforts for protection of landscape connectivity.

**Jensen, Meghan,** *Buffalo State College;* **Amy McMillan**, *Buffalo State College*

**Conservation Genetics of New York's Giant Salamander: The Eastern Hellbender**  
The hellbender, *Cryptobranchus alleganiensis*, is North America's only giant salamander and is endemic to the eastern United States. Like many species of amphibians worldwide, hellbender populations are declining at alarming rates. Management efforts are essential to the continued survival of the hellbender. The Buffalo Zoo is raising hellbenders collected from the wild by the New York State Department of Environmental Conservation. These animals will be released back into the wild in an attempt to increase the overall population size. In order to understand the impact these animals will have on extant populations, both the genetic structure of the wild populations and the genetic composition of the released animals must be determined. Unfortunately, little is known about the genetic diversity and structure of hellbenders in New York. Therefore, this study used nine microsatellite loci to assess the genetic relationships of over 200 hellbenders from various locations throughout the Allegheny River drainage of New York and Pennsylvania and of the captive-raised individuals from the Buffalo Zoo. Based on previous research, hellbenders from different drainages differ strongly, while those from the same drainage are genetically similar. However, we found significant genetic differences between Allegheny tributaries. These genetic differences have implications for management as releasing captive-raised animals may alter the genetic structure of subpopulations.

**Jesudasan, Allwin,** *Ashoka Trust for Research in Ecology and the Environment (ATREE)*

**The role of awareness programs in influencing Willingness To Pay (WTP)**

Although Contingent Valuation (CV) is the most frequently used non-market valuation technique for environmental goods, debate persists over its reliability and the overall suitability of passive use values in economic policy analysis. One such contentious issue is the information bias, which can distort the estimate of the service being valued. In our study, we test the impact of one such 'bias' that can be introduced through awareness programs. A debate on this is necessary because of the potential importance of CV values in influencing public opinion and policy decisions. To assess the impact of awareness programs on the Willingness to Pay (WTP), we conducted a CV survey in two villages around a wetland, one (Naanalkulam) which was exposed to an awareness program and another (Vaagaikulam ) which was not exposed. We analyzed the data using a bi-probit model and it shows that the Naanalkulam villagers are likely to have significantly more WTP than the ones in Vaagaikulam. Whether this impact is a 'desirable bias' or a 'bias' at all has not been sufficiently debated in the ecological economics literature and needs to be addressed for CV to be holistic in valuing complex environmental goods.

**Jirik, Katherine,** *Birch Aquarium at Scripps Institution of Oceanography, UC San Diego*

**Making conservation relevant: an integrative evaluation process for public engagement**

To bolster public involvement in conservation, environmental organizations increasingly emphasize stewardship and behavior change in their program goals. Because many human behaviors do not favor conservation, programs are strengthened when integrative, front-end research informs engagement strategies. Leveraging knowledge from diverse fields of study helps to assess scientific evidence, decide program priorities and identify barriers to behavior change. Here, a six step front-end evaluation process is described to aid conservation practitioners in engaging public audiences and fostering sustainability. This process includes useful decision points to narrow communication priorities and to interpret emerging conservation issues, which have not yet been well-studied. Steps 1-3 use evidence-based, interdisciplinary research to guide topic selection and conduct literature reviews. Steps 4-6 explore how to align research insights with project goals and engagement strategies. The topic of marine debris is used to illustrate how synthesizing research from marine ecology, sustainability science and social psychology can help to enhance science literacy and mitigate barriers to sustainable behavior.

**Jogesh, Tania,** *University of Illinois Urbana Champaign;* **Arthur Zangerl**, *University of Illinois Urbana Champaign;***Margaret Stanley,** *University of Auckland;* **May Berenbaum**, *University of Illinois Urbana Champaign*

**Can weeds evolve resistance to biocontrol agents? Invasive Pastinaca sativa reunites with its coevolved natural enemy in New Zealand**

Classical biocontrol, the use of coevolved natural enemies against invasive species, is used in the management of invasive weeds but how rapidly invasive weeds can evolve in response to their re-associated natural enemies is largely unknown. The wild parsnip, Pastinaca sativa, is a Eurasian species widely distributed across North America. It forms dense stands that crowd out native species; moreover, aerial parts of the plant contain photosensitizing toxins that cause contact dermatitis in humans. This plant has been associated with its coevolved European florivore, Depressaria pastinacella, the parsnip webworm, across the U.S. for over 100 years. In 2004, webworms invaded New Zealand (NZ), where wild parsnips have been free from herbivory since their introduction 150 years ago. To determine if reassociation with this specialist herbivore will select for rapid adaptive evolution in the weed, we conducted reciprocal common gardens with seeds originating in NZ or the US. NZ seeds were collected over the span of 6 years from populations either never infested, infested for 4 years, or infested for 6 years. Comparing fitness, damage and floral chemistry, we found that webworms significantly reduce plant fitness overall but plants from populations infested for 6 years had lower damage, higher fitness and greater tolerance to herbivory. The capacity of weeds to evolve in response to biological control agents should thus be included in the management of invasive weeds.

**Johnson, Arlyne,** *Foundations of Success;* **Jean-Gaël Collomb**, *Wildlife Conservation Network;***Peter Blinston,** *Painted Dog Conservation Organisation;* **Gregory Rasmussen**, *Painted Dog Conservation Organisation;* **Forgie Wilson**, *Painted Dog Conservation Organisation;* **Wilton Nsimango,** *Painted Dog Conservation Organisation;***Gregory Gibbard**, *Painted Dog Conservation Organisation;* **Nick Salafsky,**

*Foundations of Success*

**Adaptive Management Improves the Effectiveness of Painted Dog (Lycaon pictus) Conservation in Zimbabwe**

Conservation practitioners must prioritize use of limited resources and demonstrate the effectiveness of their actions to achieve biodiversity goals in order to obtain ongoing support and participation from stakeholders, partners and funders. To address this need, the Painted Dog Conservation Organisation, with support from the Wildlife Conservation Network, is using the five steps of the Open Standards for the Practice of Conservation to iteratively plan, evaluate and adapt their strategies to conserve highly endangered Painted Dog (or African Wild Dog - Lycaon pictus) populations in Zimbabwe. We show how the process has resulted in explicit assumptions and testable hypotheses about four prioritized strategies to reduce 11 critical threats to Painted Dogs, their ungulate prey and key habitats. The first iteration of monitoring and evaluation revealed that law enforcement, education, and species management strategies have been effective to varying degrees in achieving intermediate objectives. Major challenges still exist for reducing the threats of prey depletion and cascading ecological impacts of artificial waterholes. The results indicate that the adaptive management process is contributing to increased involvement of staff and partners in understanding and achieving the organization's objectives and goals, improved strategies and reallocation of resources to increase effectiveness, and refined monitoring and evaluation protocols to better inform future management.

**Johnson, Cheryl,** *Environment Canada;* **Tyler Muhly**, *Alberta Innovates - Technology Futures;***Eric Nielson,** *Environment Canada*

**Predicting spatial patterns of predation risk for boreal caribou from wolves across the boreal forest in Canada**

Boreal caribou (Rangifer tarandus caribou) is listed as a threatened species in Canada. Environment Canada released a Recovery Strategy for this species in 2012. The document identified increased predation facilitated by human development as the species' primary threat which could be mitigated through coordinated resource planning, habitat restoration and management. The objective of this panCanadian research collaboration involving researchers from across the country was to identify factors influencing spatial variation in predation risk for boreal caribou. This objective was achieved by developing a national scale model of wolf habitat use using information about habitat types, patterns of natural and anthropogenic disturbances and climate as input variables. The wolf habitat model results were combined with existing caribou habitat models developed by Environment Canada. Landscape features predicting spatial variation in predation risk for boreal caribou were identified using patterns of co-occurrence between caribou and wolves as a surrogate measure of risk. These variables included anthropogenic disturbances, although the type of disturbance and their effect appeared to vary across ecozones found within the boreal region of Canada. This work provides a useful starting point for assessing predation risk for boreal caribou, particularly for areas in Canada where little information is available.

**Johnson, Crista,** *University of Illinois Urbana-Champaign*

**Border Existence: Managing people, pressures and Papio ursinus in Cape Town, South Africa**

Managing human-wildlife conflict around the edges of a city is further complicated by the complexity of societal relations within an urban context. Over the past 10 years Cape Town has experienced an exponential increase in reports of baboon-wildlife conflict around the foothills of Table Mountain National Park. Attempts to manage the troops of Chacma baboons (Papio ursinus) have led to intensified intra-societal tensions amongst institutions, affected communities and the public with regards to race, space and class. In turn, these tensions have pressured authorities to produce tangible management outcomes, which have resulted in the removal of over half the male baboon population in the Cape Peninsula from 2009-2012. Although the Chacma baboon is not endangered presently, similar wildlife management practices in the past have led to regional extinctions of fauna in the Cape. This study has been conducted from 2012-2013 and investigates the dimensions of cross-racial human relations within a socially stratified urban context that has led to the application of strong wildlife management techniques. Interviews, baboon population surveys and behavioral monitoring, and spatial analysis have been conducted to achieve a greater understanding of these social dimensions. This study purports the integral importance of addressing intra-societal divisions in order to achieve a level of collaboration that can lead to effective and sustainable baboon management.

**Johnson, Jeff,** *University of North Texas;* **Michael Morrow**, *United States Fish and Wildlife Service;***Susan Hammerly,** *University of North Texas*

**A pedigree gone astray! Implications for the captive management of the critically endangered Attwater's Prairie-chicken**

Ex situ conservation programs largely focus on minimizing mean kinship, thereby maintaining equal representation of the genetic founders used to initiate the captive population. This approach, however, relies heavily on a pedigree that is assumed correct. If errors exist, a pedigree-based approach becomes less effective for minimizing inbreeding depression. Both pedigree- and DNA-based methods were used to assess whether inbreeding depression existed in the endangered Attwater's Prairie-chicken (Tympanuchus cupido attwateri) captive population. When examining the population for signs of inbreeding, variation in pedigree-based inbreeding coefficients (f-pedigree) was less than DNA-based methods (f-DNA). Survival of chicks and adults were also negatively correlated with parental relatedness (r-DNA) and f-DNA, respectively, while no correlation was observed with pedigree-based measures when controlling for additional variables such as age, breeding facility, gender, and captive/release status. Individual heterozygosity and parental r-DNA values were also positively correlated with adult survival and the occurrence of a lethal congenital defect in chicks, respectively, suggesting that inbreeding may be a contributing factor increasing the frequency of this condition. This study highlights the importance of using DNA-based methods to better inform management decisions when pedigrees are incomplete or errors may exist due to uncertainty in pairings.

**Johnson, Laura,** *Prescott College;* **Cristina Eisenberg**, *Oregon State University*

**A transferable model for effective conservation communication**

Models for effective conservation communication exist, but?when reviewing accounts of where these models have been executed successfully?a disproportionate number come from urban, affluent areas. This study sought to design a transferable model for conservation communication that incorporates both urban and rural audiences. We conducted a case study in rural northeast Michigan where coastal communities have experienced the social and economic impacts of anthropogenic biodiversity changes in the Great Lakes. We interviewed 30 participants from three groups?natural resource managers, communication practitioners, and citizen stakeholders?to investigate how differences between urban and rural communities affect stewardship motivation. We found that differences in capacity (financial and human resources), land use, and culture strongly influence stewardship motivation. As such, these community characteristics act as guiding principles in our resulting model, which steers practitioners through three phases of a conservation communication plan?research and development, messaging, and implementation. To help both urban and rural practitioners succeed, the model provides tips on how to execute each phase based on the targeted community's financial and human capacity level and their cultural relationship with local natural resources. This preliminary research strongly supports the need for a more integrated and environmentally just approach to conservation communication design.

**Johnson, Shelly,** *University of Florida;* **Holly Ober**, *University of Florida;***Damian Adams,** *University of Florida*

**Modeling Wildlife Occurrence to Evaluate Ecosystem Service Tradeoffs**

Conservation incentives encourage management and restoration of forest ecosystems to promote biodiversity in general, but specifically to enhance habitat for the threatened gopher tortoise in longleaf pine in the SE United States. This interdisciplinary project assesses how occurrence of habitat for tortoise leads to spillover effects on habitat for other species of terrestrial vertebrate wildlife, the tradeoffs among wildlife habitat diversity, and how this impacts potential ecosystem services. I use point-occurrence data for wildlife in Florida, USA, with course-scale environmental covariates to predict the relative probability of occurrence of habitat with maximum entropy modeling (Maxent). I use the probability of occurrence to identify correlations of each species' occurrence relative to probability of tortoise habitat. I found 30 species with overlapping ranges within tortoise habitat in the native range of longleaf pine in Florida. Additionally, I found a high probability of tortoise habitat may increase the probability of endangered red-cockaded woodpecker habitat, but decrease probability of threatened black bear habitat. The overall implications indicate that management and restoration may have a potential impact on overall species diversity. The relationships identified here are of value to the investigation of both ecological and ecosystem service tradeoffs, and should be considered for effective conservation planning and future management decisions.

**Jones, Emily,** *University of New Mexico*

**Introduced grazers, human demography, and landscape impacts: environmental change in contact-era New Mexico**

The 17th century brought a large number of changes to New Mexico, many of which could be expected to have left a signature on New Mexican landscapes. Old World domesticates such as sheep and cattle became well-established members of New Mexico's faunal community; indigenous populations may (or may not) have undergone radical demographic shrinking due to new diseases; settlement patterns and strategies shifted for many indigenous groups; and a number of new ethnic groups, including the Spanish, moved into the area with their own distinct subsistence and settlement practices. Some or all these factors may have impacted New Mexican landscapes - but which ones, and how? This poster uses faunal data from both archaeological and paleontological contexts to explore human impacts -both direct and indirect - on New Mexican landscapes in the 17th century, and the legacies of those impacts on today's landscapes.

**Joppa, Lucas,** *Microsoft Research;* **Piero Visconti**, *Microsoft Research;***Clinton Jenkins,** *North Carolina State University;* **Stuart Pimm**, *Duke University*

**Optimizing Global Conservation Priorities**

The 'silver bullet' allure of biodiversity hotspots - areas with exceptionally high numbers of endemic species and catastrophic levels of habitat loss - continues to capture the conservation communities' attention and funding. We advance Norman Myer's iconic idea by systematically optimizing the hotspot's underlying plant-based species maps. Globally, and then by region, we find the maximum number of species in the minimum amount of area. In doing so we show that 87% of all plant species in our database can be contained in 17% of the terrestrial land surface - 17% chosen with consideration of the Convention on Biological Diversity's Aichi Target 11. Repeating this exercise while maintaining a rule of endemicity incurs computational complexity but ensures irreplaceability of 67% of all species in 17% of terrestrial area. The regions involved in those two calculations differ considerably, with one reasonably favoring continents and the other islands. Our single-point estimates, and the accumulation curves they originate from, bring a new understanding of global and regional biogeography. As the window begins to close on opportunities for expanding the global protected area network, our results provide guidance on areas critical for optimal conservation efforts, and provide a benchmark for reviewing conservation progress.

**Jordan, Tom,** *Smithsonian Environmental Research Center;* **Donald E. Weller**, *Smithsonian Environmental Research Center;***David L. Correll,** *Smithsonian Environmental Research Center;* **Dennis F. Whigham**, *Smithsonian Environmental Research Center;* **Matthew E. Baker**, *University of Maryland, Baltimore County*

**Nutrient overload to Chesapeake Bay: Where it comes from and ways to control it**

Overload of nutrients, especially nitrogen, is one of the largest threats to the Chesapeake Bay; causing depletion of dissolved oxygen, demise of submerged vegetation, and possibly declines in some fisheries. To investigate the factors affecting nutrient discharges, we measured discharges from 500 watersheds with differing land cover in four major physiographic provinces within the Chesapeake Bay basin, and we developed budgets of anthropogenic nitrogen inputs to the watersheds. The main inputs of nitrogen to the Chesapeake watershed are fertilizer application, nitrogen fixation by crops, atmospheric deposition, and import of animal feed. Much less than half of the net nitrogen input to the land reaches the Bay and the fate of the remaining nitrogen is poorly known. Developed land contributes nitrogen to the Bay via runoff from impervious surfaces and sewage releases. Agriculture contributes the majority of the nitrogen load to Chesapeake Bay, but the amounts differ greatly among physiographic provinces. Piedmont and Appalachian croplands release more nitrogen per unit area than do Coastal Plain croplands. This reflects higher nitrogen inputs to some Piedmont croplands and greater prevalence and effectiveness of nitrogen-absorbing riparian buffers along Coastal Plain streams. There are many ways to reduce nitrogen discharges but rising populations of people and livestock and lack of knowledge of the effects of management practices may slow progress.

**Juffe-Bignoli, Diego,** *International Union for Conservation of Nature;* **Thomas Brooks**, *International Union for conservation of nature*

**IUCN Knowledge Products or how to link science to policy**

IUCN is a leading provider of biodiversity knowledge, tools and standards linking science to policy and guiding action on the ground. IUCN's science and knowledge have been the foundation of the Union's work for many years. This is achieved by a network of more than 8,000 scientists and practitioners and by bringing together civil society, science, governments, and NGOs. One of the main priorities of IUCN's Programme for 2013-2016 is providing Knowledge Products. Two key knowledge products of IUCN are the IUCN Red List of Threatened Species, and Protected Planet (including the World Database on Protected Areas [WDPA]). Real-world examples how the IUCN Knowledge Products operate and how they effectively link science to policy will be presented. New developments such as the global consultation to consolidate the criteria to identify sites that contribute significantly to the global persistence of biodiversity (Key Biodiversity Areas) and the Red List of Ecosystems will be explained and demonstrated. Finally, IUCN's plans to integrate knowledge products and the added value this integration will bring, will be shown through practical case studies. IUCN supports and encourages the use of its knowledge products at local to regional scales to help guide decision-makers, both within and beyond the conservation community, to achieve sustainable development and meet their environmental policies.

**Kadagi, Nelly,** *African Billfish Foundation;* **Tina Harris**, *African Billfish Foundation*

**Take or Release? Determining the impact of capacity building activities for recreational fishermen on billfish conservation in Kenya**

Despite several years of studies on billfish biology, there is still a need for more effective conservation and management methods for this group, especially in the West Indian Ocean region. The goal of our study was to carry out education and awareness activities with recreational fishermen and measure the impact of these activities on billfish conservation in Malindi, Watamu and Kilifi fishing sites. To understand catch rates, we tagged billfish and collected release and recovery data of tagged individuals. From the year 1990 to 2010, a total of 44, 670 billfish had been tagged using hydroscopic plastic tags and 1,812 recaptured. Additionally, we gathered responses from 420 recreational fishermen on observed trends of billfish catches and opinions on the benefits of billfish conservation and education. We used this biogeographical data and interview responses to determine the influence of recreational fishing on billfish catches between the years 1990 and 2010. Preliminary analysis shows a positive contribution of the practices of recreational fishermen on billfish conservation efforts in Kenya. We also illustrate how capacity building activities and stakeholder collaboration through sharing of information is important in the conservation of billfish given their highly migratory status.

**Kafley, Hemanta,** *University of Missouri;* **Matthew Gompper**, *University of Missouri*

**Habitat Selection Elasticity in Royal Bengal Tigers Panthera tigris tigris in Chitwan National Park, Nepal**

We investigate habitat selection elasticity of royal bengal tigers, Panthera tigris tigris, in Chitwan National Park Nepal through the use of tiger location data, remote sensing imagery, GIS techniques, and logistic regression models. Quantitative or categorical habitat variables or a mixture of both may characterize use-nonuse locations in habitats. Field data on the habitat use by the species in question were used in conjunction with the data on predictor variables obtained from satellite imagery to construct habitat selection models. We report that tigers select habitats in proximity to the mixed forests, high-density sal forests and water sources. Contrary to past findings, proximity to grassland did not predict tiger habitat use. Within the study area, tigers used the habitats, preferably, at higher altitudes. However, given the small extent of the study area and diversity of habitat types interspersed, tigers in CNP are habitat generalists. We also propose that probably habitat heterogeneity explains the persistence of tigers in such a higher density in Chitwan National Park. Our results will benefit tiger conservation and management through better understanding of habitats used by the species.

**Kahler, Jessica,** *Michigan State University*

**Poaching Risks in Community-Based Natural Resource Management**

Poaching can disrupt wildlife-management efforts in community-based natural resource management. Monitoring, estimating, and acquiring data on poaching is difficult. We used local stakeholder knowledge and poaching records to rank and map the risk of poaching incidents in 2 in Caprivi, Namibia. We mapped local stakeholder perceptions of the risk of poaching, risk of wildlife damage to livelihoods, and wildlife distribution and compared these maps with spatially explicit records of poaching events. Recorded poaching events and stakeholder perceptions of where poaching occurred were not spatially correlated. Locations of documented poaching events were spatially correlated with areas that stakeholders perceived wildlife as a threat to their livelihoods. Local stakeholders thought that wildlife populations were at high risk of being poached and that poaching occurred where there was abundant wildlife. Findings suggest stakeholders were concerned about wildlife resources in their community and indicate a need for integrated and continued monitoring of poaching activities and further interventions at the wildlife-agricultural interface. Involving stakeholders in assessing poaching risks promotes participation in local conservation efforts, a central tenet of community-based management. Stakeholder-generated maps of human wildlife interactions may be a valuable enforcement and intervention support tool.

**Kallick, Steve,** *Pew Environment Group*

**Connecting governments, scientists and stakeholders to protect wilderness in Canada's Boreal and Australia's Outback**

Few very large, unfragmented terrestrial wilderness areas remain on earth. Two large ecoregions in this category are the boreal forest region of Canada and Alaska and the Outback of Australia both of which offer unique opportunities for very large-scale landscape conservation initiatives. In Canada’s boreal forest region a host of unique conservation collaborations has achieved amazing success over the last ten years with over 150 million acres of protected areas, 200 million acres of pledged new protected areas, and 120 million acres of Forest Stewardship Council certifications. Australia too has made enormous strides to protect and maintain its wild landscapes now with over 200 million acres of terrestrial protected areas in the Outback region including in Indigenous Protected Areas. Similarities and differences in the conservation issues and strategies will be described and discussed.

**Kansky, Ruth,** *University of Stellenbosch;* **Andrew Knight**, *Imperial College London, Silwood Park Campus;***Martin Kidd,** *University of Stellenbosch*

**A Meta-Analysis of Attitudes Towards Damaging Causing Mammalian Wildlife**

Many populations of threatened mammals still occur outside protected areas and their survival depends on the willingness of communities to tolerate them. Thus an understanding of the attitudes and tolerance of these communities and the factors that determine these is essential. We conducted a meta analysis to determine factors found to affect attitudes to four groups of mammals. Urban residents had the most positive attitudes (80%) followed by commercial farmers (51%) and communal farmers (26%). Elephants (65%) elicited most positive attitudes followed by primates (55%), ungulates (53%) and carnivores (44%). A tolerance to damage index showed that tolerance for ungulates and primates was in proportion to damage levels while for elephants tolerance levels were higher than expected and for carnivores lower than expected. Among carnivores the most positive attitudes were for tigers, wild dog, lion, leopard, cheetah and jackal and the least were for wolverine, wolf, bear, hyaena and coyote. Multivariate analyses showed complex relationships between species group, stakeholder type and the probability of experiencing damage.We conclude that damage is not always the main factor determining tolerance while taxonomic bias may be an important additional factor. Determining what these other factors are and which ones operate at which sites for which species will be important in order to prioritize conservation investments.

**Kanter, John,** *New Hampshire Fish and Game Dept.*

**The Northeast Collaboration for Wildlife Conservation**

The Northeast Association of Fish and Wildlife Agencies (NEAFWA) have an extensive history of collaboration in landscape-scale conservation and implementation. NEAFWA developed regional conservation planning and implementation priorities with US Fish and Wildlife Service and non-governmental partners. The NEAFWA states supported the development of a common habitat classification system and map and developed a regional list of priority species by combining responsibility (% of range in Region) with risk (as measured by the number of states listing a species in their SWAP). The regional collaboration makes it possible to coordinate and leverage capacity- building. For example, all 14 jurisdictions (including the District of Columbia) pool 4% of their annual State Wildlife Grant allocations into a Regional Conservation Need (RCN) fund administered by the Wildlife Management Institute. The collaboration has also facilitated conservation status assessments of regional priority species and risk assessments for species in greatest need of conservation. USFWS staff integrated the goals of the RCN program into the development of the North Atlantic Landscape Conservation Cooperative (NALCC). NEAFWA and NALCC are working on the synthesis and delivery of data, maps and other tools generated through the RCN and NALCC program. Northeast states will use the information in their 2015 SWAP revisions and to improve access to and use of regional information by states and conservation partners.

**Kao, Rebecca,** *Denver Botanic Gardens;* **Jennifer Neale**, *Denver Botanic Gardens;***Michelle DePrenger-Levin,** *Denver Botanic Gardens;* **Mary Goshorn**, *Denver Botanic Gardens*

**Longer long-term data in rare plant monitoring is needed**

We have been monitoring rare Colorado plants for up to 18 years using count-based Population Viability Analyses. While many PVA studies only use four years of data, we present data on the minimum number of years needed to estimate a stable population growth rate for plants with different life histories and environmental variability. The native plants studied have a variety of survival mechanisms, from the ability of the succulent to withstand years of extreme drought to perennial herb strategies, including periods of dormancy (both of the seeds and adults). While we do not yet know if the lack of growth and flowering for many of our study species in 2012 will affect long-term population trends, we can analyze this year's data in the context of long-term data to better understand the magnitude of the impact of this extreme year. As expected, with continued long-term data collection, the growth rates of the populations we monitor have stabilized and variance around the growth rates have decreased. The number of years required to reach a stable growth rate depends not only on population size, but also on the dependence of population size on environmental conditions. Using a count-based PVA allows multiple agencies with different monitoring methods and goals to communicate the status of a particular species. Understanding the length needed for confidence in PVA results can help agencies allocate appropriate resources to successfully monitor plant populations.

**Kaplin, Beth,** *Antioch University New England*

**The importance of buffer zones in mediating edge effects in forest protected area islands surrounded by seas of agriculture**

Tropical forests alone host at least two-thirds of Earth’s terrestrial biodiversity, provisioning goods and services for human well-being at local to global scales. However, the future of tropical forests has never been more uncertain. Typically isolated and surrounded by human-dominated landscapes, a host of issues face tropical forests, including negative effects from fragmentation, isolation, edges, and human-wildlife conflict. Protected areas are a key approach in tropical forest conservation, but land use around protected areas, even large areas, may disrupt ecosystem functioning along edges. These disruptions can lead to a cascade of alterations, potentially penetrating far into forest interior and ultimately reducing effective size. Recent research shows quality of surrounding matrix can significantly mediate extent and magnitude of edge disruptions. Thus matrix matters greatly to protected area effectiveness, inviting us to revisit buffer zones. Crucial parameters to consider include permeability, hospitability, effectiveness at mediating interactions, effective buffer widths, and permissible human activities in the buffer. These are critical questions today as the need to maintain resilience in the face of climate change and food security concerns increases. Interactions between temperate and tropical forest protected areas and the surrounding matrix cannot be overlooked, emphasizing the need to consider buffer zones. 牂慯汤ⱹ眠⁥慣⁮‬‬‬‬‬‬

**Kappel, Carrie,** *National Center for Ecological Analysis and Synthesis*

**Can we avoid going over the cliff? Tipping points in marine ecosystem based managment**

Scientists have uncovered a growing number of examples of thresholds or tipping points in marine ecosystems. Many of these, like the phase shift from coral dominated to algal dominated reefs, have had undesirable consequences for ecosystem services and resource management. We define a tipping point as a point or zone where a small change in an environmental driver results in a rapid, nonlinear change in ecosystem conditions. Such tipping points have been associated with both reversible phase shifts and alternate stable states that may be difficult or impossible to reverse. We use meta-analysis to characterize tipping points in marine ecosystems around the world and assess factors that contribute to variation in the strength and pervasiveness of this phenomenon across different systems, ranging from the intertidal to the open ocean. We highlight examples where this knowledge has been incorporated into management, with varying levels of success. We then introduce a new four year, collaborative, interdisciplinary project aimed at linking the science of ecosystem tipping points to management via analyses, tools and a general framework that can help managers make better decisions and avoid potential negative consequences of unintentionally crossing thresholds. The project is being developed in collaboration with managers, policymakers, and case study partners to maximize its utility. This project may have benefits for conservation and resource management as well as restoration.

**Karthick, Muthu,** *Care Earth Trust;* **Jayshree Vencatesan**, *Care Earth Trust;***Arivazhagan Chellaiah,** *Care Earth Trust*

**Deciphering Complexity to Evolve a Conservation Consensus**

The criticality of rivers and riparian forests in sustaining biodiversity receives scant attention even in the much studied Western Ghats of India. This landscape over the last five years has also emerged to be the hub of protests against conservation programmes. Seeking to address this shortfall which we assumed to be a result of the linear approach of conservation, a two year research programme on River Moyar was undertaken in the Nilgiris district. The study was grounded in the academic domain of socio-ecology; thereby according equal attention to social, economic, cultural, political and ecological inquires. The 90km river along with the adjoining 2km riparian forests, totally encompassing 180km2 was assessed using continuous linear transects of 4km & 2km simultaneously for vegetation type, floristic composition, occurrence and density of major faunal groups, human settlements, artifacts and management regimes. While the results of the study reiterated the critical role of River Moyar in rendering the habitat its unique diversity, and identified major stakeholders, identification of three conservation-nodes along the river course helped in the development of microplans for action. These microplans were matured through strategic engagement between major stakeholders through an innovate process by which results of the study were converted into schematic diagrams and flowcharts. The entire process has now been mainstreamed into the regional working plan of forest department.

**Kaur, Biba,** *World Wide Fund for Nature-India;* **Dipankar Ghose**, *World Wide Fund for Nature-India;***SANJAY DAS,** *Guru Gobind Singh Indraprastha University, Delhi, India.*

**Assessment of Human Elephant Conflict in a Critical Wildlife Corridor within the Terai Arc Landscape, India**

Asian elephants (Elephas maximus), are threatened by extinction. One of the identified threats to the elephants is there interaction with Humans. Although the importance of human elephant conflict management is widely recognized, it is still relatively poorly understood and often ineffective in the Indian Subcontinent. Managing such a conflict management needs to take into consideration different factors that are location specific, such as perceptions and attitudes of people, socioeconomic factors and culture, behavior of elephants, etc. A survey of attacks of Elephants was carried out in the critical corridor (Bailparao-Kotabagh Corridor) in Terai West Forest Division, Ramnagar, Uttarakhand, India. We recorded crop-raiding, property damage, attack by elephants, and fear of attack, in the area. The methods adopted to document the problem were forest trails and village surveys. We found that crop damage is a problem for nearly all families in the village due to proximity of their agricultural fields to the park border and the village location within a traditional elephant migration route.The attitude of the villagers towards elephants was depressing. The depredation by the elephant has created antagonism among the owners, which has resulted in little cooperation towards elephant conservation programs. The survey provides a set of recommendations for the mitigation of the conflict.

**Kazyak, David,** *University of Maryland Center for Environmental Science, Appalachian Laboratory;* **Robert Hilderbrand**, *University of Maryland Center for Environmental Science, Appalachian Laboratory*

**Growth variation in a Mid-Atlantic Brook Trout population**

Brook trout (Salvelinus fontinalis) are declining across their native range and are the focus of major conservation and management initiatives. Despite considerable attention, we lack basic information needed for population-level management because they have very plastic life histories. In 2010, we began using passive integrated transponder (PIT) tags to monitor >2500 tagged brook trout in the Savage River watershed of western Maryland. To date, biannual sampling has yielded over >2000 physical recapture events, offering valuable insights into the structure and function of brook trout populations. Unsurprisingly, individual growth rates varied greatly among fish, ranging from 0 to 144 mm?y-1. More importantly, we found substantial growth differences among years, with some fish in their second year being as long as four year old fish. Such extreme growth events have major implications for population management, particularly because of the strong relationship between fish length and fecundity. The results also highlight the importance of multi-year data when using science to inform management. We are using linear mixed effects models to identify the roles of climatic conditions, habitat, and competition in driving growth rates and its implications for population resilience.

**Keane, Aidan,** *Imperial College London*

**Modeling behavior to understand patterns and drivers of illegal resource use**

East Africa's dryland areas are famous for their spectacular wildlife, but are also home to

many poor communities. In recent years, initiatives throughout the region have increasingly sought to combine conservation with economic development. Kenya's community conservancies are a prominent example: local pastoralist households lease their land for conservation and eco-tourism, foregoing rights to grazing in return for regular payments. Conservancies are promoted as an effective means to enhance local well-being while achieving conservation goals, but their longer-term consequences are poorly understood. Focussing on the Maasai Mara area as a case study, we used a combination of household modelling, economic games and discrete choice experiments to predict what effect the creation of conservancies will have on levels of illegal grazing. Our results compare the economic conditions where conservancies will reduce a household's reliance on livestock with those where, by contrast, households will use their conservancy payments to buy larger herds, leading to higher levels of illegal grazing.

**Keelan, Kayla,** *University of Maryland, Baltimore County;* **Madeline Hall**, *University of Maryland, Baltimore County;***Margaret Holland,** *University of Maryland, Baltimore County;* **Kelly Wendland**, *University of Idaho;* **Mikaela Weisse**, *University of Wisconsin-Madison;* **Lisa Naughton-Treves,** *University of Wisconsin-Madison;***Catherine Woodward**, *CEIBA Foundation - Ecuador;* **Manuel Morales,**

*ECOLEX Ecuador*

**Evaluating the social impacts and ecosystem service outcomes of Ecuador's SocioBosque program**

We provide a preliminary assessment of the socioeconomic impacts of Socio Bosque Ecuador's national rewards for ecosystem services program. Modeled after similar payments for ecosystem services (PES) programs in Costa Rica and Mexico, Socio Bosque targets areas of high ecosystem service value and deforestation threat, but is unique in its legislated goal of alleviating poverty through program participation. In 2012, we conducted key informant interviews with members of governmental and non-governmental organizations involved in program implementation, and semi-structured interviews with participants in three geographically distinct regions of the country. We provide a preliminary assessment of the current status of program's impact on land use and socioeconomic trends. Our interview results suggest that the incentives directed towards communities are fulfilling unique development needs, which could point to more substantial poverty reduction than the experiences reported by our set of individual participants. Finally, we connect the field visits and key informant interviews with past land use change in each of the three regions, to discuss priorities for future targeting. To conclude, we outline key research questions that should be addressed to ensure the future vitality of PES programs within and outside of Ecuador.

**Keeley, Annika,** *Northern Arizona University;* **Paul Beier**, *Northern Arizona University;***Tabitha Graves,** *Colorado State University;* **Brian Keeley**, *N/A*

**Comparison of landscape resistance measures as estimated by habitat use, movement behavior, and dispersal**

Wildlife corridors are a widely used conservation strategy. Least-cost models identify corridors that are expected to offer the least resistance to animal movement. These models rely on landscape resistance values that reflect how much landscape features impede or promote movement of a focal species. We studied kinkajous (Potos flavus) in a Costa Rican landscape to derive and compare 3 sets of empirical resistance estimates, namely (1) resistance estimated from analyzing habitat use data from GPS radio-tags on 10 female kinkajous, (2) resistance estimated from movement paths (from the same data), and (3) resistance estimated from 38 dispersal events (locations of 38 parent-offspring pairs inferred from 10-locus microsatellite genotypes analyzed in PARENTE software). Because conservation corridors are intended to support dispersal movements, the latter estimates are the most appropriate for corridor design, but they can be more expensive to obtain. Resistance values derived from the 3 datasets were similar, suggesting that resistance estimates from habitat use and movement paths may be reliable proxies for resistance based on parent-offspring pairs. Based on this kinkajou dataset, designers of wildlife corridors can rely on resistance maps generated from data on habitat use.

**Keely, Claire,** *The University of Melbourne;* **Geoffrey Heard**, *The University of Melbourne;***Joanna Sumner,** *Museum Victoria;* **Kirsten Parris**, *The University of Melbourne;* **Jane Melville**, *Museum Victoria*

**Comparing the efficacy and impact of genetic sampling techniques for amphibians**

Toe clipping is a common technique for genetic sampling of amphibians, and involves the cutting of a single toe or toe-tip from an animal. However, recent research indicates that toe clipping may change the behaviour and/or survival rates of frogs and salamanders. This has ethical and conservation implications, and demonstrates the need to find reliable alternatives. We tested four genetic sampling techniques for the endangered Growling Grass Frog (Litoria raniformis) around Melbourne, Australia. We took a toe clip, cut a section of toe web, and took both buccal and skin swabs from thirty frogs captured across this region. For each of the four sample types, we compared DNA quantity, amplification success of mitochondrial and nuclear markers, and rates of genotyping error for eight microsatellite loci. We found toe webbing and buccal swabs to be viable alternative genetic sampling techniques for L. raniformis. However, skin swabs provided very small quantities of DNA and were unreliable for genotyping. Using a decision framework for assessing ethical trade-offs in ecological field studies, we identified the sampling technique that is optimal for amplification and genotyping success, and for species welfare.

**Kellar, P. Roxanne,** *University of Nebraska at Omaha;* **Dakota Ahrendsen**, *University of Nebraska at Omaha;***Shelly Drenkow,** *University of Nebraska at Omaha;* **J. Chris Pires**, *University of Missouri;* **Amanda Jones**, *University of Nebraska at Omaha*

**Phylogenetic Diversity using massively parallel sequencing: Robust biodiversity metrics for conservation planners**

As ecosystems change across the globe, the preservation of biodiversity will best be achieved by the conservation of evolutionary processes. A significant gap exists between the capabilities of current technologies and the biodiversity assessment tools upon which conservation decisions are made. Our research bridges that gap, demonstrating that the newest sequencing technologies lead to biodiversity assessments that: 1) provide better characterization of genetic variation present in an ecosystem and 2) better inform policy-makers. Using massively parallel sequencing to estimate phylogenies and calculate Phylogenetic Diversity (PD) of organisms in an ecosystem represents an enhancement to biodiversity assessment for conservation planning. In this investigation, robust phylogenies of angiosperms were estimated at two prairie sites in Nebraska, and three PD metrics were calculated and compared with species richness. The questions addressed were: 1) How are PD and species richness correlated? 2) How does PD vary between angiosperm plant families? and 3) How does PD vary between ecosystems? Complete plastid genomes plus nrDNA genes were recovered for 30 species of Asteraceae and Fabaceae for phylogeny estimation. The primary conclusion is that species richness and phylogenetic diversity are not always correlated. These empirical results give scientists and conservation planners a better understanding of the genetic diversity present in an ecosystem, beyond simple species counts.

**Kelly, Luke,** *The University of Melbourne;* **Andrew Bennett**, *Deakin University;***Michael Clarke,** *La Trobe University;* **Michael McCarthy**, *The University of Melbourne*

**A method for determining the optimal mix of fire histories for biological conservation**

Fire is used as a management tool for biodiversity conservation worldwide. A common objective is to avoid population extinctions due to inappropriate fire regimes. However, in many ecosystems, it is unclear what mix of fire histories will achieve this goal. Here, we present a method for determining the optimal fire history of a given area for biological conservation, based on the geometric mean of species relative abundance. Our case study is based on extensive field surveys of birds, reptiles, and small mammals in fire-prone semi-arid Australia. First, we develop statistical models of species' responses to fire history. Second, we calculate the optimal allocation of successional states in a given area, based on the geometric mean of species relative abundance. Finally, we use stochastic dynamic programming to show how managers could achieve a fire management target based on strong empirical data. We show that pyrodiversity, per se, does not necessarily promote biodiversity. In our case study area, middle (11-35 years) and late (36-110 years) successional states were disproportionately important for species conservation. By clearly defining fire management objectives based on the habitat requirements of species in the community, this approach could be used globally to maximize biodiversity in fire-prone ecosystems.

**Kelly, Sarah,** *La Trobe University;* **Michael Clarke**, *La Trobe University;***Andrew Bennett,** *Deakin University;* **Rowan Mott**, *La Trobe University;* **Greg Holland**, *Deakin University;* **Anna Flanagan-Moodie,** *Deakin University*

**Assessing changes in the forest bird community after experimental prescribed burns, with a little insight from the scarlet robin**

The increasing demand for prescribed burning on public land will lead to more frequent use of fire in ecosystems where little is known about appropriate fire regimes, such as the box-ironbark forests in north-central Victoria. This collaborative study was set up by researchers and government land managers to investigate the impact of prescribed burning on this ecosystem. A series of experimental burns were conducted during 2011 in two different seasons (autumn, spring) and at different levels of burn cover. Bird community monitoring was undertaken to look at density and composition before and after burning. A focal species, the scarlet robin Petroica boodang, was selected and radio tracking used to investigate the direct impact of burning and changes in territory, habitat use and foraging behaviour following spring burns. Scarlet robins proved to be quite resilient to high coverage burning of their habitat, remaining in areas of >90% burn coverage and canopy scorch, but there was an increase in extent of habitat used post-burn and some small shifts of territories. New nests were built in the post-burn landscape and two-thirds of tagged birds were found using the same territory one year post-burn. While there was little change observed in the density and composition of the overall bird community, radio tracking provided some insight into the impacts of burning on individual birds and highlighted the importance of adjacent unburnt forest for use as refuge during the fire.

**Kendall, Corinne,** *Columbia University*

**Movement patterns of Threatened African Vultures**

Animal movement studies can provide insights into causes of decline, habitat use, range size, and interactions between species. Using GSM-GPS telemetry in Masai Mara National Reserve, Kenya, I assessed the movement patterns of three species of vulture that are rapidly declining. Results demonstrate that the association between vultures and migratory ungulates may not be as strong as once thought and thus that vultures may depend on other sources of carrion including non-migratory wildlife and livestock. Mortality data suggests that poisoning is the primary threat and that all three species are susceptible due to their extremely large home ranges, which are considerably larger than the largest local protected area, the 25,000 km2 Mara-Serengeti ecosystem. Movement patterns also demonstrate that competition between species may drive subordinate species to spend more time outside protected areas, thus heightening their extinction risk. Further comparisons of habitat use pattern and decline rates suggest that movement patterns may be a better predictor of extinction risk than range size. Animal movement studies can provide critical information for conservation practitioners and with cheaper technologies such as GSM-GPS, such studies should continue to expand into new species and regions.

**Kester, Marieke,** *George Mason University;* **Thomas Huff**, *George Mason University;***Elizabeth Freeman,** *George Mason University;* **Thomas Goodwin**, *Hendrix College;* **Nucharin Songsasen**, *Smithsonian Conservation Biology Institute*

**The Solitary Maned Wolf Uses Scent Signals to Ensure Reproductive Success**

The maned wolf (Chrysocyon brachyurus) is unique among canids; this species is an induced ovulator (ovulation occurs only in the presence of a male), unlike most other canids that spontaneously ovulate. Because females housed next to males, but without direct contact, ovulate normally, it appears that chemical signals facilitate ovulation. It is hypothesized that these reproductive signaling chemicals exist in the males' urine. Using an integrative approach connecting chemical-ecology techniques with reproductive behavioral observations, this project's goal is to identify male signaling compounds responsible for estrus induction. Urine samples and behavioral data were collected from maned wolves housed at the Smithsonian Conservation Biology Institute. Results showed that female maned wolves interact more with male urine collected during breeding season compared with samples collected outside breeding season. Using gas chromatography-mass spectrometry, over 120 volatile compounds were identified including alkyl-pyrazines, thiols, thiophenes, ketones, and hemiterpenoids, including compounds that may be unique to males. The findings suggest that certain urinary volatile compounds may signal individual identity, sex, and reproduction among conspecifics. Results generated from this research will be applied to develop a non-invasive method of inducing estrus, easing captive breeding management while advancing assisted reproductive technologies in this threatened species.

**Keth, Andrew,** *Clarion University of Pennsylvania;* **Heather Mitchell**, *Clarion University of Pennsylvania;***Alysha Cypher,** *Center for Conservation Studies, Inc.;* **Michell Clay**, *Clarion University of Pennsylvania;* **Kevin Hart**, *University of Pittsburgh;* **Douglas Smith,** *Clarion University of Pennsylvania*

**Amphibian Conservation: A Novel Detection Method for the Pathogen Batrachochytrium dendrobatidis (Bd)**

There are approximately 6000 species of amphibians that have been described worldwide. Of these, nearly half are threatened with extinction and approximately 500 of that total currently face threats that cannot be effectively stemmed. The primary threat is a waterborne chytridiomycete fungus, Batrachochytrium dendrobatidis (Bd). In moist, cool conditions the fungus rapidly spreads and can eliminate 80% or more of a population in one year. The Amphibian Conservation Action Plan relies upon rapid, accurate detection of this pathogen. Polymerase Chain Reaction (PCR) is the common method used to detect Bd. This method can be inaccurate, expensive, and time-limiting. We report on the development of an antibody-based test that will be inexpensive, Bd-specific, and performed in the field. This test will be vital in tracking the spread of chytridiomycosis, particularly in developing countries seeking to conserve rare, endemic species on an insufficient budget.

**Khadka, Madhav,** *World Wildlife Fund Nepal Program;* **Hemanta Kafley**, *University of Missouri;***Rupak Maharjan,** *Department of National Parks & Wildlife Conservation, Government of Nepal;* **Ritesh Basnet**, *Department of Forests, Government of Nepal*

**Shift in Strategy for the Implementation of a Successful Wildlife Crime Control: Coordination among Stakeholders as a Key Approach**

Nepal, with its rich diversity of several critically endangered species, serves both as a source and a transit for wildlife trade. Wildlife crime control strategies have been evolving in Nepal since early 19th century. However, effectiveness of the adopted strategies was never assessed. We report on effectiveness of the current wildlife crime control strategy in Nepal to fill this knowledge gap. This study is based on a synthesis of expert knowledge and opinions along with the critical examination of the wildlife crime control strategies existed at different times. Current integrated wildlife crime control strategy that mobilizes different institutions to act simultaneously for the control of wildlife related crime has been the most effective strategy till date. However, illegal trade reportedly continues threatening biodiversity of the country. We also analyzed the preference of traders to use different available routes in the country. Location data on seizures and arrests show that routes are not chosen based on the wildlife parts being traded. Traders generally preferred safest route, which is not surprising. However, as opposed to common notion shorter routes did not have significant effect in choosing routes for trading wildlife products. The results contribute in improvising wildlife trade control strategy and the trade route analysis objectively guides the law enforcement agencies.

**Khalid, Sahar,** *Government College University, Lahore, Pakistan*

**Ethno-Ecological Studies of Kathar Game Reserve**

An ethnoecological assessment study was carried out during September 2010 to August 2011 in Kathar Game Reserve in Rawalpindi District of Pakistan, to evaluate its ethnoecological potential. 35 plant species were recorded from the reserve belonging to 23 families; one belonged to Gymnosperm Family and 22 belonged to Angiosperms. The area was found dominated by trees like Acacia modesta, Olea ferrugenia and Pinus roxburghii while shrubs like Carissa opaca, Dodonaea viscosa, Justicia adhatoda and Nerium oleander. Family Sapindaceae showed the highest FIVI of 15.37 while the lowest FIVI was recorded in Asteraceae of 0.56. Soil analysis of the Reserve showed that the soil texture was overall loamy.The Carbon sequestration of the Reserve was calculated by the evenness and commonness of plant species present in the area. The dominant trees and shrubs were selected on random basis and the calculations were made. The highest calculated carbon sequestration among trees was of Pinus roxburghii having 83452 kg. While among shrubs, the highest sequestered carbon was found in Dodonaea viscosa with 485.71 kg of carbon.The Reserve showed very limited amount of carbon sequestration from trees and shrubs, as compared to the literature survey of other forests. The high dependence of locals on the area and the pressures exerted by the native communities are degrading the forest vegetation. There is heavy grazing in these forests throughout the year.

**Khan, Md Saiful,** *Lakehead University*

**REDD+ site selection through systematic conservation planning using MARXAN in Tanzania**

Mainstreaming conservation priorities into REDD+ decision making process is one of the biggest challenges for conservation. Adoption of systematic conservation planning principles for REDD+ site selection can be a solution. This research explores the feasibility of integrating conservation and REDD+ spatial planning at national level in Tanzania. Marxan with Zonae Cogito software was used for selection of REDD+ sites using relative land value as cost and reducing deforestation, maintaining carbon reserve, provisioning biodiversity conservation, participatory management and other socio-economic benefits as targets to achieve. Using GIS based datasets potential REDD+ sites were mapped under different decision scenario. Maps of selected REDD+ sites in Tanzania were easily interpretable and showed logical response in sensitivity analysis under different decision scenario. These sites showed congruence of conservation priorities in terms of biodiversity richness, rareness and complimentarity. This selection mechanism can be used for subsequent stakeholder consultation in systematic planning process. Marxan has the potential to become key REDD+ spatial planning software with some adaptation. Successful adoption of systematic planning and use of Marxan as decision support tool for REDD+ site selection with due importance to biodiversity and its habitats can change the face of conservation efforts across prospective REDD+ countries.

**Khan, Shujaul,** *Hazara University Mansehra, Pakistan;* **Sue Page**, *University of Leicester, UK;***Habib Ahmad,** *Hazara University Mansehra, Pakistan;* **David Harper**, *University of Leicester, UK*

**Assessment of anthropogenic pressure on plant biodiversity of Western Himalayas; linking its abundance with human uses**

This study was undertaken to quantify the vegetation ecosystem services and the anthropogenic pressure on them. People derive essential goods from nature, yet linkages between biodiversity, ecosystem services and human well-being are poorly understood. There have been no previous quantitative risk analysis studies in the Western Himalaya. Phytosociological attributes of species like density, cover and frequency were measured alongside environmental variables. Abundance in terms of Importance Values (IV) from field data were calculated for total of 198 species from 68 families at 144 stations along 24 transects across an elevation range of 2450-4400 m. Data collected through social surveys provided information on indigenous knowledge of local plant names and uses. Use Values (UV) for all species were calculated and the IV and UV data were brought together in their analyses to understand vegetation ecosystem service values. Integration of data sets revealed that 50.8% of the species had residual values greater than the standard deviation, signifying risks of their rarity and extinction due to overuse by the indigenous inhabitants. These species are also highly habitats specific and under tremendous use as trend mentioned by indigenous people. The results contribute to (i) anthropogenic influences on plant diversity; (ii) risk analysis for highly used species; (iii) regional plant conservation priorities.

**Kielgast, Jos,** *University of Cophnhagen*

**Monitoring of rare freshwater animals in Europe using environmental DNA - a valuable shortcut to crucial biodiversity data?**

Freshwater ecosystems are among the most endangered habitats on Earth greatly suffering from anthropogenic impacts across the globe. Reliable monitoring of threatened freshwater species is crucial for data-driven conservation actions in this context but remains a challenge owing to non-standardized methods that depend on practical and taxonomic expertise, which is steadily declining. Here, we show that a diversity of rare and threatened European freshwater animals - representing amphibians, fish, mammals, insects and crustaceans - can be detected and quantified based on DNA obtained directly from small water samples of lakes, ponds and streams. We successfully validate our findings in a controlled mesocosm experiment and show that DNA becomes undetectable within 2 weeks after removal of animals, indicating that DNA traces are near contemporary with species presence. We also test the comparative performance of conventional monitoring methods and environmental DNA detection in the field showing promising evidence of high sensitivity in DNA based surveys. Lastly, we demonstrate that eDNA from small water samples can be used to exhaustively detect entire assemblages of amphibians and fish by high-throughput sequencing. Our findings underpin the ubiquitous nature of DNA traces in the environment and support the use of environmental DNA as a tool for monitoring rare and threatened species across a wide range of taxonomic groups.

**Kiik, Laur,** *Tallinn University, Estonia*

**Militarized conservation conflict, ontologies of tiger 'extinction,' and (de-)ethnonationalization in Kachin, Myanmar**

This ethnographic paper analyzes a current conservation conflict?between a prominent transnational conservation NGO and an 'indigenous' ethno-nationalist environmental movement?in terms of 'ontological dissonance' and (anti-)ethnopolitics. Presently amid war and refugee crisis, the biodiverse Himalayan subtropical foothills and rainforests of Kachin land in northern Burma/Myanmar have recently been the site of notable conservation controversies. These have, among others, involved the NYC-based Wildlife Conservation Society's (WCS) "world's largest tiger reserve" and the globally headlines-making Myanmar anti-Myitsone Dam campaign. The heated conflict between the WCS and Kachin environmentalists is here explored through the two sides' divergent ontological theories, particularly about species 'extinction,' and clashing ethno-political interventions. The study calls attention to the socio-cultural, identitarian, religious, and geopolitical 'pre-histories' to different formations of environmental subjecthood and theorizations of 'nature'. Responding to the conference theme of 'Connecting Systems, Disciplines and Stakeholders', the presentation questions the potential for integrating the 'environmentalist systems' of these embattled 'stakeholders'. Yet, their continuing disconnect hinders efforts at ecological conservation in the face of, mainly Chinese-led, large-scale resource extraction projects and endangered wildlife trade on-going in the militarized landscapes of Kachin.

**Klaus, Valentin,** *University of Münster, Germany;* **Till Kleinebecker**, *University of Münster;***Steffen Boch,** *University of Bern;* **Jörg Müller**, *University of Potsdam;* **Stephanie Socher**, *University of Bern;* **Daniel Prati,** *University of Bern;***Barbara Schmitt**, *University of Bern;* **Nico Blüthgen,**

*University of Darmstadt;* **Markus Fischer,** *University of Bern;* **Norbert Hölzel,** *University of Münster*

**Implication for management and conservation of species-rich temperate grasslands from an interdisciplinary research project in Central Europe**

Land use is a precondition for the existence of species-rich grasslands in the temperate zone, but highly intensive land use leads to a drastic drop in species richness. The Biodiversity Exploratories (www.biodiversity-exploratories.de), a broad scale research project with 300 people involved in Germany, addresses interactions between land-use intensity, biodiversity and ecosystem processes in agricultural grasslands. We assessed data on grazing, fertilization and mowing intensities, on diversity, productivity, biomass nutrients and the delta15N isotopic composition of 150 grassland plots. Productivity, nutrient concentrations and delta15N in biomass were positively related to land-use and especially fertilization intensity, while plant species richness was clearly negatively related. Highest plant species richness was found under P- or NP co-limitation. Our results showed multiple negative impacts of intensive land use on the conservation value of temperate grasslands. Analyzing a subset of organic grasslands revealed that plant species richness did not benefit from reduced land-use intensity under organic management. A seed addition experiment implied that a gap between potential and realized plant species richness exists, where former land use was highly intensive. These results indicate that dispersal limitation is a major obstacle for species richness to benefit from reduced land-use intensity and to effectively conserve and restore grassland biodiversity.

**Klein, Mary,** *NatureServe*

**A network connecting science and conservation: NatureServe's perspective**

The conservation-support program concept described in Meretsky, et al. 2012 has merit. NatureServe has pursued these goals since the 1970s. We see the concept as having two interrelated components: 1) developing consistent information about the classification, distribution, status, and trends of key resources on multiple scales; and 2) applying that knowledge in a broader, coordinated fashion. Implicit is the need for increased consistency across state lines to achieve landscape-level outcomes. The framework must support assessment, planning, implementation, and monitoring at scales from local communities to regional landscapes. NatureServe has existing tools, business processes, data, expertise and partnerships enabling immediate contributions to these core functions. We understand the value of public/private partnerships and practical methods. We currently work with AFWA and the Western Governors Association to develop and deliver biodiversity data in support of State Wildlife Action Plans and the Crucial Habitat Assessment Tool. Greater mission success is possible if our work could be linked to a nationally-coordinated, implementation framework as envisioned in Meretsky, et al. This vision will only succeed with the explicit support of state and federal agencies, scientific rigor, a non-advocacy position, and new, sustained funding streams that support the whole value chain including data gathering, information management, analysis, decision support, and implementation.

**Kleisner, Kristin,** *University of British Columbia;* **Daniel Pauly**, *University of British Columbia*

**Modeling potential fisheries recovery using catch reconstruction**

The global fisheries crisis has been illustrated by numerous examples: catches are declining despite increasing fishing effort; otherwise unprofitable fisheries are kept afloat by government subsidies; the state of stocks - except for a few areas with prudent management - is abysmal; and biodiversity is decreasing. In the world of marine fisheries and biodiversity, it is common to attempt to mitigate this fisheries crisis in the form of a zero-sum game, where increased fisheries yields are seen as incompatible with maintaining marine biodiversity. However if depleted stocks were allowed to rebuild, they would produce more in terms of fisheries yield and contribute to increased biodiversity in their ecosystems. This win-win situation logically follows from the basic principles of both fisheries and marine conservation science: in situations where stocks are overfished, allowing them to rebuild will, after a transition period, lead to potentially higher productivity and, if managed well, more sustainable catches. We estimate the potential for catch increases in 25 major fishing countries using a data-poor assessment method that relies on a time series of landings to estimate maximum sustainable yield and compare these potential catch estimates with results from ecosystem-based models. Results suggest that some countries are experiencing strong exploitation and that reduced fishing effort would allow key species’ biomass to increase, and thus their sustainable levels of yield.

**Klymus, Katy,** *University of Missouri;* **Cathy Richter**, *U.S. Geological Survey;***Duane Chapman,** *U.S. Geological Survey;* **Craig Paukert**, *University of Missouri*

**DNA shedding rates of Asian carps, for use in understanding field collections of eDNA**

The use of environmental DNA (eDNA) as a tool for species detection has come to the forefront in the fight against aquatic invasive species. The technique works by extracting DNA shed into an organism's environment and using polymerase chain reaction (PCR) to identify species specific DNA. The sensitivity of the technique is higher than that of more traditional methods (surveys) of species detection. This increased sensitivity is especially important because invasive species likely exist in low densities at the beginning of an invasion. Currently, eDNA is being used to detect Asian Carp, (Silver carp, Hypophthalmichthys molitrix, and Bighead carp, H. nobilis) in the Chicago Area Waterways (CAWS). Positive eDNA samples have been found in the CAWS, but intense fishing in the area has only found one Bighead and no Silver carp. We aim to better understand the information that this tool provides by examining how DNA of Asian Carps gets into the environment and how quickly it degrades. In a controlled laboratory setting, we first measured how much DNA a single fish sheds and investigated the variability of these measurements using quantitative PCR (qPCR). In a series of manipulative lab experiments, we studied how temperature, biomass, and diet affect the shedding rate of eDNA by these fish. Ultimately this data will inform a probabilistic model that can be used by resource managers as a way to statistically infer the presence of live Asian Carps from positive eDNA hits.

**Knight, Andrew,** *Imperial College London*

**A policy process for identifying and orientating the conservation problem in opportunity assessments**

Over the past decade, conservation planners have emphasised the importance of careful scoping of the conservation problem. However, few studies have presented a systematic process for problem scoping, particularly in the areas of problem identification and problem orientation. Such processes need to be established and implemented alongside conservation opportunity assessments to ensure that important elements of the conservation context are embedded in the assessment, including key stakeholders. This presentation will present an overview of one process for identifying and orienting the conservation opportunity problem, as developed by a team of researchers and practitioners who attended a workshop in Australia on The Development of New Tools and Processes for Assessing Conservation Opportunity (April 23-26 2013). The process links together elements of the Systematic Conservation Planning process with elements of established environmental policy and natural resource management processes. The presentation will conclude with a discussion of the strengths and weaknesses of this process in regards to the translation of conservation priorities into effective conservation actions.

**Knott, Katrina,** *Memphis Zoo;* **Gabriela Mastrmonaco**, *Toronto Zoo;***Joanne Simerson,** *San Diego Zoo;* **Megan Owen**, *San Diego Zoo Global;* **Monica Stoops**, *Cincinnati Zoo and Botanical Gardens;* **Erin Curry,** *Cincinnati Zoo and Botanical Garden;***Terri Roth**, *Cincinnati Zoo and Botanical Garden;* **Beth Roberts,**

*Memphis Zoo;* **Andrew Kouba,** *Memphis Zoo*

**Improving the demographic and genetic management of polar bears through greater understanding of their reproductive physiology**

Poor reproductive success and high neonatal mortality threatens the demographic security and genetic diversity of both ex situ and in situ polar bear populations. Urine and feces were collected from polar bears in North American zoos for reproductive monitoring. Endocrine metabolite concentrations were examined through enzymeimmunoassay, and ceruloplasmin (CP) by its enzymatic activity. Matched urinary-fecal profiles suggest that urinary estrone-glucuronide was elevated during breeding similar to fecal testosterone, and that urinary progestagens (P) increased after breeding at a similar time and magnitude (~2 fold) as the increase of fecal P. Urinary P of both parturient and nonparturient females was also elevated for 50-137 days during late fall. CP activity was elevated during the initial P rise corresponding to presumed implantation in 1 parturient female examined whereas CP activity occurred 34-81 days prior to baseline P in 3 nonparturient females. CP activity also correlated with elevations in estrone-glucuronide and prostaglandin. These data are anticipated to improve understanding of polar bear reproductive physiology and guide management decisions for captive animals thereby helping build a more sustainable population. Greater knowledge of the reproductive physiology of captive animals also provides information on the timing and plasticity of reproductive events in free-ranging polar bears and insight into the causes of reproductive failures in declining populations.

**Knuth, Kate,** *University of Minnesota, Institute on the Environment*

**Educating Graduate Students to be Environmental Leaders and World-Changers: Experiences from the Boreas Leadership Program**

Finding and enacting solutions to conservation challenges requires effective, innovative and well-networked leaders. Graduate education in conservation biology and related fields prepares students in many important skills, but misses some important leadership skills. Furthermore, students have easy access to academic networks but may have some difficulty branching out into wider networks. The Boreas Leadership Program at the University of Minnesota's (UMN) Institute on the Environment (IonE) is an innovative, co-curricular, non-credit education program working to fill some of these gaps in graduate education. By offering leadership training, networking, and skills building experiences Boreas complements more traditional graduate education programs. Skills workshops focus on communications and media, integrative leadership, systems thinking and tools, and mentoring. Networking events bring students into contact with leaders in global business, state government, NGO organizing and more. In its first two years of existence Boreas has trained over 200 graduate and professional students from over ten colleges at the UMN, and the program's breadth and depth of impact continue to grow. This presentation will outline the development of the Boreas Leadership Program, offer lessons learned from two years of experience, and reflect on the need to train the next generation of conservation leaders and how to do so effectively.

**Koizumi, Noriyuki,** *Institute for Rural Engineering, NARO;* **Shinsuke Morioka**, *Japan International Research Center for Agricultural Sciences;***Atsushi Mori,** *Institute for Rural Engineering, NARO;* **Bounsong Vongvichith**, *Living Aquatic Resources Research Center;* **Keiji Watabe**, *Institute for Rural Engineering, NARO;* **Kazuya Nishida,** *Institute for Rural Engineering, NARO;***Takeshi Takemura**, *Institute for Rural Engineering, NARO*

**Investigation of population genetic diversity of common small fish in the Mekong River Basin, Vientiane, Lao PDR, for conserving native fishes**

Although a rich biodiversity still remains in rural areas around Vientiane, Lao PDR, recent installation of living infrastructure and agricultural facilities along with introductions of alien fishes for aquaculture have disturbed the natural habitats for native fishes. We, hence, investigated the population genetic diversity of common small fishes, Esomus metallicus and Parambassis siamensis that such human activities may have damaged. The fish samples were obtained from agricultural canals in the river basins of the Mekong main stem and the tributary Nam Ngum. Estimation of parameters for genetic diversity and genetic cluster for connection among populations were carried out on the samples using microsatellite loci. The average numbers of allele richness and heterozygosity per locus were relatively high for both species, with varying 10.0-12.5 and 0.67-0.85, respectively. Significant departures from the Hardy-Weinberg equilibrium were not detected in the samples. Consequently, serious deteriorations of the genetic diversities do not appear to occur as yet in the investigated areas. The 3 and 2 genetic clusters were detected for E. metallicus and P. siamensis, respectively. Considering proportions of these genetic clusters and their geographical locations, they were mainly characterized as the genetic properties of the river basins. The existence of such clusters may have been formed by the effect of natural isolation by distance rather than artificial disturbance.

**Kolowski, Joseph,** *Smithsonian Conservation Biology Institute;* **Alfonso Alonso**, *Smithsonian Conservation Biology Institute;***Hadrien Vanthomme,** *Smithsonian Conservation Biology Institute;* **Lisa Korte**, *Smithsonian Conservation Biology Institute*

**Distribution of a community of mammals in relation to roads and other human disturbances in a mosaic landscape of central Africa**

Despite the expansion of roads and settlement in Central Africa, we have limited knowledge of how both ecological and anthropogenic factors integrate to determine the distribution of terrestrial mammals. We present the first community-level study of the associations of both roads and other human disturbances with the distribution of mammals in Gabon. We used sign surveys, observation and camera traps along 199 line transects to document mammals in a mosaic landscape that includes an oil concession. Generalized linear mixed-effect models identified associations between ecological and anthropogenic variables and the abundance or presence of 17 species. Some types of roads and other disturbances were negatively associated with elephants, buffalos, gorillas, sitatungas, duikers, and some monkeys. Yet we also found positive associations with road presence (red river hog, some monkeys, duikers), agriculture (sitatunga, small carnivores, large rodents) and industrial activities (sitatunga, red river hog, red duikers, side-striped jackal), stressing the importance of accounting for multiple anthropogenic factors. Hunting, agriculture, and urbanization, all facilitated by roads, were key factors in determining mammal distribution, indicating that land-use planning is critical to conservation of mammal populations. This study highlights that industry partnerships can result in unique opportunities to advance conservation science and the development of impact mitigation solutions.

**Kolozsvary, Mary Beth**, *Siena College*; **Mangun, Jean**, *Siena College*; **Magnun, William,** *East Carolina University*

**Interviewing public and private sector experts to inform an effective, regional approach to vernal pool conservation**

In the northeastern United States, vernal pools are a unique class of small, isolated, ephemeral wetlands that serve an important ecological role providing habitat for specialized invertebrate and amphibian species. Their small size, dynamic nature, and isolation from larger water bodies combine to create challenges to their conservation. Existing legislative protections are not uniform. We examined state-level regulations governing vernal pools across the region. We interviewed a panel of experts from the public and private sector to obtain input for identifying conservation criteria necessary to protect these resources more effectively. Six of the jurisdictions surveyed have legislated policies that directly recognize and provide protection to vernal pools, although the degree of protection varies widely. The remaining eight jurisdictions lack regulations that specifically target vernal pools; however, five of these do have other regulations that limited protection. Key informant interviews were used to develop a metric to evaluate the effectiveness of existing state-level legislation. By incorporating perspectives from various experts, we are able to evaluate the relative effectiveness of policies across regional jurisdictions. Characterization of conservation criteria and benchmarks of legislative effectiveness provide direction for advocates and policymakers moving toward a more effective, cohesive regional approach to regulation and protection of vernal pools.

**Kolte, Prasanna,** *Ashoka Trust for Research in Ecology and the Environment (ATREE);* **Kiran M.C.**, *Ashoka Trust for Research in Ecology and the Environment (ATREE);***Madhura Niphadkar,** *Ashoka Trust for Research in Ecology and the Environment (ATREE);* **Pranita Sambhus**, *Ashoka Trust for Research in Ecology and the Environment (ATREE)*

**Visualizing biodiversity information to achieve multiple conservation goals**

Sound information is a prerequisite for sound decision-making. A good deal of information is generated by diverse research groups in conservation sciences. This information can be made available to the wider research community as well as other stakeholders - local communities, managers and policy makers. An application that can facilitate this process will ideally make a significant impact on the policy making process. Based on this assumption we set out to create a comprehensive spatial database of biodiversity. This is a great opportunity to understand policy making in general, as well as facilitate conservation focused policies. This application called the Karnataka Biodiversity Atlas covers the geo-political region of the state of Karnataka in southern India. The Atlas is based on a webGIS platform using open source but robust, interoperable technologies. The goals are to map the species distribution in Karnataka and provide the user with a set of tools to produce maps of interest. Data is collected from secondary published sources. Various collaborations are formed for data sharing with national and regional institutions to enable data sharing for the Atlas. The Atlas will be an open access platform that can be used by any stakeholder. We envision that the Atlas will encourage conservation action across the State; enable spatially-oriented learning among students and attract policy makers to use it to make conservation decisions.

**Kornbluth, Sarah,** *Rutgers University;* **Kimberly Russell**, *New Jersey Institute of Technology;***Gareth Russell,** *New Jersey Institute of Technology*

**Native bees and large-scale organic farming: Are sufficient pollination services provided?**

Pollination is a critical ecosystem service that maintains biodiversity and ecosystem function. Honeybee deaths and escalating costs of rental in the wake of Colony Collapse Disorder has demonstrated that dependence on domesticated honeybees for agricultural pollination in the future is unrealistic for many farmers. Native bees may be able to provide sufficient pollination services when their populations are encouraged, but data on the spatial distribution habits of native bees is critical to understanding the pollination services that they can provide. Research that quantifies in-field distribution and diversity is limited but is especially important as field size and distance from natural habitat increases. We found cooperative collaborators in organic farmers and chose the largest scale farm (285 acres) to maximize our chance of estimating the distance at which bee penetration might diminish. Using beds as long as 250m of bee-pollinated crops (pepper, tomato, and eggplant) with adjacent natural habitat, we trapped and observed bees to quantify the density and diversity of bee pollinators at intervals within the fields, and we performed hand pollination and pollinator exclusion in mid-field. We found over 30 species of native bee and statistical analysis of distribution corroborates the satisfactory level of pollination services provided. We find that a farm of this scale receives sufficient pollination services from native bees living in adjacent natural habitat.

**Kosaki, Randall,** *NOAA Papahanaumokuakea Marine National Monument;* **Corinne Kane**, *Washington State University*; **Richard Pyle**, *B.P.* *Bishop Museum*; **Daniel Wagmer**, *NOAA Papahanaumokuakea Marine National Monument*

**Mesophotic Coral Reef Fish Assemblages of the Northwestern Hawaiian Islands: Globally Significant Levels of Endemism Threatened By Climate Change**

Mesophotic coral ecosystems, also known as the coral-reef "twilight zone", are receiving increased attention from coral-reef ecologists because of their potential contributions to tropical biodiversity, and their potential to serve as refugia for fishes that are depleted due to anthropogenic activities on shallow reefs. However, the composition and trophic structure of these fish communities are poorly characterized. We present the results of the first transect-based, quantitative assessments of mesophotic reef fish assemblages from the Northwestern Hawaiian Islands (NWHI). These mesophotic assemblages (50-80 m) were found to have the highest levels of endemism recorded from any marine ecosystem, with endemic species comprising >90% of the total assemblage at Midway and Kure Atolls. High endemism was driven by the numerical dominance of endemic planktivorous fishes. This planktivore community is supported by seasonal increases in planktonic productivity from the high-chlorophyll waters of the Transition Zone Chlorophyll Front (TCZF). The TCZF shifts far enough south in the winter that the northern atolls of the NWHI lie within its productive waters. Increases in sea surface temperatures may drive the TZCF slightly north, depriving these planktivore-dominated, high-endemism fish assemblages of this enhanced planktonic primary productivity. Climate change may thus threaten the trophic structure of these ecosystems and their extraordinary levels of endemism.

**Kouba, Andy,** *Memphis Zoo*

**Assisted reproductive technologies**

Captive assurance colonies of endangered amphibians have been established world-wide as potential brood stock for recovery and reintroduction programs; however, reproductive success has been low. In 2006, the Memphis Zoo (MZ) initiated a program to develop amphibian reproductive technologies (ART) for the critically endangered Mississippi gopher frog after natural breeding failed. Our objectives were to: 1) evaluate hormone therapy as a means for collecting gametes from both male and female gopher frogs; 2) develop in vitro fertilization (IVF) methods for the production of tadpoles; and 3) transfer chilled and frozen sperm between institutions as a method for genetic management. Beginning in 2008, following several years of hormone therapy studies, we were able to develop protocols for successfully obtaining gametes for IVF resulting in most females laying ~ 2,000 eggs with an average fertilization rate of 76% and thousands of tadpoles produced. There are now 20 times more captive gopher frogs in captivity than the wild, creating a source population for reintroductions to begin. In addition, we tested our IVF protocols on gopher frogs at various partner institutions using chilled and frozen sperm that had been cryopreserved for genetic management. The transfer of this technology and production of endangered amphibians using chilled, shipped sperm from live animals is a conservation milestone that can be applied to other amphibian captive breeding and reintroduction programs.

**Kretser, Heidi,** *Wildlife Conservation Society*

**Conservation during global conflict: opportunities to curtail wildlife trade through work with the U.S. military**

Political conflict can have devastating effects on the environment. One indirect outcome of military conflict is the significant buying power that military personnel and affiliates possess to influence local markets, including the ability to drive the demand for wildlife products. The Wildlife Conservation Society is working with the Department of Defense’s Legacy Natural Resources Program to develop a comprehensive outreach and education program to curtail military demand for wildlife products. We surveyed military bazaars (n=4) in Kabul, Afghanistan from April to December 2008 to observe which species were available to soldiers in markets. We also surveyed army personnel (n=371) at Fort Drum, New York, USA in June 2008 who had been deployed or stationed overseas including in Afghanistan. In Afghanistan, skins of wild felids and the Eurasian wolf Canis lupus were the most commonly observed wildlife products for sale. At Fort Drum, 40% of the soldiers surveyed had either purchased or seen other members of the military purchase or use wildlife products, yet only 12% had heard of CITES. Current efforts to raise awareness and the consequences of purchasing wildlife trade products target military personnel serving abroad, as well as soldiers preparing for deployment. We use outreach and training materials to convey messages about wildlife trade, reduce demand for wildlife products, and explore the potential for military to proactively combat wildlife trade in the field.

**Kretz, Daniela,** *University of Bayreuth;* **Martin Wegmann**, *University of Würzburg;***Nathalie Pettorelli,** *Zoological Society of London;* **Thomas Rabeil**, *Saharan Conservation Fund (SCF)*

**Oil conflicts in the Sahara: detecting overlaps between oil exploration activity and conservation efforts using Landsat satellite imagery**

The extreme climate of deserts, with high incoming radiation, and water stress is home to some of the world's most specialized species. In this study we focus on one of the last remaining locations of large vertebrate populations such as Addax, the Saharan cheetah, and Dorcas gazelle in the Sahara of Niger, that are threatened as the Sahara has become a newly exposed to anthropogenic activity in the search for oil. We investigate the use of remote sensing, via satellite imagery using texture analyses for the detection of features associated with oil refineries in order to determine where anthropogenic activity takes place. Texture analyses such as variance, maximum and minimum were performed using Landsat data in a test region in Algeria. Results consist of the classification and predict of landscape features (buildings, roads, water, vegetation, fire) in Niger using a RandomForest model. Especially the combination of fire (from the gas flare) with road networks and buildings led to the detection of anthropogenic activity consistent with oil refineries. The existence of oil refineries in protected areas has the potential to lead to increased human-wildlife conflict, and risks the depletion of some of the last remaining populations of large vertebrates and the destruction of resilient ecosystems in the Sahara.

**Kristiansen, Trond,** *Institute of Marine Research*

**Mechanistic insights into the effects of climate change on larval cod**

Understanding the bio-physical mechanisms that shape variability in fisheries recruitment is critical for estimating the effects of climate change on fisheries. In this study, we coupled an Earth System Model (ESM) simulation with a mechanistic individual-based model (IBM) for larval fish to analyze how climate change may impact the growth and survival of larval cod in the North Atlantic. We focused our analysis over 5 regions that span the current geographical range of cod and are known to be important spawning populations. Under the SRES A2 scenario, surface ocean temperatures are projected to increase by > 1oC for three of the five regions and stratification is expected to increase at all sites between 1950-1999 and 2050-2099. Enhanced stratification was projected to lead to decreases in large phytoplankton productivity and mesozooplankton biomass, particularly during the spring and fall. Decreased abundance of mesozooplankton and increased larval metabolic costs associated with warming temperatures were projected to reduce larval size during spring and fall, increasing their exposure to invertebrate predation. Larval survival and weight during the summer showed relatively modest changes at four of the five sites. Projected annual mean survival rates, however, decreased at all five sites. In contrast to past observed responses to climate variability in which warm anomalies led to better recruitment in cold-water stocks, our simulations suggest that reduced prey availability under climate change caused higher temperatures to have a negative impact on larval survival throughout the cod range. In the lower prey environment projected under climate change, the higher metabolic costs due to higher temperatures outweighed the advantages of higher growth potential.

**Kritzer, Jake,** *Environmental Defense Fund*

**Marine reserves revisited: integrating spatial management with harvest control rules in data-limited tropical fisheries**

Marine reserves are effective at conserving habitat, biodiversity, and abundance and population structure of exploited species, and enhancing fisheries through export of larvae and adults. However, despite demonstrated success within marine reserves, considerable challenges remain in managing harvest on fishing grounds. Those challenges are due in part to the severe data limitations facing many fisheries, especially in the developing tropics, and the fact that stock assessment and management paradigms developed in high latitude fisheries are largely inappropriate for reef systems. We outline approaches to overcome these challenges by integrating marine reserves into assessment and harvest control systems for networks of coupled reserves and territorial user rights (TURFs). Density and demographic traits of key species within reserves can be used to set management targets outside reserve boundaries, and to evaluate stock status against those reference points. Furthermore, reserve boundaries can expand outward when resource conditions are poor on fishing grounds, and then contract back to a core zone as conditions improve. Areas within the expansion zone would provide higher catch rates when re-opened, creating incentives to accelerate recovery. Innovative approaches like these can transform marine reserves from being primarily conservation tools with ancillary fisheries benefits, to core components of a management strategy that improve data and enhance outcomes.

**Krosby, Meade,** *University of Washington;* **Robert Norheim**, *University of Washington;***Brad McRae,** *The Nature Conservancy;* **David Theobald**, *National Park Service*

**Riparian Climate Corridors: Prioritizing valley bottoms as natural conduits for climate-driven range shifts**

Climate change is causing large shifts in many species' ranges, as parts of existing ranges become climatically inhospitable and species move into areas that remain suitable (i.e., refugia) or become newly suitable. Maintaining and restoring ecological connectivity has thus been recognized as a critical tool for minimizing the threat of climate change to biodiversity. Riparian areas provide particularly valuable movement pathways for climate-driven range shifts; they naturally span the climatic gradients species ranges are likely to follow as they track shifting areas of climatic suitability, and because they are naturally buffered against warming, they may offer some of the best climate adaptation opportunities in flat landscapes with high levels of human modification. Yet previous approaches to identifying riparian corridors for climate adaptation have been largely subjective and ad hoc. We used a fine-scale map of valley bottoms (i.e., potential riparian areas) across the Pacific Northwest, USA, to identify and prioritize those likely to offer effective movement corridors for climate-driven range shifts. We created a simple index that measures the extent to which valley bottoms span temperature gradients, are buffered against warming, and are unmodified by human activities. Results revealed significant variance in riparian climate-corridor quality across the region, and stressed the importance of incorporating multiple scales of analysis and interpretation.

**Krupnick, Gary,** *National Museum of Natural History;* **Dennis Whigham**, *Smithsonian Environmental Research Center;***Melissa McCormick,** *Smithsonian Environmental Research Center*

**A National Focus on Orchid Conservation and Restoration**

Many species are at risk globally, and species in the Orchidaceae, one of the most species rich families of flowering plants on earth, are no exception. More than half of native orchid species in North America have been listed as threatened or endangered at local, state, regional, or national levels. To respond to the ever increasing threats to native orchids (e.g, habitat alteration, climate change, invasive species, illegal harvesting), organizations need to aggressively pursue approaches that reduce the risks to orchids while providing a mechanism for restoration and conservation. The North American Orchid Conservation Center (NAOCC) was recently established with a goal of conserving the heritage of all native orchid species in the U.S. and Canada. The goals and objectives of NAOCC will be accomplished through a network of collaborators focused on interactive efforts of botanical gardens, researchers and public and private organizations with responsibilities to assure the survival of native orchid species. NAOCC's initial conservation and restoration efforts are focused on ex situ and in situ conservation, research, and education. This presentation will share the experiences of NAOCC.

**LaCivita, Lisa,** *George Mason University*

**Working Landscapes in Virginia**

The mission of the Virginia Working Landscapes is to study and encourage the sustainable use of Virginia's landscapes for native biodiversity through community engagement and scientific research. The effort currently focuses on stemming the decline of native plants, birds, and insects in eastern U.S. grasslands due, in part, to intensive land management and invasive plant species. Participating properties are monitored for bird, plant and pollinator species to provide baseline data and trends on restored landscapes. Landowners are networked with each other for the dissemination of information and with state and federal agencies that can provide specific technical and financial assistance. Demonstration sites have been established that showcase best practices and opportunities are provided for landowners to visit and tour working farms that serve a dual purpose in agricultural production and biodiversity. Lead by the Smithsonian Conservation Biology Institute an extensive network of groups are partnering, to advance the science of land management and develop best practices relevant both to working farmers and conservationists.

**Lacoeuilhe, Aurélie,** *National Museum of Natural History;* **Nathalie Machon**, *National Museum of Natural History;***Jean-François Julien,** *National Museum of Natural History;* **Agathe Le Bocq**, *EDF R&D;* **Christian Kerbiriou**, *National Museum of Natural History*

**Responses of bat species to artificial light in a semi-natural context**

Artificial light is suspected of having substantial effects on the ecology of species by, for example, producing discontinuity in nocturnal animal territories. Here, we studied its potential effect on bats at the community scale in a semi-natural context. We assessed bat activity with an acoustic survey among a gradient of light intensities, taking into account weather and environmental conditions and spatial correlation structure. With a trait approach, we showed that some specialist species were disadvantaged by lighting conditions whereas others, more generalist, could benefit from disturbed habitats like lit areas. Indeed, we established three groups of species: one group positively influenced by light that could benefit from disturbed habitats and two groups negatively influenced by light, including rare and threatened species in Europe, such as an aerial hawking bat group and a gleaning bat group. Thus, our results suggest a biotic homogenization process towards more generalist species, occurring along gradients of human activities. For an applied perspective, recommendations for light management, protection of hedgerows and creation of nocturnal networks are proposed. These strategies should be taken into account for efficient bat conservation plans.

**Lacy, Robert,** *Chicago Zoological Society;* **Philip Miller**, *IUCN SSC Conservation Breeding Specialist Group;***Philip Nyhus,** *Colby College;* **John Pollak**, *Cornell University;* **Becky Raboy**, *University of Toronto;* **Sara Zeigler,** *Virginia Tech*

**Metamodels: Connecting models and people for inclusive, integrated, transdisciplinary analysis of populations facing multiple threats**

Population viability models have facilitated important advancements in species conservation planning, but existing species risk assessment approaches have been criticized for their narrow disciplinary perspective and limited success in assessing coupled biological--human complexity. We describe a novel metamodel approach to species risk assessment for systems in which diverse threats are addressed through different disciplines, act at different spatiotemporal scales, or interact in non-linear ways. A metamodel links multiple, discrete models that depict components of a complex system, by governing the flow of information among models and the sequence of events in a simulation analysis. Each discrete model simulates processes specific to its disciplinary realm while being informed of changes in other parts of the metamodel by accessing common descriptors of the system, populations, and individuals. Interactions among models are revealed as emergent properties of the system. We introduce a metamodeling platform to implement this approach and illustrate how it can reveal complex processes that link population dynamics to external forces such as other species, infectious disease, landscape change, and climate. The metamodel approach can be used to integrate the expertise of diverse disciplines to address conservation problems that require understanding and action at the levels of populations, habitats, ecological communities, ecosystem processes, and human activities.

**Lahoz-Monfort, José,** *University of Melbourne;* **Gurutzeta Guillera-Arroita**, *University of Melbourne;***Brendan Wintle,** *University of Melbourne*

**Imperfect detection of species in biological surveys reduces the accuracy of species distribution models: when and how much does it matter?**

Although it is known that imperfect detection affects species distribution models (SDM), the implications of ignoring this issue have not been fully assessed and recognized. Here we compare two widely used SDM methods, GLM and Maxent (based on 'presence-absence' and 'presence-only' data respectively), to an approach that explicitly accounts for imperfect detection (based on repeat detection-non detection data). We assess their performance using simulations under different imperfect detection scenarios with varying degrees of correlation between detectability and the environmental variables that influence occupancy. We show that imperfect detection can seriously impact the conclusions drawn from SDMs, and how this impact depends on the correlation between occupancy and detection. Although imperfect detection has traditionally been overlooked in SDMs, our results highlight the need for more careful consideration of detection when interpreting and using SDMs. The rapid increase in the application of SDMs in wildlife management, conservation planning and ecological studies of species-habitat relationships calls for rigorous approaches to their development and interpretation.

**Lance, Richard,** *U.S. Army Corps of Engineers*

**Detecting terrestrial animal eDNA in aquatic samples from desert watering sites**

On arid lands, limited water resources attract a large diversity of wildlife from large geographic areas. Wildlife that live in these restricted habitats, or that merely visit these resources or surrounding catchments for drinking or hunting, will deposit DNA that may eventually enter the aquatic milieu. We are exploring the potential for aquatic eDNA samples to be used as a tool for identifying the suite of terrestrial mammals (including bats) that live near or visit these resources, and for detecting rare or elusive species. In September 2012, eDNA samples were collected from 13 locations in the low desert and mountain canyons of southern Arizona. More than 60 multiplex primer sets aimed at amplifying mitochondrial targets within Microchiroptera, Carnivora, and Soricidae were designed using existing whole mitochondrial genomes in NCBI GenBank. After trials to identify those primer sets that provide the most reliable amplification of target species, the select subset of primer sets will be used to create, for each sample location, an enriched, pooled template for amplicon resequencing on a high-throughput next-generation sequencer. The single-molecule sensitivity of such sequencers and massive sequence output may allow us to detect species that have deposited very little eDNA in a system. Ultimately, the described approach, or variations thereof, may provide unprecedented power for detecting rare or elusive species in areas with limited freshwater resources.

**Lang, Judith,** *Atlantic and Gulf Rapid Reef Assessment;* **Patricia Kramer**, *Perigee Environmental Inc.;***Kenneth Marks,** *Atlantic and Gulf Rapid Reef Assessment;;* **Krista Sherman**, *Bahamas National Trust;* **Craig Dahlgren**, *Perry Institute for Marine Science;* **Andrew Bruckner,** *Living Oceans Foundation;***Eleanor Phillips**, *The Nature Conservancy;* **Philip Kramer,** *The Nature Conservancy;* **Lester Gittens,** *Bahamas Department of Marine Resources*

**Habitat-specific reef condition and threats report cards for marine management and conservation in The Bahamas: a case study using the AGRRA protocols**

The Bahamas, with its thousands of patch reefs, dozens of fringing reefs, and a few bank barrier and atoll-like bank reefs, may possess some of the wider Caribbean’s least threatened corals. Representative reef monitoring is a formidable challenge as the archipelago’s widespread sub-regions also vary greatly in human population size, extent of coastal development, tourism, industry and shipping, and degree of resource protection. The AGRRA protocols are designed to assess key structural and functional attributes of western Atlantic reefs and give fisheries-independent estimates of fishing intensity. Spatial and temporal baselines can be derived from its database of 1,865 Caribbean-area surveys collected in a variety of reef types since 1997. AGRRA surveys were conducted on a total of 96 fore reefs, 25 patch reefs and 15 reef crests around Andros/South Berry Islands, Cay Sal Bank, Great and Little Inagua, Hogsty Reef and New Providence/Rose Island over a 13-month period in 2011-2012. Collaborative pooling of the benthos, coral and fish datasets in ecological report-card formats will allow us to compare reef condition and attendant threats in these habitats and sub-regions. Scientists and local marine managers are working together to select indicators useful for management and choose appropriate grading criteria. The results can be merged with fisheries and socioeconomic data to propose adaptive conservation and sustainable development policies for the Bahamas.

**Lange, Glenn-Marie,** *World Bank (WAVES)*

**How are the expanded national accounts being used by Botswana, Guatemala and other nations to foster sound decision-making and investment?**

“How we measure development will drive how we do development.” This is the idea behind the World Bank initiated partnership to promote Natural Capital Accounting, called Wealth Accounting and Valuation of Ecosystem Accounting, or WAVES. The critical role of natural capital in human well-being, especially in poor communities in developing countries, is widely recognized, but ecosystems continue to deteriorate, often in the pursuit of short-term economic growth. Unless the economic value of ecosystem services is recognized, their contribution to sustainable economic welfare will be seriously underestimated, resulting in under-investment in sustainable management and ultimately lower incomes. Extending the National Accounts for natural capital provides information to demonstrate the influence of natural capital on the major indicators of macroeconomic performance, such as GDP, employment and the balance of payments, and what can potentially be lost under mismanagement. Hence, Natural Capital Accounting can be particularly effective for engaging agencies responsible for economy-wide management. Recent international agreement on the UN’s System of Environmental and Economic Accounting provides credible methodology, although much work remains to be done.

The presentation will highlight progress in WAVES partner countries to extend natural capital accounting for ecosystems, and policy advances possible with natural capital accounting.

**Langhammer, Penny,** *Arizona State University;* **Karen Lips**, *University of Maryland;***James Collins,** *Arizona State University;* **Patricia Burrowes**, *University of Puerto Rico*

**Population-level impacts of endemic disease on direct-developing frogs in the Caribbean**

The Caribbean is a hotspot of amphibian decline, with ~75% of species threatened with extinction. The infectious disease chytridiomycosis, caused by a fungal pathogen of the skin, is implicated in the decline of amphibians worldwide, including the loss of three frog species on Puerto Rico. Extinction from infectious disease can occur if disease-induced mortality is significant and pathogen transmission is maintained despite low host densities. We combined lab experiments with modeling to study the impacts of chytridiomycosis on a direct-developing frog species from Puerto Rico. In a series of lab experiments, we tested the susceptibility of juvenile and adult Eleutherodactylus coqui frogs to the fungus. We also measured the rate of pathogen transmission and tested whether both direct (frog-to-frog) and indirect (environment-to-frog) transmission occur, a first attempt to study chytrid transmission in direct developers. Juvenile frogs had much lower survival than control froglets or adults when exposed to the pathogen; in contrast, most adults cleared infection rapidly. Pathogen transmission was low, but terrestrial frogs can become infected with this aquatic pathogen via zoospores on damp vegetation. We parameterized a stage-structured mathematical model to analyze population-level outcomes of disease. In areas with endemic disease like the Caribbean, frog populations can decline even if adults are resistant or tolerant through reduced survival and recruitment of juveniles.

**Lapointe, Nicolas,** *Carleton University;* **Steven Cooke**, *Carleton University;***Jack Imhof,** *Trout Unlimited Canada;* **Daniel Boisclair**, *University of Montreal;* **John Casselman**, *Queen?s University;* **Allen Curry,** *University of New Brunswick;***Otto Langer**, *British Columbia Marine Conservation Caucus;* **Robert McLaughlin,** *University of Guelph;* **Charles Minns,** *University of Toronto;* **John Post,** *University of Calgary;* **Michael Power***, University of Waterloo;* **Joseph Rasmussen,** *University of Lethbridge;* **John Reynolds,** *Simon Fraser University;* **John Richardson,** *University of British Columbia;* **William Tonn, University of Alberta**

**Principles for ensuring healthy and productive freshwater ecosystems that support sustainable fisheries**

Freshwater ecosystems and the fisheries they support are increasingly threatened by human activities. To aid those seeking to manage and protect fisheries of inland ecosystems, we outline nine key principles of healthy and functioning ecosystems based on the best available science using Canada as a case study. The principles are: laws of physics and chemistry apply to ecology; population dynamics are regulated by reproduction, mortality, and growth; the importance of habitat quality and quantity; habitats must remain connected; species and their habitats are subject to ecosystem-scale effects; biodiversity enhances ecosystem resiliency and productivity; global processes affect local populations; anthropogenic stressors can have cumulative effects; evolutionary processes must be protected. Additionally, we provide general recommendations for managing and protecting freshwater ecosystems and the fisheries they support providing examples of successful implementation for each management principle. Examples of management recommendations include: engage stakeholders, adopt a precautionary approach, embrace adaptive management, and implement ecosystem-based management. Ecosystems are complex with many components that are spatiotemporally intertwined. Ignoring linkages and processes significantly reduces the probability of successful management efforts. The principles of ecosystem structures and functions must be considered when developing policy and identifying management options.

**Laramie, Matt,** *USGS - Boise, ID*

**Integrating a molecular approach at the landscape-level: Determining distribution of Chinook salmon in Upper-Columbia River watersheds**

ESA-listed, stream-type Chinook salmon (Oncorhynchus tshawytscha) have declined dramatically in the Upper-Columbia River basin. Significant resources and effort are invested annually to restore degraded Chinook habitat and reestablish depressed or exhausted populations. Monitoring and evaluating the effectiveness of such efforts is a critical step in the conservation and management of declining populations or species at risk of extinction. Due to the timing of stream-type Chinook spawning runs (during peak runoff), the effectiveness of traditional aquatic sampling methods (i.e. electrofishing, snorkeling, weir traps) is greatly reduced. Additionally, electrofishing and trapping of a threatened or endangered species can lead to undesired harm or mortalities. The hands-off approach of environmental DNA (eDNA) sampling offers a method for determining the presence of Chinook in streams, sight-unseen, even during periods of high stream flow. Preliminary results from landscape-level sampling (n=294) of mainstem rivers and headwater streams throughout the Methow and Okanogan Sub-basins of Washington and British Columbia demonstrate the effectiveness of eDNA sampling for Chinook salmon. This project benefits managers planning to reintroduce Chinook to the Okanogan Sub-basin by providing a baseline survey of Chinook presence and a comparison of eDNA methods with electrofishing and snorkeling to better understand how this molecular approach could be integrated into management programs.

**Larsen, Trond,** *Conservation International*

**Conserving biodiversity and ecosystem services through CI's Rapid Assessment Program (RAP+) in Suriname**

Almost entirely forested, Suriname is the greenest country in the world. However, looming plans for new mining concessions, roads, and hydropower projects could threaten its exceptional biodiversity and disrupt indigenous livelihoods. Consequently, Suriname represents a rare opportunity for carefully planned sustainable development before major changes have occurred. However, conservation planning in the rugged interior of the country is hampered by a lack of biological and socioeconomic data. Conservation International's Rapid Assessment Program (RAP+) has conducted a series of expeditions to integrate our understanding of vital linkages between biodiversity, healthy ecosystems, and human societies. By quantifying and mapping ecosystem services, such as wild food sources, we are helping to empower local indigenous communities to protect their natural resources. We are also training students and conservationists from local communities. We have documented thousands of species, including dozens of species new to science. Surprisingly, we found that even supposedly pristine rivers contain harmful levels of mercury, despite their remoteness and complete lack of upstream gold-mining. Working closely with a wide variety of stakeholders, we are now using our data to identify conservation priorities and to guide the creation of new conservation areas. This approach could provide a flexible, cost-effective tool to protect natural capital in other countries around the world.

**Lasch, Cristina,** *The Nature Conservancy*

**Measuring conservation progress in the Gulf of California and Mexico's Northern Pacific Region**

A conservation practitioner with more than 20 years experience, Lasch works worldwide to link conservation practitioners with knowledge and tools needed for adaptive project management. Drawing on her work in Mexico, Lasch will describe how The Nature Conservancy and other environmental organizations integrate new and emerging scholarship into conservation practice. She will present the Open Standards for the Practice of Conservation, which provide a project design and assessment framework for the Baja Marine Initiative. This initiative is a multi-objective, multi-million investment in coastal and marine ecosystem-based management in Gulf of California region of northwest Mexico. In the next ten years, a wide array of public and private sector partners will apply a variety of conservation and fisheries management tools to protect biodiversity, fish habitat, and to enhance fisheries productivity. Determining whether or not these strategies are working is crucial, not only for accountability purposes, but also because it will enable the team to learn from their efforts, to adjust future actions, and track progress towards the outcomes they are ultimately striving for. Lasch will conclude with a discussion of how the conservation science community can more effectively engage in the design, implementation and assessment of conservation interventions in the future.

**Lauber, Bruce,** *Cornell University;* **Nancy Connelly**, *Cornell University;***Richard Stedman,** *Cornell University;* **Richard Ready**, *Pennsylvania State University;* **Gregory Poe**, *Cornell University;* **Selmin Creamer,** *Ithaca College*

**Aquatic Invasive Species in the Great Lakes and Mississippi River Systems: Economics, Human Behavior, and Ecology**

Policy decisions about how to control aquatic invasive species are driven in part by economics. We conducted a study of how aquatic invasive species movement between the Mississippi River system and the Great Lakes could affect the economic value of recreational fishing; this study has implications for the management of aquatic pathways between the two systems. Our work was informed by an understanding of economics, human behavior, and ecology. We conducted a mail and internet survey of 7,201 recreational anglers in a 12-state region encompassing the U.S. portion of the Great Lakes and Upper Mississippi and Ohio River basins. This survey collected detailed information about fishing trips taken in 2011 and about how anglers would respond to hypothetical decreases in recreational fish species. An economic model was developed to estimate the current and future value of the fishery. Our results show that anglers would respond to decreases in fish stocks brought about by invasive species in a variety of ways, depending on their preferences and other characteristics. These angler responses are closely related to changes in the net value of the fishery, and, therefore, have policy implications. Our work demonstrates how integrating an understanding of economics, human behavior, and ecology can contribute to conservation, and how that integration can be improved in the future.

**Law, Elizabeth,** *Environmental Decisions Group, University of Queensland;* **Brett Bryan**, *CSIRO Ecosystem Sciences;***Erik Meijaard,** *People and Nature Consulting International;* **Matt Struebig**, *DICE, University of Canterbury;* **Thilak Mallawaarachchi**, *Risk and Sustainable Management Group;* **Kerrie Wilson,** *Environmental Decisions Group, University of Queensland*

**Trading carbon, biodiversity, and livelihoods: an ecosystems service analysis in Central Kalimantan, Indonesia**

The challenges of landscape planning for multiple objectives are particularly pertinent in the context of REDD+. Demonstration sites will ideally show effective carbon mitigation, while being beneficial for (or at least not negatively impacting) social and economic development, and biodiversity conservation. This study aims to provide decision support tools for land use planning in our case study region: a high priority REDD+ demonstration area in Central Kalimantan, Indonesia. We map the value of ecosystem services (agriculture, forestry, carbon, and biodiversity) across the study region. We define how different land use options affect each ecosystem service, and then apply multi-objective optimisation to evaluate the appropriateness of stated planning targets, and the development strategies that may be applied to achieve them. For this study region, we demonstrate that failure to include both above and below ground carbon flux in carbon accounting will fundamentally shift the location of activities aimed at carbon mitigation, and strongly reduce the likelihood of reaching stated carbon mitigation targets. We show the potential value of balancing land sharing and land sparing policies for achieving both targets and equitable impacts across districts. This study provides a framework for analyses of multiple targets in multi-criteria land use planning, and provides a novel approach to identification of planning strategies when faced with competing actions.

**Lawrence, Niel,** *Natural Resources Defense Council*

**Environmental Impact Assessment and Public Lands Stewardship -- -- Biodiversity in Federal Lands and Federal Actions -- NEPA/NFMA/FLPM**

Input by scientists and citizens alike into habitat conservation and climate response on US federal lands is more affected by three statutes than any others: The National Forest Management Act; the Federal Land Policy and Management Act; and the National Environmental Policy Act. Each sets standards for agencies to disclose and solicit comments on proposals affecting, among other things, biodiversity. The NFMA and its regulations uniquely in federal law include a biodiversity mandate. FLPMA contains multiple protections for the habitat of even non-imperiled taxa. And NEPA, as implemented, creates accountability for the scientific integrity of decisions affecting the environment, and requires reasoned responses to outside scientific opinion. The effectiveness of these laws in safeguarding U.S. biodiversity and promoting climate change preparedness, though very substantial, has been constrained by several factors. Under NFMA and FLPMA, agency officials can with impunity intentionally authorize irreversible loss of biodiversity. CEQ’s NEPA guidance on commitments to mitigate environmental impacts does not guarantee mitigation. And the rules of administrative law make most agency decisions, including climate-related ones, extremely difficult to challenge in court, when non-judicial efforts fail. Strategies exist, however, for ameliorating these shortcomings, particularly if concerted and coordinated advocacy is mounted from across affected scientific disciplines.

**Lawson, Dawn,** *SPAWAR SSC Pacific;* **C. Wolf**, *Naval Weapons Station Seal Beach, Detachment Fallbrook;***Andrew Dyer,** *Dept. of Biology and Geology*

**Application of a field ecological study to optimize adaptive management for invasive plant eradication.**

A population of barbed goatgrass (Aegilops triuncialis), an annual grass native to the Mediterranean, was discovered in southern California in 2006, over 250 km from the nearest known population, and targeted for eradication. This species forms dense monocultures and is difficult to manage because unlike most non-native annual grasses in California's annual grasslands it has dormant seed and can reestablish from the seed bank. Seed longevity in the field is unknown. Initial spot herbicide treatments were meant to minimize pesticide use while providing for eradication. Although plant density was greatly reduced, detectability declined and after initial population reductions the population rebounded. In 2011, an adaptive management program was designed to eradicate this population while minimizing long-term costs and herbicide use. We addressed the key data gap of seed longevity with a buried seed study running parallel to herbicide applications and focused surveys for any undetected plants nearby. We present our adaptive management program, data on population change under spot treatments, and preliminary results from our buried seed study. For seed collected in both 2011 and 2012, our population had lower dormancy than the Northern California populations. We found lower seed viability than expected (68% to 79%). We found seed longevity declined with depth of burial. Herbicide treatments will continue until seed bank has been exhausted.

**Layzer, Judith,** *MIT*

**Enabling Change: The Politics of Ecosystem-Based Management**

According to its proponents, ecosystem-based management (EBM) should yield plans that are rooted in integrative scientific assessments, protective of ecological elements and processes, and capable of adjusting to new information over time. But skeptics worry that EBM will not deliver on its promise and instead will draw scarce resources away from the tools—such as lawsuits, administrative appeals, and public relations campaigns—on which environmentalists historically have relied. This project systematically compares EBM with more conventional approaches to protecting large-scale ecosystems, seeking to isolate the political influences that contribute to more or less environmentally protective outcomes. I conclude that, although EBM generates important environmental benefits, its results often fall short of expectations. This is partly because, in order to achieve consensus, planners agree to pursue environmental and economic goals simultaneously. To this end, they reframe problems in ways that enable them to avoid policies that would impose short-run costs on development interests; they also adopt technology- and management-intensive solutions that impose substantial risk on the environment. Because the resulting plans are environmentally risk-tolerant and provide inadequate funding for monitoring and data analysis, a rhetorical commitment to adaptive management is unlikely to translate into genuine learning from experience.

**Learmonth, Gerry,** *UVA*

**The Bay Game**

**Lee, Elizabeth,** *The University of Alabama;* **Ryan Earley**, *The University of Alabama*

**Hormonal changes in a hermaphroditic fish exposed to ethinyl estradiol**

A diversity of aquatic organisms inhabit mangrove habitats, which are becoming imperiled due to anthropogenic influences. Many mangroves are exposed to wastewater treatment plant effluents, potentially subjecting organisms to endocrine disrupting compounds (EDCs) such as ethinyl estradiol (EE2). The mangrove rivulus (Kryptolebias marmoratus) thrives in mangroves and is an excellent model organism in which to assess anthropogenic effects at the organismal level. Populations consist of self-fertilizing hermaphrodites with males being quite rare. Studies have shown male fish exposed to EDCs in freshwater habitats show a steep drop in sex hormones. We hypothesized that individuals exposed to EE2 would exhibit changes in estradiol (E2) and 11-ketotestosterone (KT; a fish androgen). We used 20 individuals (10 hermaphrodite, 10 male) from an isogenic lineage, SSH (Melbourne Beach, FL). They were kept in 500 ml glass jars with 25 ppt salt water for 30 d. Each day the water was changed and half received a dose of 4 ng/L EE2 and the other half received vehicle. At 30 d we collected waterborne hormone samples and excised gonads for histological analyses. Exposed males showed a decrease in KT while exposed hermaphrodites exhibited no change. Both sexes showed a drop in E2 when exposed. Our findings provide insights into how EDCs might disrupt reproduction in fishes and raise questions concerning the extent of exposure and the mechanisms driving EDC accumulation in mangrove ecosystems.

**Lee, Janice Ser Huay,** *ETH Zurich*

**Understanding the sustainability and tradeoffs associated with smallholder oil palm expansion in Indonesia**

Oil palm expansion in Indonesia has received global attention over the last few decades as a result of its impact on the environment and human livelihoods. Large-scale industrial expansion of oil palm has driven most of the landscape and societal changes of this agricultural system but the proportion of smallholder farmers is rising rapidly in Indonesia. Here, I present recent work on smallholder oil palm production systems, their compliance with sustainability standards, and compare their environmental impact with other sectors of the industry, namely private enterprises and state-owned plantations. To understand future environmental and socioeconomic trade-offs associated with smallholder oil palm expansion, I conducted a spatially explicit scenario analysis of different pathways of smallholder oil palm expansion in Indonesia and discuss the various conservation and development implications of each scenario.

**Lee, Tien,** *Earth Institute, Columbia University;* **Ezra Markowitz**, *Princeton University;***Peter Howe,** *Yale University;* **Chia-Ying Ko**, *Yale University;* **Anthony Leiserowitz**, *Yale University*

**Global disparity in the predictors of public climate change awareness and risk perceptions**

Climate change is one of the greatest threats facing humanity. Opinion polls suggest that levels of public awareness and risk perception vary worldwide, yet little is known on the underlying correlative structure of climate change perceptions. Here, using a global dataset, we explore the influence of socio-demographic, beliefs, and opinions in predicting public climate change perceptions. Globally, we find strong geographic trends and that education level and cause of global warming are key in classifying an individual's level of awareness and concern, respectively. However, modeling nations separately, we uncover complex interactions and global disparities in their correlative structures. Specifically, education is the strongest predictor of awareness outside of Europe, North America and Australia. Perceived cause of global warming is most critical when predicting threat perception in only Europe and Latin America whereas local temperature change perception is most vital in African and Asian countries. Analyzing the multi-dimensional structure of predictors of threat perception, we show that nations hardly cluster according to their geographic region and their dissimilarities are only weakly explained by national economic and ecological indicators. Overall, our results suggests that national, and international discourses must consider the correlates of public climate change perceptions if we want to build global consensus and collectively respond to this global issue.

**Lefroy, Ted,** *The University of Tasmania*

**An empirical framework for retrospective evaluation of environmental programs and its implications for conservation opportunity assessments**

Monitoring of environmental programs is much advocated but rarely practised over sufficiently long time frames to provide data to improve future design. An alternative explored in this paper is retrospective evaluation. A series of retrospective evaluations of environmental programs targeting water quality and vegetation extent and condition suggested that a mixture of quantitative and qualitative methods applied at three different scales can be used to measure change in environmental condition and infer cause, providing assessment of the effectiveness of interventions. Landscape scale analysis using air photos is a readily available method of establishing change in vegetation extent, while space-for-time substitution was found to be an effective way to establish relationships between land use and water quality in the absence of longitudinal data. Property scale analysis through workshops with land owners and local experts was found to be a rapid way of attributing observed change between natural and human influence that can be subsequently tested through landholder surveys and interviews. Site scale modelling using Bayesian Belief Networks or State-and-Transition models that combine empirical data, landholder experience and expert opinion provide approaches to defining current and feasible future states of target ecosystems and a means of participatory goal setting in relation private land conservation. We conclude by discussing the implications of these results for conservation opportunity assessment.

**Leidner, Allison,** *NASA Earth Science Division/Universities Space Research Association;* **Woody Turner**, *NASA Earth Science Division*

**Contributions of the NASA Biodiversity and Ecological Forecasting Programs to Conservation Biology**

For over four decades, NASA has used the vantage point of space to observe Earth. The NASA Earth Science Division includes a Biodiversity program, a basic research program using satellite and airborne remote sensing technology to detect and understand patterns of biodiversity and characterize how they are changing through time. This program is complemented by the division's Ecological Forecasting program, an applications program that promotes the use of NASA observations, models, and scientific results for societal benefit by transitioning tools and applications to use by conservation partners. Conservation biology is a key focus for both the Biodiversity and Ecological Forecasting programs. Here, we describe these two programs, outline their aims, and review the solicitation and selection processes that support research and applications projects relevant to conservation biology. Additionally, we highlight recently-launched and soon-to-be launched NASA satellite missions that will contribute to the next generation of observations that advance conservation science and practice. We will also provide examples of how funded research contributes to the conservation community. Finally, we identify resources for obtaining NASA datasets, which are all freely available, as well as NASA visualizations, which are showcased via the NASA hyperwall in the ICCB exhibit area.

**Lemieux, Andrew,** *Netherlands Institute Crime & Law*

**The WILD LEO Project: Using Technology to Combat Poaching in Uganda'**

The WILD LEO Project is an attempt to provide anti-poaching teams with the technology and training necessary to undertake advanced intelligence gathering and analysis. The Wildlife Intelligence and Leadership Development (WILD) training protocols were specifically developed for Law Enforcement Officers (LEOs) in Queen Elizabeth Protected Area, Uganda. The WILD LEO team consists of foot patrol rangers, crime analysts, prosecutors and commanders. Using digital cameras with integrated GPS units, the foot patrol rangers are creating a spatially referenced, photographic database of poaching activity. The crime analysts use these photos to prepare patrol coverage maps and maps of illegal activity to help commanders make informed deployment decisions. The georeferenced photos are also used by the prosecution team as courtroom evidence to prove poachers were operating inside the protected area. By design, The WILD LEO Project utilizes low-cost technology and open source software to ensure sustainability in law enforcement operations with limited budgets. This presentation will discuss the project’s implementation, initial findings and potential for expansion within and beyond Uganda.

**Lenda, Magdalena,** *Institute of Nature Conservation, Polish Academy of Sciences;* **Piotr Skorka**, *Institute of Zoology, Poznan University of Life Sciences;***Dawid Moroń,** *Institute of Systematics and Evolution of Animals, Polish Academy of Sciences;* **Michal Woyciechowski**, *Institute of Environmental Sciences, Jagiellonian University*

**Fragmentation or invasion - which is a bigger threat to biodiversity?**

Habitat fragmentation and invasion of alien species are among the largest threats to biodiversity worldwide. Habitat fragmentation and invasions may be spatially autocorrelated but the relative effects of both phenomena on native biodiversity and ecosystems services are unknown. The aim of this study was to assess the relative effects of habitat fragmentation (habitat patch size and its isolation) and invasion (presence of invasive plant Solidago spp.) on species richness of native plants and pollinators (wild bees, hoverflies, butterflies) inhabiting fallow lands in the agricultural landscape of Poland. Using GIS we chose habitat patches that ranged in size between 0.5 ha and 4 ha and isolation between 25 m and 300 m. The habitat patches were divided into two categories: invaded and non-invaded by alien plant. We found that in smaller, more isolated habitat patches invasion of alien species was rare in comparison with larger and less distanced habitat patches. Likewise, plant and pollinator species richness was larger in more distanced non-invaded habitat patches than in invaded patches which were not isolated from each other. Our results clearly show that when the habitat fragmentation and invasion of alien species co-occur in one area the latter has much stronger negative effect on biodiversity and ecosystem services. Thus, in some circumstances the habitat patch isolation may prevent spread of invasive alien species.

**Lentini, Pia,** *University of Melbourne*

**The impact of data quality and surrogate species on conservation decisions for a regional corridor network**

Australian stock routes form a vast network of corridors, containing some of the best examples of threatened woodland communities. Despite their conservation value, some of these remnants may now be sold. Given both the ready availability of wildlife atlas data, and the growing use of presence-only methods for species distribution modelling, we hoped to determine whether use of atlas data alone could effectively identify which stock routes should be prioritised for protection. We constructed two sets of habitat maps for 30 species (ten birds, ten microbats, and ten bees) for a 15000km2 region. The first set of habitat maps was based on generalised linear models of data collected during targeted surveys. The second set was generated using presence-only wildlife atlas data in MaxEnt. We then used Zonation to see which portions of the landscape, and which routes specifically, should receive priority for protection for each taxonomic group. There was often direct conflict between habitat maps generated based on survey vs atlas data for individual species, and there was also little congruence in priority areas identified for the different taxonomic groups. Consideration of survey and atlas habitat maps together greatly improved the generality of priority areas for all groups. We demonstrate that even small investments for additional surveys in less-visited areas, and consideration of less-conspicuous groups, can improve the adequacy of conservation planning for a range of taxa.

**Lepczyk, Christopher A. ,** *University of Hawaii at Manoa*

Green spaces offer critical habitat to many species of plants and animals, provide locations for people to experience nature, and provide a number of important ecosystem services. This closing presentation synthesizes the talks of the symposium and discusses the overall value of these important habitats, both socially and ecologically for conservation.

**Lerman, Susannah,** *USDA Forest Service*

**Sustainability begins at home: Backyard habitats for birds and people**

Urban sustainability research seeks to improve the livability of our cities through the exploration of the flows and fluxes of materials in urban ecosystems. Several fluxes and flows occur in private yards; thus yards provide an opportunity for households to put into practice the reality that ‘sustainability begins at home’. Individual household-level stewardship decisions might scale up and improve city-level and even regional sustainability. When backyard stewardship closely mimics the wildlands, these ‘sustainable yards’ have the potential to alleviate the impacts of habitat loss on urban bird diversity. Identifying ways to strengthen stewardship participation becomes necessary for effective bird conservation efforts. Guidelines exist for designs and management of sustainable yards, and a growing body of research documents how birds and other wildlife respond to backyard habitats. However, neither has yet spurred a national movement, nor do we fully understand household attitudes towards urban wildlife and preferences for sustainable yards. We highlight strategies for communicating the importance of urban wildlife, identify new conservation partners for large-scale management of private property, suggest iterative steps urban stewards can practice for immediate positive results, and emphasize the importance of scientific engagement with the public. Yards that support biodiversity have an important role to play in our efforts to improve the sustainability of our cities.

**Leslie, Heather,** *Brown University*

**The Many Paths to Ecosystem-Based Management**

Leslie will provide closing remarks for the symposium, highlighting the connections among the themes addressed by the earlier speakers. To help guide the discussion to follow, Leslie, an ecologist and conservation scientist with substantial experience in interdisciplinary investigations of conservation and management, will introduce a framework for human-environment scholarship that researchers and practitioners alike may use to develop more effective collaborations and navigate the diverse approaches are used to investigate the processes and impacts of ecosystem-based approaches.

**Levengood, Jeffrey,** *University of Illinois*

**Role of Ecotoxicology in ecosystem health**

Ecotoxicology is the science that studies exposure, fate and adverse effects of chemical pollutants on populations, communities and ecosystems. This discipline goes beyond measuring chemical concentrations in the environment and conduct of standardized toxicity tests. A more holistic view of the fate and effects of contaminants is essential. Interrelationships among pollutants, soil and water properties, atmospheric conditions, habitat quality, food availability, infectious diseases, predator prey relationships, and other complexities of life in both natural and human-dominated ecosystems are required to evaluate sustainability of ecosystem health and services. The technologies and processes that have brought us advances in health care, abundant and nutritious food, modern transportation, communication, entertainment, and comfort have also affected our environment. Chemical hazard and risk are regulated to some degree by governmental regulations and international treaties. Although such controls have afforded some protection, pollutants continue to impact biodiversity and ecosystem functioning. Often, ecological problems associated with contaminants have been of such scale that they have threatened long-term survival of sensitive species. In this presentation, we focus on the complexity of assessing the effects of toxicants, including their indirect effects and interactions in concert with the multiple anthropogenic stressors of today’s world.

**Levenson, Jacob,** *Conserve.IO;* **Pernell Francis**, *Caribbean Association of Whale Watch Operators*

**Leveraging Mobile Technology-Informing Resource Management: Connecting Stakeholders to fill data gaps, A Tourism Associations Unique Partnerships**

Scientists, resource managers, and conservationists face an ever-present challenge of collecting data of sufficient rigor that it can be used to inform management with confidence. Enabling electronic data collection using a new tool known as WhaleSpotter, data collection using opportunistic platforms becomes much easier. Caribbean Regional Association of Whale and Dolphin Watching Operators has implemented a unique cloud-based data collection program affording the opportunity to collaborate on cetacean sightings across the region. With an extensive network of members through more than ten islands in the Caribbean region, Caribwhale works to promote conservation education, implements operator training and certification programs to ensure a high caliber among its members. Collaborations have led to scientific publications, reports, and innovative projects advancing regional conservation. Caribwhale's sighting database tool allows operators to document sightings during whale watch excursions, and collaborate on photo-identification. This unique collaboration has resulted in filling in knowledge gaps in species distribution and inter-island movements. The successful collaboration could not have been achieved without the efforts of stakeholders from diverse disciplines. Partners from academia, private-sector businesses, and non-government organizations are working together to fill in critical knowledge gaps of cetacean distribution.

**Levitt, James,** *Harvard University*

**Sustainability or Responsibility? Applications of sustainable development to a real-world continental landscape**

Canada’s boreal forest region, which supports hundreds of Aboriginal communities, is one of the last places on earth that retains significant, vast ecosystems that have not been touched by large-scale industrial development. This combination presents a special opportunity found in few other regions on earth to apply this kind of truly balanced approach to sustainable development. Already there are a great many First Nations and Inuit governments in partnership with provincial and municipal governments, corporations, and other entities that have designed and implemented initiatives that are positive models of responsible and sustainable development. For example, both the Ontario and Quebec governments have pledged to balance protection of tens of millions of acres of northern lands with mining, forestry and other industrial land-uses that use leading edge environmental and social standards. First Nations like the Labrador Innu, Poplar River of Manitoba, and the Deh Cho of the Northwest Territories are some among many that have completed comprehensive land-use plans that provide visions to provide a long-term sustainable future for their communities and the environment in which they live. In this presentation I will describe some of the best examples of initiatives from across Canada’s boreal forest region that apply true sustainable development principles.

**Lewis, Jesse,** *Colorado State University;* **Kevin Crooks**, *Colorado State University;***Sue VandeWoude,** *Colorado State University;* **Larissa Bailey**, *Colorado State University*

**The effects of urbanization on interactions between wild felids: implications for disease transmission**

Landscape pattern that is altered by habitat fragmentation can affect interactions among species and ecological processes. Bobcats and mountain lions broadly occur over a similar range in the western US, although it is unclear how these 2 species interact on a finer scale. Further, additional research is necessary to understand how urbanization influences the interactions between these species and disease dynamics in wild felid populations. We evaluated how urbanization affected the inter-specific interactions between bobcats and mountain lions across 2 study sites in Colorado, USA characterized by varying degrees of human development. Within each study site we maintained a grid of 40 motion-activated cameras and used occupancy modeling to evaluate inter-specific interactions. As expected, our data demonstrate high spatial overlap between bobcats and mountain lions across a broad extent where bobcats did not avoid areas occupied by mountain lions. On a finer scale, we predicted that interactions between these 2 species would be higher in areas associated with urbanization, compared to wildland areas away from human development, due to home-range pile-up along urban boundaries. Bobcats tended to avoid areas that mountain lions recently visited, but only in wildland habitat and not in habitat adjacent to urban development. Our results provide important information about how urbanization influences species interactions and the potential for disease transmission.

**Lewis, Anne,** *City Wildlife*

**Birds and Buildings: Engaging the public in reducing bird/glass collisions**

Migratory bird populations continue to decline annually because of anthropogenic factors. One great killer of birds is collision with glass, with some claims of as many as a billion deaths each year. Though scientists have been studying this issue for at least two decades, it is only now garnering the public attention it deserves. Key to engaging the public has been a citizen science project called “Lights Out” where volunteers get up before dawn to collect dead birds at downtown buildings during spring and fall migration. The enormity of the tragedy becomes real when the birds are photographed en masse: hundreds -- and in some cities, thousands -- of carcasses are photo-documented each year. Since the first “Lights Out” project was begun in 1993 in Toronto, at least nineteen cities have launched similar programs, leading some jurisdictions now even to have laws mandating “bird-safe design.” Why have these citizen-run projects proven effective? 1) they are local; 2) they are odd; 3) the results are emotionally compelling; and 4) they are backed by sound science. In addition, the tragedy is familiar. In almost any audience, the question, “Have you ever witnessed a bird hitting a glass window?” is affirmed almost unanimously. This talk will describe how City Wildlife’s Washington, DC based project, Lights Out DC, has evolved over the past three years, what we are asking people to do, and what changes we can realistically expect from the public (and governments).

**Lewis, James,** *IUCN Amphibian Specialist Group*

**Red List Assessments, Citizen Science and the Future of Conservation Assessments**

The IUCN Red List of Threatened Species is an essential tool for conservationists, researchers, policy makers and donors alike. In 2004 the Global Amphibian Assessment (GAA) published assessments for all 5,743 amphibians known at the time. This was the result of a three year initiative involving more than 500 scientists from over 60 countries. Since then, new information on amphibians has increased dramatically, and there is roughly one amphibian species described every two days. For the Red List to remain a relevant tool each new species requires an assessment while all other previously assessed species need to be reassessed within a ten year time frame. The IUCN SSC Amphibian Red List Authority is tasked with keeping the Amphibian Red List current. With only one full- time and a half-time staff members and a small team of volunteer experts this process is proving extremely challenging. Historically, the majority of GAA assessments have been performed through workshops, bringing together experts to assess species. Although this approach has many advantages, it is no longer economically viable for reassessments, given current financial limitations. Through a collaboration between the IUCN SSC Amphibian Specialist Group, iNaturalist.org and the IUCN SSC Global Reptile Assessment, a new online tool has been developed to bring Red List assessments to an online global community. During the first half of 2013 these tools will be used to assess a number of amphibian and reptile species with the long-term aim of creating a tool widely accessible to all IUCN SSC Specialist Groups interested in assessing species online. We will begin by presenting the online tools and explaining how they were developed. We will end by summarizing an ongoing pilot applying the tools to neotropical amphibian reassessments and describe future plans for scaling the effort.

**Li, Binbin,** *Duke University;* **Stuart Pimm**, *Duke*

**Prioritize multi-species conservation of endemism in China**

With the growing, but still limited, resources and management input in China, it is essential to prioritize species conservation and identify specific locations of manageable size. These sites would support most of the biodiversity and are important to the success of conservation, especially under increasing pressure from development. This study aims to map out species based hotspots for China. We refined the coarse ranges for all endemic species of mammals, birds and amphibians from IUCN by SRTM 90m DEM according to elevational ranges. We further subset the ranges using suitable vegetation types derived from landcover map released by European Space Agency (ESA) in December 2010. We reevaluated the status of each endemic species according to its new range size using IUCN Red List Categories and Criteria v3.1. We overlapped all species ranges to identify the richest concentration of biodiversity in China. (1) 40% of birds, 57% of mammals and 58% of amphibians in China need to be reconsidered, as their current ranges fall in a higher category in IUCN Red List. (2) The largest congruence of endemic birds, mammals and amphibians is in Minshan and Qionglaishan Mountain in Sichuan province. The other hotspots for each class do not overlap extensively. However, the nature reserve system, which mainly aims for Giant Panda conservation, covers only 40% of this area. Our study indicates the needs for multispecies conservation and improvement for priority settings in China.

**Li, Juan,** *Center for Nature and Society, Peking University;* **Dajun Wang**, *Center for Nature and Society, Peking University;***Hang Yin,** *Shanshui Conservation Center;* **Duojie Zhaxi**, *Qinghai Snowland Great Rivers Enviormental Protection Association;* **Zhala Jiagong**, *Shanshui Conservation Center;* **George Schaller,** *Panthera;***Charu Mishra**, *International Snow Leopard Trust;* **Tom McCarthy,**

*Panthera;* **Hao Wang,** *Center for Nature and Society, Peking University;* **Lan Wu,** *Center for Nature and Society, Peking University;* **Lingyun Xiao***, Center for Nature and Society, Peking University;* **Lamao Basang,** *Qinghai Forestry Department, Sanjiangyuan National Nature Reserve;* **Yuguang Zhang,** *Chinese Academy of Forestry;* **Yunyun Zhou,** *Chinese Academy of Forestry;* **Zhi Lu, Center for Nature and Society, Peking University**

**The Role of Tibetan Buddhist Monasteries in Snow Leopard Conservation**

The endangered snow leopard lives in rugged mountains in 12 countries of Central Asia and on the Tibetan Plateau. Current conservation strategies, including nature reserves and incentive programs, have limited capacities to protect snow leopards. In this study, we investigated the role of Tibetan Buddhist monasteries in snow leopard conservation in the Sanjiangyuan region on the Tibetan Plateau. From 2009 to 2011, we systematically surveyed snow leopards in the Sanjiangyuan region, and analyzed their relationship with corresponding environmental variables using MaxEnt modeling to obtain a snow leopard distribution map. This model indicated 7,674 km2 of snow leopard habitat lay within Sanjiangyuan Nature Reserve's core zones. At the same time, we found high spatial overlap between monasteries and snow leopard habitat, with 46% monasteries located within snow leopard habitat, and 90% within 5 km. The 336 monasteries in the Sanjiangyuan region could protect more snow leopard habitat (8,342 km2) through social norms and active patrols than covered by the Nature Reserve's core zones. Furthermore, most local herders claimed that they did not kill wildlife, with 42% adding that they did not kill because it was a sin in Buddhism. Our study indicates that monasteries play an important role in snow leopard conservation. As a strategy, monastery-based snow leopard conservation could be extended to other Tibetan Buddhist regions, covering about 80 percent of global snow leopard range.

**Li, Sheng,** *School of Life Sciences, Peking University;* **Songqiao Su**, *Peking University;***Yiju Wang,** *Institute of Ecology and Evolutionary Biology,National Taiwan University;* **Dajun Wang**, *Peking University*

**Automated Acoustic Recording to Monitor Breeding Songbirds in the Mountainous Forests of SW China**

There is increasing interest in using automated acoustic recording (AAR) as new non-invasive approach for monitoring birds. To evaluate the effectiveness of AAR in a complex forested environment, we systematically surveyed 67 AAR stations (recording 5min/0.5hr) in 2 forest types at Laohegou Reserve, SW China, and simultaneously conducted conventional point count surveys by human observers for comparison (2-5 replicates/station). We examined the daily and seasonal patterns of avian soundscapes by creating a Songbird Acoustic Index representing the accumulative energy at >4000Hz. We evaluated the performance of 2 automatic and 2 manual methods to scan and identify 6 representative species at 3 foraging heights. We then estimated the occupancy rates and detection probabilities of these 6 species based on AAR and point count data, respectively. Results indicated that breeding songbirds were most vocally active from -1h ~ +2.5h of sunrise from late-Mar. to early-Jul. Among the 4 methods, manual visual scanning was the slowest but had highest accuracy and comprehensiveness. Occupancy measures estimated from AAR differed little from those based on point counts, whereas the ability of more frequent repeated sampling ensured higher overall detection using AAR. Our results provide baseline information and guidelines for using AAR on songbird monitoring in remote temperate forests, and demonstrate that robust population measures could be derived by combining AAR and ecological modeling.

**Li, Yiming,** *Institute of Zoology, Chinese Acade*

**Ecological Knowledge to Reduce the Religious Practice of Releasing Invasive Species**

Originating from the traditions of Buddhism and other Asian religions, the ceremonial release of wildlife poses a paradox. Buddhism is generally considered to have great respect for the environment and a desire to cause no harm to any living being, but Buddhist wildlife releases have resulted in biological invasions. By evaluating the release of two highly invasive species--American bullfrogs Lithobates catesbeianus and red-eared slider turtles Trachemys scripta elegans--across four provinces in China, we found that this invasion stems largely from a lack of invasive species knowledge. Targeted public education about invasive species could be an effective strategy for preventing religious release of invasive species on a global scale.

**Liebgold, Eric,** *Salisbury University;* **Tamar Roomian**, *National Human Genome Research Institure;***Gina Sorce,** *Salisbury University;* **Christian Kramer**, *Salisbury University;* **Paul Cabe**, *Washington & Lee University*

**Heterozygosity-fitness correlations and male territory size in a salamander with limited dispersal**

Genetic heterozygosity is of concern to conservation because, as inbreeding increases, typically a result of small population size or limits to dispersal, decreased heterozygosity is often correlated with low fitness. Territory size is a result of behavioral interactions but also indicates resources available for survival and mating success, both of which can be difficult to measure in the field. We investigated the relationship between heterozygosity and territory size, as well as other fitness measures, in the red-backed salamander, Plethodon cinereus, which has highly limited dispersal, indicating the potential for inbreeding. We compared heterozygosity at microsatellite DNA loci with growth of juveniles in experimental enclosures as well as growth and survival of juveniles and territory size of adults in the field. We found that heterozygosity was correlated with growth of juveniles and territory size of adult males. As growth is important for territory acquisition, we have potentially identified a mechanism linking heterozygosity and territory size in this salamander.

**Linder, Joshua,** *James Madison University;* **Erin Knight**, *James Madison University;***Christos Astaras,** *WildCRU;* **Matthias Waltert**, *Georg-August University;* **David Okon**, *WWF-Cameroon Coastal Forests Programme;* **Richard Lawler,** *James Madison University*

**Spatiotemporal patterns of primate abundance and mixed-species association in a heavily hunted Cameroonian forest:implications for conservation action**

Bushmeat hunting has become pervasive and intense in many parts of the African tropical forest zone, leading to declines in primate populations and alterations in primate community structure. While the impact of hunting on seed dispersal and forest regeneration has been investigated, few studies have considered the implications of overhunting for other ecological processes. We investigate how bushmeat hunting has influenced spatial and temporal patterns of primate abundance and how changes in primate community structure may alter the frequency and composition of mixed-species primate associations. Relying on long-term data sets from transect and recce surveys conducted in different areas of Korup National Park, Cameroon, we show that hunting intensity is increasing, primate community structure is changing, and even the species most resilient to hunting may be declining. While mixed-species associations were historically and continue to be common, their composition may be changing over time. To effectively conserve the rich primate community, as well as other large-bodied mammals and the natural ecosystem functioning in Korup NP, we advocate for the creation of conservation-priority "no-take" zones in the park. This can be accomplished through the integration of anti-poaching patrols with novel methodologies (such as acoustic monitoring), conservation education in local communities, and hunter engagement as skilled field assistants in monitoring and research projects.

**Linke, Simon,** *Griffith University*

**Operationalising connectivity frameworks in freshwater conservation planning**

While over 40 papers in peer reviewed literature have dealt with connectivity in riverine conservation planning for fish, invertebrates and waterbirds since the first two major publications in 2007 (by Linke et al and Moilanen et al), implementation was still difficult. Until now, construction of the river network topology still required high level GIS skills. In this presentation we will introduce two free software tools that facilitate freshwater planning by automatically constructing connectivity files for the software package Marxan. The first method starts with a digital elevation model (DEM) and uses the GIS package ArcHydro to delineate subcatchments and watercourses which are then the input data layer to construct a connectivity file. For this second method, the only required input is the global hydrological framework HydroSHEDS, from which connectivity files can be constructed at all available scales. We demonstrate this method based on a real conservation planning exercise in the Congo River Basin in which fish, crabs, dragonflies, molluscs and aquatic plants were planned for.

**Lipsky, Andrew,** *SeaPlan*

**Connecting Science with Policy and Practice**

An experienced interdisciplinary scientist, regulatory expert, and policy advisor, Lipsky will offer a unique perspective how use-­‐ inspired investigations of management in practice can and have informed policy development and implementation in the US state and federal domains. Based on his recent role as a senior advisor to the White House National Ocean Council, where he was integrally involved in the development and implementation of the policy, he will share observations of opportunities and challenges to science-¬‐policy translation and offer recommendations on how knowledge of ecosystem--‐based management in practice may be most effectively translated to guide future implementation and assessment. Applications of the National Ocean Policy in practice will focus on three SeaPlan projects now underway: 1. Filling key knowledge gaps associated with the interaction of marine fisheries, e.g., Groundfish and lobster, and offshore renewable energy development at the Block Island Wind Farm, Rhode Island 2. Facilitating agreement between the offshore wind industry and fishing interests through industry to industry engagement; and 3. Developing critical marine recreational use data products and information systems to inform regional ocean planning efforts in the Northeastern US.

**List, Rurik,** *Universidad Autonoma Metropolitana -Lerma;* **Krista Schlyer**, *Environmental Public Information Campaigns*

**A wall on the way: wildlife at the Mexico-United States border**

Between 2007 and 2009, the U.S. government built approximately 1050 km of border barriers along the 3200 km US-Mexico border, waiving all laws to expedite construction and without environmental impact assessments. Some of the impacts of this infrastructure are readily visible, like increased human activity in formerly remote and well-preserved areas, but many effects will become evident over the years. Cross-border work to raise awareness and to identify and mitigate the effects of the barriers is being conducted. Populations of threatened species are being evaluated along the border and the potential impact of the wall assessed. A Rapid Assessment Visual Expedition took place along the border by a team of American and Mexican photographers in 2009, the products of this expedition have been seen by thousands of people and members of the congress of both countries. A coalition of people is working to bring some of this documentarian information to the US Congress as it considers immigration reform. Initial results of these efforts are starting to be seen, like a projected 2 km wide corridor along the border, included in the recently published ecological zoning of the Janos Biosphere Reserve in Mexico. This corridor will allow for the creation of a roadless buffer area, which could be used to negotiate the modification of the currently wildlife-proof fence. Modifications should allow the passage of pronghorn and bison while reducing vehicle transit.

**Liu, Owen,** *Environmental Defense Fund;* **Jacob Kritzer**, *Environmental Defense Fund;***Jenn Aiosa,** *Environmental Defense Fund*

**Integrating ecosystems and communities into fisheries management: the Virginia blue crab sanctuary revisited**

The Virginia blue crab sanctuary was created in 1942 to protect spawning females, and was expanded over time in response to stock depletion to provide additional protection of blue crabs' seasonal migration. The biological performance of the sanctuary has been evaluated before, using fishery-independent dredge survey data and mark-recapture data. However, there have been no analyses to date of its socio-economic effects. Based on interviews with scientists, managers, and watermen, we show that the crab sanctuary affects fishing communities differently based on factors such as the presence or absence of nearby large tributaries and distance from shore to the border of the sanctuary. These results are pertinent to a current industry-led effort to reevaluate blue crab management in Virginia. At the same time, there has been a recent scientific effort to map a course towards ecosystem-based fishery management for Chesapeake Bay. In this research, blue crabs have been shown to associate with healthy oyster reefs, which provide nursery and foraging habitat. Blue crabs and oysters are currently managed separately, but their ecological linkage calls for an integrated ecosystem approach to spatial management. We propose a series of design alternatives for the blue crab sanctuary that could better achieve management objectives for both the blue crab fishery and oyster restoration, while increasing flexibility for watermen communities.

**Lloyd, Rebecca,** *Yellowstone to Yukon Conservation Initiative*

**Transforming Restoration on Public Lands through Collaborative Management:**

In the US, thresholds in ecosystem resiliency have been exceeded leading to declines and even collapse in ecosystem goods and services, triggering a response by scientists and practitioners alike to develop solutions to rebuild the resiliency of degraded ecosystems. New directives for management of public lands shift focus from resource extraction to restoration and managing for resilience. Despite this trend, little information is available to practitioners on how to design projects to restore desired ecological services and ecosystem resilience to future disturbance. A collaborative management program between the Nez Perce Tribe and the Clearwater National Forest in north central Idaho provides a model case to evaluate how partnerships can transform management approaches to restoration. In 10 years, this partnership expanded the focus project area from 20,000 acres to over 400,000 acres. Along with expanding area, project goals evolved from an early focus on reducing sedimentation at a site-scale to restoring ecological and hydrological processes at a watershed and landscape scale. Preliminary results from research evaluating outcomes show integrated designs have measurable benefits for water and carbon storage, connectivity, and habitat quality. Critical components of partnership success include the following: 1) combining progressive science with traditional ecological knowledge, 2) creating an adaptive monitoring program, and 3) including diverse partners networks.

**Lohr, Bernard,** *University of Maryland Baltimore County;* **Brian Rolek**, *University of Maine;***Aymen Hussein,** *University of Maryland Baltimore County*

**Song variation in Grasshopper Sparrows (Ammodramus savannarum) with an emphasis on the critically endangered Florida subspecies (A. s. floridanus)**

There is considerable conservation value in the ability to discriminate between birds of the morphologically similar eastern and Florida subspecies of the Grasshopper Sparrow (Ammodramus savannarum), which co-occur in central Florida until early May. The sedentary Florida subspecies (A. s. floridanus) is the most critically endangered of all recognized subspecies of this bird. We investigated whether Grasshopper Sparrows might be distinguishable at a distance based on song. We recorded 34 individuals of the Florida subspecies and measured the frequency and duration of several components of the principal advertisement song, the "buzz" song, using the SIGNAL/RTSD sound analysis software. This song normally consists of four short, introductory notes followed by a longer, rapidly amplitude modulated ("RAM") sequence, which is in turn followed by a final note. Our measurements were then compared with identical measurements from songs of the eastern subspecies. We found that the duration of the introductory portion of the RAM sequence was longer, the peak frequency of the song's RAM sequence and last note was lower, and the bandwidth of the RAM sequence smaller in the Florida subspecies than in eastern birds. We also found population-level variation within the Florida subspecies' songs. These results suggest that acoustic characters may be useful as population-specific markers as well as subspecies-specific markers in the Grasshopper Sparrow in central Florida.

**López Fletes, Carlos,** *Universidad de Guadalajara;* **Rosa Chavez Dagostino**, *Universidad de Guadalajara;***Valentina Davydova Belitskaya,** *Universidad de Guadalajara*

**Perception of tourism's contribution to the care of nature in Puerto Vallarta Jalisco Mexico.**

Tourism has become an essential activity for many economies, as a source of employment and foreign exchange for different destinations. These advances in infrastructure have caused environmental degradation and environmental changes. However developments are already now then how they contribute to the care of nature?. Do they contribute?. It is research that tries to answer these questions in part by the perception of the residents. This study takes place in Puerto Vallarta Mexico one of the main attractions of sun and beach in the country, which were performed for field visits and surveys to local residents. We found that there are differences between the responses since for some, tourism contributes to the care of nature, and for another interviewed the opposite. As if respondents agree is the necessity to create new programs in this field, because there are limited to the care of sea turtles and garbage collection. As concludes that the need for a friendly tourism to nature becomes increasingly in the latent perception of the inhabitants of Puerto Vallarta.

**Lubansky, Tanya,** *New Jersey Institute of Technology;* **Gareth Russell**, *New Jersey Institute of Technology*

**Novel use of identification of individuals to model small-scale movements and habitat selection of endangered baleen whales in the Gulf of Maine**

Quantifying the movement patterns of animals is critical to the understanding of life history and thus important to their conservation. Identification of factors that determine where an animal is located spatially and what drives movement around that area greatly aids the creation of effective management plans. There has been a recent increase in the development of spatial habitat models of large endangered whales, whose offshore distributions make comprehensive data financially and logistically difficult to collect. With this study, I demonstrate use of photo-identification data to model habitat selection, minimizing the need for invasive research and greatly increasing the sample size used in such endeavors. A conditional logistic model was written for a 20-year sightings dataset collected on Bar Harbor Whale Watch Company vessels, examining choice of individuals over a given landscape and incorporating the cost of movement. Habitat choices were represented by static and remotely sensed variables including bathymetry, slope, tidal interaction, and SST. Results show significant active decisions of whales to move towards specific conditions; these optimal sites also shift between species and depend on group size. These models are validated by systematic boat surveys conducted during the past two field seasons. This research provides new insight into whale decision-making that can be of great use in marine spatial planning and applicable to many already existing datasets.

**Lubin, Daniel,** *Bowling Green State University;* **Juan Bouzat**, *Bowling Green State University*

**Assessing the historical range of the Greater Prairie Chicken using provenance data from avian species native to Canadian grasslands**

Due to anecdotal evidence from early naturalists, the Greater Prairie Chicken (GPC) was assumed to have extended its range during the 1880s with agricultural expansion into the West by early settlers ("Following the Plough" hypothesis). Thus, the GPC was considered a species "non-native" to Canada. Provenance data from ORNIS and other museum databases were used to characterize the putative range expansion of the GPC into the Canadian prairies between 1890 and 1935. We suggest that the apparent pattern of expansion revealed by collection dates and locations is the result of bias in historical records from early naturalists reporting GPC presence as they settled westward ("Record Bias" hypothesis). Analysis of Minimum Convex Polygons based on provenance data from eight avian species native to the Canadian prairies revealed similar patterns of apparent range expansion consistent with the Record Bias hypothesis. Putative expansion rates for these native species averaged 12,982 km2/year, similar to the expansion rate estimated for the GPC (12,296 km2/year). This is consistent with genetic data that suggest that the GPC inhabited the Canadian prairies prior to the expansion of agriculture to the West, and thus it should be considered a "native" extirpated species in Canada. This study demonstrates the importance of museum collections as a source of information for assessing the historical range and conservation status of wild species.

**Luna Salguero, Betsabé,** *Sociedad de Historia Natural Niparajá, A. C.;* **Héctor Reyes Bonilla**, *Universidad Autónoma de Baja California Sur;***Nuria Torrejón Arellano,** *Sociedad de Historia Natural Niparajá, A. C.;* **Amy Weaver**, *Sociedad de Historia Natural Niparajá, A. C.;* **Israel Sánchez Alcántara**, *Universidad Autónoma de Baja California Sur;* **Adriana González Azcárraga,** *Universidad Autónoma de Baja California Sur*

**MPA with Small No-Take Zones Produce Bigger and More Fish in Five Years: Case Study from Espiritu Santo Marine Protected Area, Gulf of California**

Espiritu Santo National Marine Park was established in 2007 because of its high biodiversity and biological productivity, which sustain an important artisanal fishing even when the core zones (no fishing allowed) is only 1.4 percent of the area. The aim of this work was to analyze the changes observed from November 2005 to November 2011 in abundance, length, and biomass of 11 commercially important species (Serranidae: Mycteroperca rosacea, M. prionura, Epinephelus labriformis, Cephalopholis panamensis; Lutjanidae: Lutjanus argentiventris, L. novemfasciatus, Hoplopagrus guentherii; and Scaridae: Scarus ghobban, S. perrico, S. compressus and S. rubroviolaceus). Abundance data were obtained in observation cylinders of 7.5m radius, and size was assessed in transects of 2x30m, at depths of 3 to 20 meters. All the species tended to increase the average size, biomass and abundance with significant differences through time. The rate of change was higher for biomass, followed by size and finally abundance. As the increase was general in the MPA, the core area is apparently a clear net exporter of biomass. In addition, we observed that the family Serranidae was relatively stable in size, thus indicating that these species fluctuate less than the others families, probably due to its longevity and long generation time. This study demonstrates short-term benefits of relatively small, no-take zones for the improvement of the status of target species and, thus artisanal fishery in general.

**Lundquist, Carolyn,** *NIWA*

**Changing the burden of proof for mangrove management in New Zealand**

While mangroves are indigenous to northern New Zealand, and an integral part of functioning estuaries, the increase in mangrove abundance in recent decades (~4% per annum) has resulted in widespread support for estuarine restoration projects that result in mangrove removals. Resource consent decisions for mangrove removal projects are often centred on ethical arguments about removing native trees, historical mangrove abundance, and human uses of the marine environment such as cultural or recreational access, flood protection, drainage, and coastal erosion. However, the likelihood of successful restoration is rarely considered in consent decisions, and minimal information is available on long term recovery (and likelihood of success) of mangrove clearings. We summarised long-term recovery trajectories at numerous mangrove removal sites to identify physical attributes (exposure, tides, sediment type, catchment, freshwater influx) and biological attributes associated with limited (or fast) recovery. This information will be used to assist decision-making for restoration activities that involve mangrove removal by identifying site-specific attributes that are associated with successful restoration, and with minimal long-term maintenance cost of removing mangrove seeds and seedlings. While a challenging and political vibrant topic, we are making headway by informing the 'mangrove debate' with science to create better outcomes for estuarine health.

**Lundquist, Carolyn,** *National Institute of Water & Atmospheric Research Ltd., New Zealand/ University of Auckland;* **David Wiley**, *Stellwagen Bank National Marine Sanctuary;***Rochelle Constantine,** *University of Auckland;* **Will McClintock**, *University of California, Santa Barbara*

**Resolving conflicts between marine mammals and shipping traffic**

Benefits of ‘roadless’ areas also apply to oceans, as shipping traffic can result in ship strike mortality of marine mammals. In Stellwagen Bank National Marine Sanctuary, USA, a collaborative effort of scientists and the shipping industry resulted in the movement of shipping lanes to protect right and other endangered large whales. Synchronous motion, acoustic recording tags were used to identify water column use and a long-term sighting database and passive acoustic network were used to develop maps of whale distributions relative to bathymetry and sediment type. These data were used to suggest alternative shipping lanes to reduce ship strike mortality, and implement a near real-time passive alert system to notify ships of the presence of right whales in the shipping lane. In the Hauraki Gulf, New Zealand, collisions with commercial shipping vessels are estimated to result in the death of at least two Bryde’s whales each year, of a resident population of ~200 individuals. Information is being gathered to improve maps of whale distributions, and maps of ‘actual’ shipping tracks hotspots have been determined, as there are no fixed shipping lanes in the Hauraki Gulf. A working group of scientists, managers, and the shipping industry is working toward mitigation of this conflict. SeaSketch, a collaborative geodesign tool, can be used to investigate potential shipping options (speeds and lanes), and calculate benefits for conservation and costs to industry.

**Lynch, Patrick,** *NOAA NMFS NEFSC Narragansett, RI*

**Potential influence of climate change on anadromous river herring in their marine habitat**

The term ‘river herring’ collectively refers to alewife (Alosa pseudoharengus) and blueback herring (Alosa aestivalis), two anadromous fishes distributed along the east coast of North America. Historically, river herring spawning migrations supported important fisheries, and their runs continue to be of cultural significance to many coastal communities; however, substantial declines in spawning run size have prompted a petition to consider river herring for listing under the Endangered Species Act (ESA). The ESA review process requires an evaluation of the population responses to multiple stressors, including climate change. For anadromous species that utilize a range of habitats throughout their life cycle, the response to a changing global climate is inherently complex, and likely varies regionally. River herring occupy marine habitat for the majority of their lives, and we project changes in marine distribution and abundance under future climate scenarios by coupling species habitat models with projected temperature regimes from global climate models. We project northward shifts in distributions, and declines in preferred habitat along the US east coast. We demonstrate that current abundance may play an important role governing the significance of climate effects on future abundance; however, there is uncertainty surrounding current population size. Thus, establishing effective conservation efforts in the near term would likely improve population resiliency, and provide lasting benefits to river herring populations.

**Lyons, Amanda,** *Bowling Green State University;* **Nora Lisnizer**, *CENPAT;***Pablo Yorio,** *CENPAT;* **Pablo Garcia-Borboroglu**, *CENPAT;* **Juan Bouzat**, *Bowling Green State University;* **Joseph Schalk,** *Bowling Green State University*

**Demography and genetics suggest metapopulation dynamics of breeding colonies in the Patagonian Kelp Gull, Larus dominicanus**

Demographic data from Kelp Gulls in Patagonia, Argentina, revealed an increase in the overall abundance of the species. However, individual colonies differed significantly in size and have variable growth rates. Demographic modeling showed that the growth of rapidly increasing colonies cannot be explained solely by within-colony recruitment, suggesting that migration from other colonies is significant. We compared the genetic structure of four Kelp Gull colonies located along a coastline of ~1,000 km, each representing regions with different demographic trends. DNA analysis of intron sequences from the myelin proteolipid protein gene revealed similar intra-colony levels of sequence diversity. Analysis of molecular variance indicated some genetic structuring, with ~4% of the observed variation being explained by differences among colonies. Genetic structuring was mainly driven by the Punta Tombo colony being differentiated from La Pastosa and Vernaci, two colonies located within regions with the highest growth rates. Genotype diversity showed increased levels of heterozygosity in Punta Tombo and decreased heterozygosity in La Pastosa and Vernaci. Decreased heterozygosities and the presence of unique haplotypes could be indicative of more recent colonizations and subsequent drift of rare haplotypes within these colonies. Our results suggest that proper conservation strategies for the Kelp Gull should take into account the metapopulation dynamics of this species.

**M. Pouzols, Federico,** *University of Helsinki;* **Atte Moilanen**, *University of Helsinki*

**An approach to develop corridors in spatial conservation prioritization and its implementation in Zonation: the corridor loss penalty**

We present an approach to building corridors in spatial conservation prioritization and spatial priority ranking. The working principle is the use of a corridor loss penalty (CLP) term in a reverse iterative algorithm used for producing priority ranking maps. The CLP reduces or prevents loss or degradation of structural connections. The method has been designed and implemented within the Zonation framework and software, and is applicable to large-scale and high-resolution spatial prioritization (up to tens of millions of elements). Zonation produces maps with a hierarchical or nested set of rankings of landscape elements or cells. Likewise, the corridor building mechanism presented defines a hierarchy of corridors at different and nested top fractions of landscape. The method can also be used for allocating habitat restoration, by identifying areas of low habitat quality included in corridors, and it has several convenient properties: a) it does not rely on resistance coefficients for different habitats, b) it does not require a priori determination of end points, habitat patches, or related thresholds, c) it does not require species targets, and 4) it is possible to quantify the cost of additional connectivity in terms of habitat quality lost across species. The method operates on novel principles and can be applied in combination with a variety of methods supported in Zonation. We expect the proposed method to be of general utility in spatial conservation planning.

**Macdonald, Catherine,** *Abess Center for Ecosystem Science and Policy, University of Miami*

**Legal barriers to ecotourism as a mechanism for shark conservation in the United States**

In recent years, a number of researchers have suggested that ecotourism can play an important role in advancing legal protections for sharks and other vulnerable species. It has been argued persuasively that shark-based tourism can create economic incentives that encourage governments and individuals to protect sharks from threats including overfishing, finning, and indiscriminate use of longlines. In spite of concerns about the potential effects of feeding sharks on public safety, animal health and ecological function, there is no scientific consensus about the effects of shark-based tourism on shark behavior or well-being. This research traces the history of shark feeding in two areas in which shark tourism was previously practiced and has now been banned by law. The first, in Florida, traces the failure of a small but relatively organized and well-funded local shark tourism industry to avoid being regulated out of legal existence as a result of liability concerns. The second, in Hawaii, demonstrates some of the cultural challenges of regulating shark tourism, as well as the difficulties associated with effectively enforcing a ban once it becomes law. This research further attempts to explain some of the reasons that introduction of legal limitations on shark feeding are predictable and, perhaps, inevitable. For this reason and others, legislation protecting sharks that does not rely on their tourism-based economic value for justification is urgently needed.

**MacDowell, Megan,** *Amazon Conservation Association;* **Adrian Tejedor**, *Asociación para la Conservación de la Cuenca Amazónica;***Amy Rosenthal,** *World Wildlife Fund*

**Science as a conservation tool in Peru's Tropical Andes: Generating conservation action and community involvement around three biological stations**

The southwestern Amazon supports some of the highest levels of biodiversity and endemism in the world and encompasses extensive wilderness connecting the lowland Amazon with the Andes Mountains. Over the past 12 years, the Amazon Conservation Association (ACA) and its Peruvian sister organization, la Asociación para la Conservación de la Cuenca Amazónica, have built a network of three research stations?Los Amigos, Villa Carmen and Wayqecha?that span a critical altitudinal gradient from 350 to 3,000 meters above sea level for the study of biodiversity, climate change, and sustainable natural resource management. Combined, these stations host an average of 25 research projects a year, involving a growing number (55+) of research and academic institutions worldwide. These studies have resulted in a wealth of discoveries: 4,369 species at Los Amigos, 625 at Wayqecha, and 551 at Villa Carmen; and over 305 research articles published through 2012. Much of this research is valuable for its contribution to the scientific body of knowledge about the region, but a good proportion is also directly applicable to conservation work on the ground. In this presentation, examples of applied conservation and sustainable livelihood projects based on research at the stations will be given, including work involving species monitoring, conservation corridor design, protected area establishment, environmental education, reforestation, agroforestry, ecotourism and aquaculture.

**Macey, Suzanne,** *Fordham University;* **Caroline Chiu**, *American Museum of Natural History;***Purva Vaidya,** *American Museum of Natural History;* **Kevin Shoemaker**, *Stony Brook University;* **J. Alan Clark**, *Fordham University*

**There's No Place Like Home: Using Microsatellites to Determine Natal Homing in Bog Turtles and Understanding the Conservation Implications**

The bog turtle is one of the smallest and most imperiled freshwater turtle species in North America. Conservation management for this species focuses primarily on protecting and restoring the wetland habitat upon which bog turtles rely. However, little is known about this species' nesting habitat requirements or its nesting ecology. Some turtle species exhibit natal homing, i.e., females nest in the same nesting area from which they hatched. If bog turtles also exhibit natal homing, protecting and restoring existing nesting areas should prove a more effective conservation tool than attempting to create new nesting areas. Because of the unreliability of permanently marking hatchlings and the delayed sexual maturity of females, assessing natal homing from long-term tracking studies is not feasible. This study uses microsatellite analysis to infer relatedness among nesting females. Using 18 previously described microsatellite loci, we are genotyping females who have nested in seven sites in New York State. We will use pairwise comparisons to determine relatedness coefficients between nesting females within a population and distance between their nests. If we find more closely-related females nest in closer proximity, such results will suggest natal homing is present in bog turtles. By better understanding the nesting behavior of bog turtles, we can help improve management decisions on habitat restoration, conservation methods such as translocation, and headstarting programs.

**MacIvor, J. Scott,** *York University*

**Contributions of green roofs to urban biodiversity**

Green roofs are a relatively new form of urban green space, increasingly common in cities on new and existing buildings to reduce cooling costs, storm water runoff, and contribute to an architectural aesthetic. Despite being highly engineered systems and restricted in size to the building footprint, green roofs are also often advocated as contributors to urban biodiversity conservation. Compared with conventional asphalt building roofs, green roofs provide novel habitat for many plants and arthropods, and to a lesser extent, birds. However, green roofs are isolated from ground level, as well, the vegetation specified is almost never focused on habitat provisioning but rather plant survival under extreme exposure, drought, and shallow growing media. Consequently, the assemblage of plant and animal species frequenting ground level urban green spaces is inherently different and more diverse. Conceivably, green roofs could even function as ecological traps, attracting biodiversity to them that cannot be supported, or be sources of exotic or nuisance species. Thus, ecological research is required to determine the benefits to native biodiversity. Further, little is known of the effect of roof height, age, planting scheme, or the surrounding urban landscape on the ecology of green roofs. These are all necessary steps in understanding the contribution of green roofs to urban biodiversity, as the impact will increase with green roof cover increasing annually in many cities.

**Madden, Francine,** *Human-Wildlife Conflict Collaborati*

**A Complex Systems Approach to Conservation Conflict Transformation: Reevaluating Our Current Practices to Effectively Address Human-Wildlife Conflict**

Human-wildlife conflict (HWC) is more often a conflict between people about wildlife, than it is a conflict between people and wildlife. In fact, HWC often serves as a microcosm of the larger social system-level conflicts in society. Unfortunately, current practices – failing to address the drivers of HWC within the social system; discounting “irrational” actions even as they are important indicators of conflict; pushing for urgent solutions; and addictively relying on approaches which are comfortable and familiar – have resulted in narrowly drawn lines around what it means “to do” wildlife conservation that has limited our capacity for success. Even while efforts may succeed initially, they often fail to continually provide broader cycles of engagement and system-level feedback inhibiting the durability of well-intentioned efforts. Thus, many of today’s HWC failures are often a result of yesterday’s solutions – especially those with too little emphasis on understanding the role of underlying and identity conflict and subsequently failing to create equitable, iterative decision-making processes that would ultimately reconcile the relationships needed to sustain and evolve them. Through use of theoretical models and illustrated case studies from HWCC’s work, the author will make a case for our field’s need adopt new capacities and approaches to effectively transform these seemingly intractable conflicts into opportunities for positive, durable, system-level change.

**Madden, Francine,** *Human-Wildlife Conflict Collaboration*

**Understanding Identity and Engaging Systems to Untangle Conflict in Contemporary Conservation**

Much of the intractability characterizing wildlife conflicts stems from the near-universal existence of identity conflict within conservation contexts. Identity conflicts engage strong passions and can lead to great destruction; yet reconciliation of such conflicts can be highly creative and transformative. Unfortunately, identity conflicts are often mistaken for or disguised as simple disputes over material or economic resources. Undeniably, efforts to settle such misdiagnosed conflicts generally fail, since the resolution process failed to address the underlying cause of these conflicts. To transform these conflicts, one needs to understand and engage the social system in which decisions are made. Wildlife conservation often serves as a lightning rod for deeper social conflicts that may have their roots elsewhere in society. As a result, conservation efforts may temporarily or superficially solve a problem, but fail to create the changes needed in processes, capacities and relationships to ensure lasting improvements for human and wildlife communities. HWCC is the only organization using a conflict transformation model, addressing the multiple levels of conflict and engaging systems to reconcile conservation conflicts. This presentation explores the analysis and non-linear decision-making processes HWCC uses to foster positive, durable benefits for people and wildlife.

**Madliger, Christine,** *University of Windsor;* **Oliver Love**, *University of Windsor*

**Applying Stress Hormones to Conservation Biology: The Value of a Context-Dependent Approach**

Levels of stress hormones (eg., corticosterone, cortisol - CORT) are increasingly being implemented as integrative conservation biomarkers for monitoring disturbance levels and overall condition in wild populations. For such measures to indicate how populations will change in the face of environmental change, CORT levels must show a predictable relationship with fitness. There has been a general assumption that the relationship between CORT and fitness is negative (i.e., that increases in CORT levels are always indicative of increasing disturbance). However, there is growing evidence that the relationship is context-dependent, differing based on factors such as age, sex, and life history stage. We experimentally investigated the relationship between baseline CORT levels and fitness in a free-living population of tree swallows (Tachycineta bicolor) within and across breeding seasons. We show that the relationship changes based on the contexts of age, environmental quality (food availability), and reproductive stage. In addition, our results provide evidence that CORT levels can provide valuable predictive information, improving on traditional demographic monitoring methods. However, a predictive, context-dependent approach that considers factors such as life history stage, age, and habitat metrics may be necessary to effectively apply stress hormones as physiological indices of population disturbance or health.

**Madosky, Jessa,** *Warren Wilson College*

**Service Learning: Connecting Students with Stakeholders and Managers and Connecting Academics to Conservation in Action**

Service learning has been used in many disciplines to connect students with real world issues and to introduce students to professionals in the field. Service learning in conservation biology can be a valuable tool to assist managers and stakeholders as well as to provide students with practical experience. Service learning experiences allow students to experience conservation in action and to connect with local conservation issues and stakeholders involved with those issues. Case studies presented include an invasive species removal and restoration project, writing for open access databases, educational outreach to local schools, and collecting and analyzing data for the National Park Service. Involving students in active conservation projects connected students with stakeholders and professional managers and furthered both academic and conservation goals. Service learning experiences with conservation managers help to bridge the gap sometimes found between scientists and managers and help students learn how to connect conservation research with conservation management in action. Exposing students to these issues early in their career prepares them to make connections between different stakeholders as they move into professional positions of all types. These case studies illustrate both the educational value of engaging students in conservation issues through relevant service and the powerful connections that students make through service learning experiences.

**Madsen, Stephanie,** *At-Sea Processors Association*

**Education Tax Credits: Found Money for Marine Mammal Conservation in Alaska**

The member companies of the Pollock Conservation Cooperative own and operate catcher-processor vessels that catch pollock in the Bering Sea off Alaska. The PCC member companies pay a Fishery Resource Landings Tax based on the value of the pollock catch. The Alaska Education Tax Credit Program provides a tax credit to businesses that make contributions to the Alaska accredited public and private nonprofit colleges for research and educational purposes. Since 2000 PCC member company combined contributions of over $3 million have funded over 30 marine mammal research projects. Collaborators include multiple state and federal agencies, academic institutions, and no-profits throughout the Pacific Northwest and Canada, studying Steller sea lions, northern fur seals, harbor seals, and killer whales over an area from California through the Pribilof, Aleutian, and Commander Islands. Research has focused on marine mammal predators, foraging ecology, prey diets and nutrition, pollutants, and the potential for competition with groundfish fisheries for prey. Significant marine mammals declines that began as early as the 1960s and extending throughout much of the North Pacific Ocean and southern Bering Sea motivated many of the projects. Important accomplishments include development of implantable life-history tags used to investigate mortality, and the deployment of data loggers on pollock fishing vessels to evaluate the potential for fishing-induced declines in pollock abundance.

**Mahamued, Bruktawit,** *Manchester Metropolitan University;* **Afework Bekele**, *Addis Ababa University;***Paul Donald,** *Royal Society for the Preservation of Birds*

**Behaviour and habitat associations of the Liben Lark Heteromirafra sidamoensis, Southern Ethiopia**

The Borana rangelands were once known to have the highest grazing potential in East Africa and for their high cattle productivity. Today rangelands represent one of the most threatened grassland ecosystems throughout the continent of Africa due to increases in human population, overgrazing by unregulated (and increasing) cattle stocks, and agricultural expansion. The Liben Plains are widely recognised as the last remaining remnant rangeland habitat for the critically endangered Liben Lark (Heteromirafra sidamoensis).In this study I use logistic regression analysis to determine the habitat preferences and quantify the behaviour of the Liben Lark to help guide appropriate habitat restoration strategies for the species and the Borana rangelands. Line transect surveys were conducted during August and November, 2010 and March and May, 2011. A total of 49 individual larks were counted during the study period. The Liben Lark avoided areas with high percentage bare ground cover, high density of trees and paths. Larks spent up to 72% of their time foraging, on vigilance for 20%, walking/running for 2.8%, preening for 2.1% and displaying or singing for only 1.4% of the observation time. The results suggest that habitat restoration strategies should focus on efforts to improve foraging habitat for the Liben Lark by reducing the amount of bare ground, reduce tree encroachment and measures that minimize the impact of cattle grazing.

**Maheshwari, Aishwarya,** *WWF-India*

**Conservation of snow leopard (Panthera uncia) in the Kargil Himalayas, Ladakh, North India**

First base-line surveys were conducted in Kargil, Ladakh to document the occurrence and distribution of large carnivores and presence of snow leopard through camera photo trapping has been confirmed confirmed from the battlefield of India. Along 13 trails, habitat use by these carnivores was assessed through direct and indirect evidence. Eight vantage points were selected for estimating abundance of prey species; overall density estimated 0.09/km2 for Asiatic ibex and for Ladakh urial 0.06/km2 in areas surveyed of Kargil. Snow leopard-human conflicts was identified as one of the key threat to its survival. More than 500 cases of depredation i.e. 10% loss of the total livestock population by large carnivores in Kargil during 2009 to 2012 were reported by villagers. Loss of livestock by snow leopard, Tibetan wolf and Himalayan brown bear instigate the retaliatory killing of these carnivores. Scat analysis also revealed that 45% diet of snow leopard contributed by snow leopard. The root causes of this conflict are decline in the natural prey base and lack of infrastructure to maintain the livestock has been identified in the questionnaire surveys. Keeping this in view, safe guard measures; livestock corrals were provided to the the local communities to maintain their livestock and reduce the livestock depredation along with conservation awareness workshops to enhance the wildlife knowledge among various stakeholders in Kargil.

**Mahon, Andrew,** *Central Michigan University*

**Error, quality assurance, and information exchange when using genetic technologies for monitoring and surveillance in aquatic ecosystems**

Detection of rare species, whether threatened or endangered or newly introduced invasive species, routinely relies upon the ability to detect and monitor low densities of patchily distributed species. This can be particularly challenging in aquatic ecosystems, where even large organisms can be difficult to directly observe or capture. Traditional sampling methods are only effective in a narrow range of habitats, principally shallow water, with slow water velocities, or moderate to high visibility. Genetic sampling methods have the potential to overcome many of the constraints posed by traditional aquatic monitoring and detection gear and have been the focus of many recent investigations (e.g., Asian carp, etc.). However, despite the promise of DNA-based monitoring methods, the adoption of these tools in decision-making frameworks remains challenging because of uncertainty associated with molecular technologies. This presentation will address a number of environmental genetic technologies and will discuss possibilities for limiting detection uncertainty and error rates. Additionally, the effective communication of results will be discussed in concurrence with the use of genetic technologies for decision-making.

**Majyambere, Methode,** *National University of Rwanda;* **Katherine McFadden**, *Clemson University*

**Effects of Habitat and Buffer Zones on Small Mammal Diversity and Abundance in Nyungwe National Park, Rwanda**

In Rwanda, buffer zones of plantation-style cultivation are commonly found adjacent to protected area (PA) forests. These areas are partially restricted but may give added protection to PAs while providing benefits to neighboring communities. Understanding the response of species in buffer zones is essential to design effective conservation programs for

PAs. This study explores the role buffer and edge habitat play in maintaining species diversity and abundance of small mammal species in high altitude rainforest of Nyungwe National Park. We live trapped at three sites within the park and compared small mammal species diversity and abundance in tea and pine plantation buffer habitat adjacent to the park, forest edge, and forest interior habitat for a total of 6936 trap nights in 2011-2012. Only 11 of 29 total small mammal species captured in the study sites were able to use the plantation buffer habitat and 22 species were found to be intermediate in habitats, being able to use forest edges. We found 20 species occurring in the interior of the forest, at least 100 m from the edge. The greatest relative abundance of small mammal individuals occurred in interior habitat, followed by edge. Overall, buffer habitat supported more generalist species. Pine buffer habitat supported significantly higher species diversity than tea plantation. Results indicate that the type of buffer habitat may be important in maintaining species diversity within and surrounding protected areas.

**Makindi, Stanley,** *Egerton University*

**Sustainable approaches to managing competing claims on natural resources in Kenya**

With over 75% of wildlife in Kenya being found on private or communal land, one of the greatest challenge in the country is reconciling and sustaining economic development with biodiversity conservation and sharing the costs and benefits of conservation between individuals, state and the general community. The study was conducted in three categories of protected areas under different governance types and primary management objectives in Kenya (government managed, communally managed, and privately managed). The research examined the general issues of how local communities in Kenya have embraced different biodiversity conservation strategies. The research employed both qualitative and quantitative techniques in gathering the data. The general findings of the study suggest that although local people appreciate the crucial value of biodiversity and the role of protected areas in conserving it, there is some evidence of resentment towards some management activities of the protected area regulators. Negative attitudes were attributed to perceived problems of living next to the protected areas while widespread support for the management activities was associated with perceived benefits to the local populations. It is clear from this study that different rationales of conserving biodiversity need to address the issue of protected area management in the context of sustainable development through a combination of conservation strategies.

**Makkay, Amanda,** *Fordham University;* **Evon Hekkala**, *Fordham University;***Patrick Thomas,** *Wildlife Conservation Society*

**Patterns of Relatedness and Genetic Diversity in Ex Situ Species: An Analysis of the Captive Snow Leopard (Uncia uncia) Population**

As humans continue to encroach on once pristine ecosystems, these anthropogenically modified landscapes limit the effectiveness of traditional in situ conservation. When small populations continue to decline, despite in situ conservation, one way to ensure species survival is maintaining a population ex situ, or in captivity. The Association of Zoos and Aquariums (AZA) consist of more than 200 institutions that maintain ex situ populations and manage them according to the parameters outlined in species specific Species Survival Plans (SSP). SSP's are designed to maintain 90% of genetic diversity for 100 years or 10 generations. The snow leopard (Uncia uncia) is one of the AZA's longest exhibited species, since 1903. Each year, their SSP presents management and breeding recommendations to maintain the genetic diversity of the founders and ensure a demographically stable population. These recommendations are based on the predicted mean kinship (MK) values, of each snow leopard, as derived by studbook data. Literature suggests that model based, studbook derived, values of MK differ from empirically derived measures, from molecular genetic data. We are comparing studbook derived and molecularly derived values of MK for the AZA's snow leopard population to advise future breeding recommendations. Preliminary data indicate that genetic values of MK, derived from DNA extracted from sloughed epithelial cells present on snow leopard scat, differ from studbook derived values.

**Malcolm, Christopher,** *Brandon University*

**Identification of northern pike spawning sites in Riding Mountain National Park, using VHF telemetry**

We examined spawning habitat selection by northern pike (Esox lucius) in Clear and South Lakes, Riding Mountain National Park, Manitoba. Clear Lake is a 29.22 km2 mesotrophic lake, while South Lake is a 2.03 km2, eutrophic lake. The two lakes are separated by a sand barrier bar which is often breached during the spring melt, thus providing a temporary corridor between the lakes; the barrier then reforms later in the summer. South Lake appears to support the richest pike spawning habitat in either lake, but can become anoxic in the winter. In order to examine whether temporary connectivity between the lakes is important for Clear Lake pike reproduction, we placed VHF micro-transmitters into the oviduct of n=19 female pike captured in Clear Lake, prior to spawning and spring breach of the barrier bar. Each fish was also fitted with an external VHF transmitter. Fish were tracked throughout April to determine where each micro-transmitter was deposited. Fifteen of nineteen micro-transmitters were located, all in South Lake. We sampled for eggs at five of the micro-transmitter deposition sites and five random sites. Eggs (n=137) were found at 4 of 5 transmitter sites and 1 out of 5 random sites (n=3). Habitat analysis was also conducted. Micro-transmitter sites differed significantly from random sites in depth, clarity, and vegetation. South Lake is likely an important spawning area for the Clear Lake pike population for which regular spring connectivity is important.

**Malcolm, Jay,** *Faculty of Forestry;* **Erica Barkley**, *Faculty of Forestry;***Mike Burrell,** *Faculty of Forestry;* **Brian Campbell**, *Faculty of Forestry;* **Terrance Carleton**, *Faculty of Forestry;* **James Dennis,** *Faculty of Forestry;***Alison Fischer**, *Faculty of Forestry;* **Tomasz Gradowski,**

*Faculty of Forestry;* **Ben Kuttner,** *Faculty of Forestry;* **Mark Newman,** *Faculty of Forestry;* **Geoff Sherman***, Faculty of Forestry;* **Charlotte Sharkey,** *Faculty of Forestry;* **Alissa Sugar,** *Ontario Ministry of the Environment;* **Agnieszka Sztaba,** *Faculty of Forestry;* **Mark Vanderwel, Faculty of Forestry**

**Testing the Sustainability of Boreal Clearcut Logging: Forest Age and Habitat Structure**

Clearcutting logging in the boreal forest is argued to be sustainable from a wildlife perspective because as harvested stands re-grow, their structural features emulate those developing after natural stand-replacing disturbances. However, two features of clearcutting may be problematic: 1) gradual elimination from the landscape of forests older than the rotation age and 2) failure of young forests to develop the structural complexity of old-growth forests. We tested whether such elimination was occurring by comparing 3 managed and 4 natural landscapes in boreal northeastern Ontario, Canada, and whether structural habitat development in pre-rotation age forests achieved that of older forests in a sample of 107 stands. In the managed landscapes, forests older than 100 years comprised only 17-35% of the landscape, whereas in the natural landscapes they comprised 54-78%. Among a diverse set of structural habitat variables, including 3 dimensional measurements of foliage stratification and measurements of standing and downed woody debris, 10 variables showed maximum values at or near the rotation age (80-100 years), whereas 6 showed maximum values at greater ages. These six variables were also key correlates of community variation for several faunal groups. Our results draw into the question the sustainability of clearcut-based landscape management in boreal forests and call for land management practices that better maintain the structural features of old forests.

**Mancha Cisneros, Maria del Mar,** *Arizona State University;* **Jose Anadon**, *Arizona State University;***Benjamin Best,** *Duke University, University of California Santa Barbara;* **Leah Gerber**, *Arizona State University*

**Habitat-specific larval dispersal and marine connectivity: Implications for reserve design**

Connectivity via larval dispersal is key to setting effective marine reserve networks. Spacing rules help ensure connectivity by setting maximum spacing between individual reserves, though they have been applied indiscriminately to all types of habitats. Here we address the extent to which such rules capture subtleties associated with dispersal distances varying among species in different regions and habitats. We applied a 50-100 km global spacing rule (SRg), also applied in the California Marine Life Protection Act (MLPA), to a previously assessed network in the Gulf of California (GoC). Using larval dispersal data for species within this region (SRr), we associated each species with eight unique habitats (SRh) and we evaluated connectivity by means of different spacing rules (SRg, SRr and SRh) using graph-theory. The SRg was found to be robust and conservative when applied to the GoC or to its different habitats (i.e., the lower limit for dispersal distance includes the distance for all species in the GoC). Species in different habitats exhibit statistically distinct dispersal profiles. Therefore, some habitats could be evaluated with more relaxed spacing rules, or larger distances, than those proposed by the rules of thumb. Our work identifies a conservation planning trade-off when implementing spacing rules: already proposed rules are robust but at the cost of efficiency. Habitat-specific spacing rules should be considered for more efficient marine conservation planning.

**Mandle, Lisa,** *Natural Capital Project, Stanford University;* **Leonardo Sotomayor**, *The Nature Conservancy;***Stacie Wolny,** *Natural Capital Project, Stanford University;* **Sofia Vargas**, *The Nature Conservancy;* **Adrian Vogl**, *Natural Capital Project, Stanford University;* **Jerome Touval,** *The Nature Conservancy;***Heather Tallis**, *Natural Capital Project*

**Accounting for ecosystem services in mitigation: Can the Pucallpa-Cruzeiro do Sul road be developed with no net loss of ecosystem services in Peru?**

Existing policies aimed at mitigating the environmental impacts of development focus primarily on preventing losses of biodiversity and ecosystem function. However, these approaches do not explicitly account for ecosystem services and impacts to people. When the link between people and nature is ignored, mitigation activities can redistribute ecosystem services, benefiting some people while neglecting others and creating social injustice. We use new serviceshed-based methods to track what parts of the landscape provide ecosystem services to different groups of people. With this approach, we estimate the amount of services that will be lost - and who will lose them - after the completion of a new road through the Peruvian Amazon. We assess the impacts of road development on nearly 250,000 people in 107 cities and towns in the Ucayali Region of Peru. We ask whether no net loss of ecosystem services can be achieved through mitigation. We find that, of the four ecosystem services we evaluated (erosion control; drinking water quality regulation for the pollutants nitrogen and phosphorus; and carbon sequestration), no net loss is possible only for carbon sequestration. Mitigation cannot return erosion control, nitrogen or phosphorous regulation services to all people impacted by road development. Given the billions of dollars spent on development projects globally, integrating ecosystem services into mitigation requirements is critical to protecting nature's benefits to people.

**Manfredo, Michael,** *Colorado State University;* **Alia Dietsch**, *Colorado State University;***Tara Teel,** *Colorado State University*

**Stability and change in social values: The influence of culture and modernization on wildlife-related cognition**

Social values and value orientations represent the core of human thought, guiding people's perceptions and driving their behaviors. Due to this value centrality, practitioners and scientists often suggest a need for educational appeals (e.g., pamphlets, advertisements, campaigns) to affect value change to facilitate conservation initiatives. However, values are proposed to be learned early in youth, to be culturally derived, and to change slowly and inter-generationally. If true, we would expect to find traces of nationality differences in the values of North Americans through their ancestry. Using data from a survey of residents from 19 states in the western U.S., we explore value stability and value shift with a focus on wildlife-related thought. We first test whether values found in countries today can be detected in the wildlife value orientations of Americans claiming ancestral origins from those countries. Second, we examine the effect of modernization, a prominent force proposed to produce culture change, on any potential ancestry effect. Results indicate that Americans' wildlife value orientations are similar to the values found in their "home" countries, indicating value stability. We also found that modernization links to a shift in wildlife-related values, independent of ancestry. Findings have theoretical implications for ecological modeling to include human cognition, and implications for practitioners developing programs aimed at influencing human behavior.

**Mannle, Kate,** *Rare Conservation;* **Amielle DeWan**,

**Incorporating the 'likelihood of behavior change' into site prioritization for coastal fisheries management**

Although the potential for fisheries recovery is critical for predicting the potential biophysical outcomes of conservation and management interventions, success will ultimately be determined by the ability to shift human behaviors. Many conservation prioritization frameworks seek to strike a balance between threats caused by local people and a conservation target but few take into account the factors that indicate communities are well suited to adopting new behaviors. Review of prioritization approaches from social marketing and behavior change theory and the results from over 200 behavior change campaign sites were assessed. Certain factors including population and target audience size, local leadership, prior community engagement, and lack of external threats play a key role in creating an enabling environment for social change. By incorporating factors that indicate ‘a likelihood of behavior change’ in addition to biophysical, political, social, and economic factors of prioritization frameworks practitioners can improve conservation outcomes by working with communities that are more likely to adopt sustainable behaviors.

**Manzer, Douglas,** *Alberta Conservation Association;* **Shevenell Webb**, *Alberta Conservaition Association;***Michael Jokinen,** *Alberta Conservation Association;* **Robert Anderson**, *Alberta Conservation Association*

**Skin in the game: citizen science plays a key role to determine wolverine occupancy in a changing landscape.**

Citizen scientists are playing a key role to determine the legal status, distribution, and resource needs of wolverines in a changing landscape. Wolverines are listed as data deficient within Alberta which means there isn't enough data to determine their legal status. Trappers appear at first to be an unlikely ally for wolverine conservation. They're frequently regarded as fringe stakeholders who are highly suspicious of government or scientists, but they're also uniquely suited to collect data from wilderness areas over broad spatial extents. The Alberta Trappers Association asked scientists to collaborate to determine the status and habitat resource needs of wolverines in a rapidly changing landscape. Casting back, we conducted a trapper questionnaire and analyzed fur harvest data to better understand distribution at a province-wide scale. Casting forward, trappers are using non-invasive bait stations to collect hair samples and photos to detect occupancy in habitat among regions. We predicted harvest and occurrence to be greater in areas with consistent spring snowpack and in larger tracts of intact forest. Surprisingly, harvests since 1989 have been consistent in regions lacking predictable spring snowpack that is generally considered vital for recruitment. Grassroots participation is enabling essential steps in the conservation process to occur, while gaining ownership from a key consumptive user of wildlife.

**Marais, Christo,** *South African Dept Environ Affairs*

**Ecological Research Priorities for Carbon Offset Projects:**

**Marchini, Silvio,** *Escola da Amazônia*

**Escola da Amazônia: engaging the next generation in the conservation of the greatest biodiversity on earth**

For most Brazilians in the cities where policy is determined, Amazônia is nothing but a distant place and they have little connection to it. Attempts to save the forest have concentrated on creating protected areas but have mostly ignored the beliefs and attitudes of people on the deforestation frontier, most of whom are poor migrant farmers who need income, but lack fundamental knowledge of how to use the forest. Vitally, we established Escola da Amazônia in 2002 to research the human dimensions of the conservation crisis in Amazonia and to engage communities on the deforestation frontier - with a focus on students, teachers and schools - in conservation. Communication interventions and evaluation of results have been based on the charisma of the species that has a stronger presence in Brazilian youngsters' minds and hearts than does any other native mammal: the jaguar. We found that school-based communication interventions can have a powerful effect on perceptions of jaguars among students, and that students can effectively transfer that effect to their parents. In a different, more recent initiative - the Young Conservationist Award - we identify creative and influential teenagers in Amazonia and provide them with learning opportunities and incentives for them to create and disseminate conservation messages, which they do by using traditional and new communication technologies and by speaking as 'forest ambassadors' at schools in the major urban centers of Brazil.

**Marchini, Silvio,** *Instituto Pró-Carnívoros*

**Human dimensions of wildlife on the Amazon deforestation frontier, Brazi**

For most Brazilians in the cities where policy is determined, Amazônia is nothing but a distant place and they have little connection to it. Attempts to save the forest have concentrated on creating protected areas but have mostly ignored the beliefs and attitudes of people on the deforestation frontier, most of whom are poor migrant farmers who need income, but lack fundamental knowledge of how to use the forest. Vitally, we established Escola da Amazônia in 2002 to research the human dimensions of the conservation crisis in Amazonia and to engage communities on the deforestation frontier – with a focus on students, teachers and schools – in conservation. Communication interventions and evaluation of results have been based on the charisma of the species that has a stronger presence in Brazilian youngsters’ minds and hearts than does any other native mammal: the jaguar. We found that school-based communication interventions can have a powerful effect on perceptions of jaguars among students, and that students can effectively transfer that effect to their parents. In a different, more recent initiative - the Young Conservationist Award - we identify creative and influential teenagers in Amazonia and provide them with learning opportunities and incentives for them to create and disseminate conservation messages, which they do by using traditional and new communication technologies and by speaking as ‘forest ambassadors’ at schools in the major urban centers of Brazil.

**Marino, Lori,** *The Kimmela Ctr for Animal Advocacy*

**The Critical Role of Psychology in the Conservation of Nonhuman Animals**

Traditional conservation practices, which focus on population size and species-level viability analyses, are missing a crucial component of conservation: the individual animals who make up these aggregates. Furthermore, invasive interventions such as culling, translocation, habitat restriction and “sustainable harvesting”, create more problems than they solve because these practices do not take into account the lives and welfare of individual animals. As a result, several conservation practices that rely upon “numbers” as a metric for success or invasive approaches have not only failed to protect certain populations, they have made matters worse. Examples include the ongoing problematic attempts to protect the African elephants, the justification of wild captures of cetaceans for “conservation “ purposes, and the culling of wolves to resolve human-animal conflicts. It is critical that conservation take a more scientifically – informed, and frankly, progressive, approach to nonhuman intelligence and sensitivities by acknowledging the data on the complexity of their social networks, families, cultural traditions, and psychosocial development and, thus, not only preserving numbers of individuals but the individuals themselves.

**Mark, Melissa,** *Columbia University E3B;* **Arshiya Bose**, *University of Cambridge*

**Evaluating Biodiversity Outcomes from Certification of Shade-Grown Crops**

Agroforestry plantations provide habitat for biodiversity in tropical agricultural areas by maintaining structural and floristic complexity similar to forests. Third-party certification of shade-grown crops is promoted as a mechanism to ensure environmentally responsible management practices that promote biodiversity conservation. However, there has been no comprehensive evaluation of the impact of third-party certification on biodiversity conservation across geographic regions. Here we review the empirical evidence for the maintenance or increase in biodiversity as a result of third-party certifications such as Organic Crop Improvement Organization (OCIA), International Federation of Organic Agriculture Movements (IFOAM), Rainforest Alliance, Smithsonian Bird-Friendly and UTZ. We also present results from interviews with coffee farmer and their perception of the impact of certification guidelines on management practices. While the presence of shade trees is positively related to measures of biodiversity, the benefit of certification is less clear. In many cases, existing management practices are more heavily influenced by historical and economic factors than certification. Clear and tangible changes in management practice and resulting ecological outcomes have been difficult to observe. We suggest approaches to future research in areas where there are little data in order to better evaluate the efficacy of third-party certification on biodiversity conservation.

**Marsden, Brittany,** *University of Maryland College Park;* **Maile Neel**, *University of Maryland College Park;***Michael Lloyd,** *University of Maryland College Park*

**Evaluating the potential resiliency of Vallisneria americana in the Potomac River (USA) using individual-based networks of genetic distances**

Large-scale losses from nutrient and sediment loading, competition with non-native species, and loss of habitat connectivity cause concern for long-term persistence of submersed aquatic vegetation and the essential ecosystem services they provide. Extensive, connected habitats are more resilient due to higher probabilities of supporting large, genetically diverse populations that can tolerate, acclimate, or adapt to environmental changes. The aquatic angiosperm Vallisneria americana (wild celery) has large and extensive patches of habitat throughout the Potomac River, MD (USA), suggesting potential high resilience to perturbations. However, because the species reproduces both sexually and clonally, the extensive occupied habitat may not support the expected genetic diversity. We genotyped 758 samples from 29 sites using 10 microsatellites. We identified 401 multilocus genotypes (MLGs) from 726 samples for which we had completed genetic inforation. Genotypic diversity within sites ranged from 0.0-1.0. The largest clone spanned over 160 river km. Genetic distances among all MLGs were used in network analysis to quantify connectivity via dispersal. Breaks in geneflow across tidal vs. non-tidal waters were observed and could be associated with changes in dispersal regime (unidirectional vs. radial) or differences in selective environmental forces. Low genotypic diversity within some sites causes concern for resilience in changing conditions.

**Martin, David,** *Davidson College*

**Noah Revisits Biodiversity Protection Prioritization**

Since pledges to finance biodiversity preservation are a fraction of the identified needs, scientists must develop tools to help prioritize the many goals. Analysts and policy makers often describe this problem with the "Noah's Ark" metaphor to imply that society must choose how much biodiversity to save in aggregate and which specific components of it to save. Unfortunately, economic models proposed to answer these questions don't capture the complexity and interrelatedness that enriches ecological perspectives while ecological models often ignore the anthropogenic aspects that drive economic analysis. I develop a model for prioritizing species conservation policies that advances the integration of the economic and ecological perspectives. I start with Weitzman's (Econometrica 1998) basic Noah's Ark model that prioritizes species and build upon Perry's (EcolEcon 2010) and Arponen's (BiodiversConserv 2012) work to develop a model that includes economic and ecological concerns. I then show how this microeconomic ranking fits within Norgaard's (EcolEcon 2010) macro-oriented ecological economics framework. I demonstrate this methodology with two examples from current issues concerning protecting Keoladeo National Park (India). In the first example I compare protecting the Siberian crane, the Sarus crane, and the greater spotted eagle. In the second example, I compare providing water to the park via monsoon runoff in a pipeline to restoring the flow of the Gambhir River.

**Martin, Laura,** *Cornell University;* **John Quinn**, *Furman University;***Rebecca Shaw,** *Environmental Defense Fund;* **Erle Ellis**, *University of Maryland, Baltimore County*

**Conservation in the Anthromes**

As global change science highlights, human activities dramatically impact biodiversity. Anthromes are geographical categories that extend biomes by representing significant ecological patterns created by sustained direct human interactions with ecosystems. We used anthromes to analyze the current global distribution of conservation efforts (priority, protection, study). We analyzed (1) the area encompassed by biodiversity hotspots in each anthrome, (2) the total protected area in each anthrome, and (3) the number of terrestrial ecological studies from 2005-2009 in each anthrome. These proxies served as a gap analysis, identifying anthromes that are under-prioritized, under-studied, or under-protected. We found that current efforts are not distributed evenly across anthromes, and that prioritization, protection, and study are not directly correlated with each other. For example, while a great density of ecological studies are conducted in the urban anthrome, the urban anthrome contains few protected areas or biodiversity hotspots. The remote woodland anthrome, meanwhile, encompasses much protected area, but had been less studied and less prioritized under the biodiversity hotspot framework. Our results demonstrate how anthromes can be used to visualize and communicate conservation opportunities in ecosystems that encompass humans. Anthromes promise to unite recent diverse proposals that call for "people friendly" conservation in "working landscapes."

**Martin, Michael,** *Rupununi Learners Inc.;* **Fernando Li**, *Rupununi Learners Inc.;***Rudolph Roberts Sr.,** *Yupukari Village;* **Rudolph Roberts Jr.**, *Yupukari Village, Rupununi Learners Inc.;* **Ashley Holland**, *Rupununi River Drifters*

**Community based links between education, ecotourism and investigations of Melanosuchus niger and Podocnemis unifilis in Yupukari Region #9 Guyana.**

Yupukari village in Region #9 Guyana is the hub for an 8 year mark recapture study of Melanosuchus niger (Black Caiman) and newly formed monitoring and headstarting program for Podocnemis unifilis (Yellow Side-necked turtle). While linkages with local efforts in education, ecotourism and conservation management grow these two community driven investigations in the pristine Rupununi environment have their roots within international cooperation and support. After 8 years and over 680 individuals caught and recorded the villager based "caiman crew" seeks collaborations to continue efforts within an open range of study areas (telemetry, dietary studies, management dialogs, genetics). In its second season the Yupukari turtle project introduced 57 "headstarted" turtles into the Rupununi river system and is working to expand to other communities past 2013. Yupukari also has a regionally recognized wildlife club, public library and community based ecotourism product that integrate the two studies.

**Martinez-Tilleria, Karina,** *University of La Serena (ULS); Institute of Ecology and Biodiversity (IEB);* **Francisco Squeo**, *University of La Serena, Institute of Ecology and Biodiversity and CEAZA;***Carlos Gaymer,** *University Catholic of the North*

**Proposal of a new conservation object for the selection of land-sea ecotones within a conservation portfolio**

So far, it has not been evaluated the influence of ecotones in conservation portfolios. Particularly important are subsidies between marine and terrestrial eco-regions. This has been implicitly recognized in the promotion of marine-terrestrial protected areas, although are not usually the result of a systematic conservation planning. But, how can we select land-sea joint areas for the integrated conservation? This study evaluates the inclusion of coastal fog (sea-land subsidy) as conservation object within a marine- terrestrial conservation portfolio for Chile. The coastal fog is known to allow the formation of very specific habitats in the coastal zone, promoting the maintenance of biodiversity and high local endemism. For the construction of this conservation object we use MODIS Aqua/Terra images, to develop conservation portfolios it was used the software MARXAN 2.1.1, and for information layer processing we used ArcGIS 10.1. We compared the conservation portfolios generated under different scenarios, with and without the explicit inclusion of the coastal fog as conservation object. We conclude that the coastal fog as a conservation object is a good proxy of terrestrial plant biodiversity in coastal areas and allows the proposal of the integrated protection of both coastal and marine systems.

**Martino, Robin,** *Antioch University New England;* **Norbert J. Cordeiro**, *Roosevelt University;***Beth Kaplin,** *Antioch University New England*

**The Influence of Buffer Zone Matrix Type on the Disperser Assemblage at Two Large-**

**Seeded Canopy Trees in Edge Forest, Rwanda**

Few studies have examined how buffer zone matrix type influences ecological processes in adjacent forest edge. The buffer zone surrounding Nyungwe National Park, Rwanda, has the opportunity to play an important role ecologically in the management of the protected area. Ourresearch looks at how different land uses in the buffer zone influence seed dispersal of large-seeded trees in forest edges. The distribution and abundance of seedlings of large-seeded trees are frequently controlled by the actions of frugivores. Changes in the composition or abundance of frugivores due to matrix effects could alter the pattern of seed removal, thus impacting regeneration processes. We used focal watches to test for differences in seed disperser visitations and dispersal of Chrysophyllum gorungosanum and Syzygium guineense, two large seeded species in forest edges adjacent to tea and pine buffer zones. Including interior control sites, we have a total of 663 observation hours in 2011-2012. Preliminary results indicate greater diversity and abundance of frugivores in forest edges adjacent to pine buffer vs. tea. Results from this research will contribute to the development of a holistic protected area buffer zone management approach that considers the ecological integrity of the protected area in addition to economic benefits of land use in the surrounding matrix.

**Mascia, Michael B. ,** *World Wildlife Fund*

**Marine protected areas and poverty alleviation: insights from Papua, Indonesia**

Marine protected areas (MPAs) are an integral component of local, national, and international strategies for biodiversity conservation, but their impacts on human well-being remain contested. Advocates tout MPAs as win-win strategies for conservation and poverty alleviation, while opponents argue that MPAs place the welfare of fish above the well-being of impoverished fishing communities. To inform this debate, we are monitoring the social impacts of six MPAs in the Bird's Head Seascape (BHS). Using a quasi-experimental design, we examine social well-being across five social domains: economic well-being, health, political empowerment, education, and culture. Preliminary impact data from two MPAs and matched controls provides insights into the short-term impacts of MPA establishment on household well-being. We find that the social impacts of MPAs are far from uniform, with the magnitude and direction of impacts varying within and among social groups, across social domains, and between sites, resulting in complex arrays of impacts. In addition to providing insights for site-level adaptive management, the variable social impacts of MPA establishment in the BHS highlights the need for a more nuanced approach to evaluating the social impacts of conservation interventions as the foundation for analyzing protected area –poverty linkages.

**Mashintonio, Andrew,** *Rutgers University;* **Gareth Russell**, *New Jersey Institute of Technology*

**Incorporating scale in habitat preference models improves prediction maps for elephants**

Identifying the habitat preferences of large mammals is important for their conservation and management. The choice of habitat an animal makes will depend upon what resources it is selecting for and at which scale. We created multiple landscape scales by applying a smoothing kernel to each landscape variable, which averages all pixels within an increasing radius. We tested the difference in model fit between applying the smoothing kernel to all landscape variables together and individually. We used conditional logistic regression to estimate the likelihood of movement patterns of savannah elephants under different combinations of environmental variables at different scales. We compared the habitat preference predictions of maps created using only original, non-smoothed variables and maps created with additional smoothed variables. Smoothing different variables at different scales produced much better predictions of movement than a single scale for all variables. For elephants, maps of landscape quality based on multiple-scale smoothing match observed large-scale distributions of animals much more closely than maps based only on pixel-level selection. This analysis suggests that elephants select different habitat variables from the landscape at different scales, and the inclusion of multiple scales in habitat selection models will aid managers in identifying important habitat.

**Massey, Ashley,** *University of Oxford;* **Sara Hamann***,* *University of Oxford;* **Sandra Nogué,** *Biodiversity Institute, Oxford Martin School* and *Oxford Long-term Ecology Laboratory;* **Shonil Bhagwat,** *University of Oxford, Biodiversity Institute, Oxford Martin School,* and *The Open University;* **Kathy Willis***, Biodiversity Institute, Oxford Martin School* and *Oxford Long-term Ecology Laboratory;*

**Do Ethiopian church forests provide ecosystem services on a landscape scale?**

The arid highlands of Ethiopia have been converted to farmland during the last 100 years and an estimated 35,000 Ethiopian Orthodox Tewahedo Church forests comprise the last remnants of Afromontane forest in the country. Locally known as debr or geddam, the churches and forests surrounding them are considered holy and act as powerful local religious and social institutions. These forest fragments serve as seed banks for native plants, deposits of ecological memory in the agricultural landscape. We identify 464 church forests via Google Earth in the Gondar region of northern Ethiopia, bounded by Lake Tana to the west, Simien Mountains National Park to the north, and the Blue Nile to the south; the aerial view of church domes in patches of green forest contrasts with the surrounding brown agricultural landscape. We assess the ecosystem service of pollination provided by church forests on a landscape scale by creating an animal pollination distance layer using crop cover maps and FAO Pollination Information Management System data in ArcGIS v.10. We employ crop suitability maps derived from bioclimatic factors to determine the potential ecosystem service of pollination in alternative cropping scenarios. Here we show that church forests support pollinators that enable crop diversification, necessitated by bioclimatic (e.g. climate change, pests and disease) or social (e.g. market trends, seed access) factors, adding adaptive capacity to the social-ecological system and enabling adaptation to future conditions. Culturally protected forests can contribute to the CBD’s 2020 Aichi Targets, which aim to conserve areas particularly important for ecosystem services.

**Mastrangelo, Matias,** *National University of Mar del Plata and National Research Council of Argentina;* **Michael Gavin**, *Forestry 231,Department of Human Dimensions of Natural Resources, WCNR, CSU, USA;***Pedro Laterra,** *Faculty of Agrarian Sciences, National University of Mar del Plata, ARG;* **Wayne Linklater**, *School of Biological Sciences, Victoria University of Wellington, NZ;* **Taciano Milfont**, *School of Psychology, Victoria University of Wellington, NZ*

**Understanding and influencing landholders´ options for conserving dry Chaco forests at the agricultural frontier**

Agricultural expansion and intensification drive the fragmentation of dry Chaco forests. Designing interventions capable of reconciling agricultural production and biological conservation requires the integration of ecological and social disciplines. This study evaluated conservation costs (changes in bird species richness) and production benefits (changes in beef cattle yields) along an intensification gradient in cattle production systems of the Argentine Chaco (n=33). Silvopastoral systems integrating native trees and exotic pastures achieved high yields (60-70% of potential yields) and high bird species richness (70-90% compared to nearest forest), however, remnant forest fragments were critical for the conservation of forest-restricted bird species. Therefore, factors influencing intentions to conserve forest remnants were evaluated in surveys to landholders (n=89). The psycho-social model of the Theory of Planned Behaviour (TPB) explained more variance in conservation intentions (r2=0.41) than a model combining the TPB, pro-social motives and landholder identity (∆AIC=14.76). Beliefs that conserving remnant forests is approved by others (social norms) and positive evaluations of remnant forests (attitudes) had the largest influence on intentions (β=0.59 and β=0.23). Interventions should promote existing pro-conservation norms within smallholders groups and establish higher environmental benchmarks among commercial producers to encourage conservation of forest remnants.

**Masuda, Yosuke,** *Yokohama National University*

**More Flexibility, Better Outcomes? - A Case Study of Marine Fish Habitat Offset in Queensland, Australia－**

There are always robust debates over how much administrative flexibility the institutional process should have, and the process for identifying and delivering biodiversity offset is no exception. Although some researches indicate the need for the more flexible operation of the biodiversity offset program in marine or coastal area, it is still not clear that what level of flexibility is appropriate for the biodiversity offset process. The present study analyzes the institutional structure and current implementation status of the marine fish habitat offset program in Queensland, which has a highly flexible operational method over the selection of offset measures, for validity verification of flexibility in biodiversity offset, and discusses advantages and disadvantages of the flexibility to increase the knowledge and perception of appropriate flexibility level for the biodiversity offset process. I conclude that the flexibility contributes to achieve better outcomes to some extent in this case, yet, appropriate flexibility depends on the conditions of scientific uncertainty and geographical limitations, and marine or coastal areas may require higher flexibility than terrestrial areas.

**Mathur, Anjali,** *Raj Rishi Govt. College, Alwar, Rajasthan*

**Integration of technologies to combat insect pests in agro ecosystems: An Indian perspective for the management of eggplant shoot and fruit borer.**

Agricultural productivity and protection of the biodiversity that underpins it are greatly dependent on the integration of theories, disciplines and technologies. While ecological engineering tools involving integrated pest management (IPM) practices has a wider public acceptability, agricultural biotechnology using genetic engineering on the other hand has limited uptake and has given both, commercial production of 'biopesticides' and the making of GM crops, Bt brinjal (Eggplant) being the first vegetable for Indian agricultural sector for the management of eggplant shoot and fruit borer (ESFB). Since IPM limits over reliance on any specific technology and its consequences such as pest resistance, resurgence and environmental contamination, the present study reviews IPM modules for the management of ESFB like resistant cultivars, use of biopesticides, botanicals, microbial formulations and sex pheromones. Results revealed that integration of different IPM modules helped in development of successful IPM strategies. In the recent past there has been much debate regarding the insect-resistant Bt Brinjal and the influence that a single mortality agent such as 'Bt gene' can have on the insect pest regulation and control. Although it can keep pest populations at extremely low ebb, it could potentially harm natural enemies disrupting ecosystem processes in long run. A scope for synergy thus reflects that GM crops can be most effective when they are used as part of IPM strategies.

**Matthews, John,** *WCPA/IUCN*

**Integrating freshwater ecosystems into protected area priorities and landscape planning**

Terrestrial, aquatic, and estuarine protected area managers are all water resources managers, whether they realize it or not. How then do we integrate freshwater effectively into conservation and protected areas? Freshwater is more than rivers, lakes, and wetlands; freshwater spans the whole hydrological cycle, incuding evapotranspiration, soil moisture, precipitation, and groundwater. By extension, managing freshwater resources in protected areas means managing across the whole of the cycle in a way that can reflect (and sometimes buffer) key eco-hydrological processes and functions. Water is also contested terrain, and dynamic in response to climate and economic pressures in ways that are critical for PA managers to understand. Here we discuss how to approaches for managing water resources coherently and effectively to sustain the water embedded within ecosystems and protected areas.

**Maxwell, Sean,** *The Environmental Decisions Group*

**How much is new information worth? Evaluating the benefits and costs of resolving uncertainty in natural resource management**

A trade-off commonly faced by decision-makers in natural resource management is whether to spend scarce resources on acting in the face of uncertainty, or gaining additional information in hope that it will improve management performance in the future. Value of information analysis can help facilitate this trade-off by determining how much management performance could improve if additional information is acquired. This study applies the concept of value of information analysis to the management of a declining koala (Phascolarctos cinereus) population in Queensland, Australia. Decision-makers managing this population must choose management strategies despite uncertainty about the accuracy of koala survival and fecundity rates, and the influence of forest cover on these rates. An age-structured matrix model of the koala population was used to evaluate the expected management performance for a range of budgets with current levels of information, and if uncertainty were to be resolved. This study is the first to translate the improvement in management performance due to resolving uncertainty into a dollar value. The results of the value of information analysis suggest that resolving uncertainty will do little to improve koala management performance, and that no more than 1.7% of a budget should be spent on gaining additional information. In this case, allocating resources to direct management action will probably give a better return on investment than gaining information.

**Tessa Mazor,** *The University of Queensland;* **Salit Kark,** *The Hebrew University of Jersualem;* **Hugh Possingham,** *The University of Queensland*

**Collaboration among countries in marine conservation can achieve substantial efficiencies**

Multinational collaboration is important for successfully protecting marine environments. However, few studies have assessed the costs and benefits incurred by taking collaborative action. One of the most complex marine regions in the world is the Mediterranean Sea biodiversity hotspot. We aimed to examine how collaboration between countries of the Mediterranean Sea affects conservation plans when costs and threats are considered. We compared three collaboration scenarios to test the efficiencies of coordinated marine conservation efforts; full coordination between Mediterranean countries, partial coordination between continents and no coordination where countries act in isolation. To do so, we developed a basin-wide surrogate for commercial and recreational fishing effort in the Mediterranean Sea. Using a systematic decision support tool (Marxan) we minimised the opportunity costs while meeting a suite of biodiversity targets. We discovered that in order to reach the same conservation targets, a plan where all the countries of the Mediterranean Sea collaborate can save over two thirds of the cost of a plan where each country acts independently. The benefits of multinational collaboration are surprisingly unequal. This approach, which incorporates biodiversity, costs and collaboration into a systematic conservation plan, can help deliver efficient conservation outcomes when planning spatially explicit actions within marine environments shared by many countries.

**Mazurek, Robert,** *Pew Environment Group*

**Global Ocean Legacy: Creating the World's First Generation of Oceanic-Scale Fully Protected Marine Reserves**

It’s been 140 years since Yellowstone National Park, the world’s first great terrestrial park, was established in the western United States. Since that time, virtually every country on Earth has protected important sites for biological, cultural, geological, historic, and scenic reasons. Unfortunately, conservation in the sea has taken a profoundly different course, with a remarkably small area of the world’s oceans protected to date. The Pew Environment Group’s Global Ocean Legacy project was created to protect and conserve some of the Earth’s most important and unspoiled marine ecosystems through the establishment of very large, fully-protected marine reserves. Through these efforts we hope to secure the designation of up to 15 oceanic-scale no-take marine reserves by 2020, thereby creating the first generation of the world’s great marine parks. To date, the first four of these parks have been designated, three of which are the world’s largest. Those include Papahânaumokuâkea Marine National Monument, the Mariana Trench Marine National Monument, the Chagos Marine Reserve, and the newly designated Coral Sea Marine Park in Australia.

**McAlpine, Clive,** *The University of Queensland;* **Christine Adams-Hosking**, *The University of Queensland*

**Using expert knowledge for a threatened species: a national elicitation to quantify koala population trends.**

Elicitation of expert opinion is a widely-used tool when data is limited or patchy. It is potentially useful for making conservation decisions because there is often a lack of empirical data on population numbers and trends. We conducted a structured elicitation procedure to quantify demographic trends for the Koala, that is declining throughout much of its natural range. Fifteen koala experts were asked to make bioregional estimations about koala population numbers and trends using a sliding window of the past three and future three generations, in a four-step question format. They were required to provide: a lowest plausible population estimate; a highest plausible population estimate; a best estimate and confidence that the true values were contained within the upper and lower bounds (range 50-100%). We found that bioregional koala populations in the states of Queensland and New South Wales, where they are now listed federally as vulnerable, have declined by 20% - 73% and 4% - 50% respectively, with the exception of one bioregion where koalas increased by 6%. In Victoria and South Australia, where koalas are not listed, populations have declined by 2% - 29%, with a 16% increase in one bioregion where koalas have been reintroduced. This elicitation process provides, for the first time, quantitative information to inform decision makers and land managers. It will assist in the implementation of a Recovery Plan for a species of national and international significance.

**McClintock, Will,** *University of California Santa Barbara*

**SeaSketch: A Participatory Marine Spatial Planning Software Service**

SeaSketch (seasketch.org) is a software service launched in October, 2012, as an end-to-end mapping solution for marine spatial planning. Building on our experience developing MarineMap for MPA planning in California, we developed SeaSketch to reflect "geodesign" principals where anyone, regardless of their technical abilities, may sketch prospective management plans and receive analytical feedback on the consequences of their designs. Importantly, a web-based interface may be accessed by planners to (a) define the geographic scope of the project, (b) create users and groups with specific permissions, (c) add map layers, (d) create "sketch classes" for each type of management tool (e.g., MPAs, aquaculture sites, energy sites, transportation zones, etc.), (e) associate sketch classes with analytical scripts, (f) create discussion forums that are dynamically tied to maps, and (e) define and launch geospatial surveys to collect information about the distribution of resources and human activities. SeaSketch is being used for marine spatial planning in the Hauraki Gulf of New Zealand, the Galapagos Islands, the Mediterranean Sea, the United States, and Barbuda by partners in the New Zealand Department of Conservation, the United Nations Environment Program - World Conservation Monitoring Center, NOAA, and a host of academic partners. We will highlight how SeaSketch is being used to facilitate stakeholder engagement and the use of the best available science for decision making.

**McCreless, Erin,** *Univ. of California Santa Cruz;* **Stuart Butchart**, *BirdLife International;***Don Croll,** *Univ. of California Santa Cruz;* **Nick Holmes**, *Island Conservation;* **Kelly Newton**, *Univ. of California Santa Cruz;* **Bernie Tershy,** *Univ. of California Santa Cruz;***Dena Spatz**, *Univ. of California Santa Cruz;* **Chris Wilcox,**

*CSIRO*

**Predicting extinction risk for threatened island vertebrates due to impacts from invasive alien mammals**

Islands are global hotspots of biodiversity and threat: island species make up a disproportionately large number of historic extinctions and currently endangered taxa. The leading threat to island biodiversity is invasive alien species (IAS), particularly mammals associated with human activity. The relative impacts of different IAS on native populations are unknown, making it difficult to prioritize the most damaging species for eradication programs. We used the first comprehensive global island dataset of native and introduced species to quantify all known co-occurrences of native vertebrates and common invasive mammals, and identified cases of confirmed and suspected extirpations of the native fauna. Island vertebrates were most often extirpated in the presence of rats, mice, cats, mongoose, and mustelids. Native birds were 2-10 times more likely than native reptiles, amphibians, or mammals to disappear on islands with IAS. We used a logistic regression analysis to investigate additional predictors of extinction risk, including the number and combination of IAS and island size, latitude, and climate. We demonstrate that extinction risk for island species can be quantified and predicted using historical species records and simple island characteristics. The ability to explicitly measure extinction risk, and thus to predict the extinction risk averted via IAS eradication, is a critical step forward in developing robust conservation plans for islands globally.

**McCue, Laura,** *NOAA Fisheries Service PIRO;* **Jayne LeFors***, NOAA Fisheries Service PIRO;* **Jean Higgins***, NOAA Fisheries Service PIRO*

**Protecting Hawaiian Spinner Dolphins from Disturbance Caused by Interactions with Humans in the Main Hawaiian Islands**  
Hawaiian spinner dolphins (Stenella longirostris) rest during the day and feed and forage at night. These dolphins routinely utilize shallow coves and bays close to shore during the day to rest, care for their young, and avoid predators, before traveling to deeper water offshore at night to hunt for food. Human interactions with dolphins in their resting habitats have increased over the past three decades, with spinner dolphins being the target of viewing or swim-with tours on a daily basis. These interactions are disrupting their natural behavioral patterns, and disturbing the dolphins' daytime rest. The cumulative impacts on Hawaiian spinner dolphin populations are also of concern as many of these dolphins may be targeted multiple times per day, which could lead to population-level effects from a reduction in the dolphins' overall fitness. In response to these growing concerns, NOAA Fisheries is proposing conservation actions with both regulatory and non-regulatory measures to protect wild spinner dolphins in the main Hawaiian Islands, and to prevent human activities that may cause "take," as defined in the Marine Mammal Protection Act and its implementing regulations. NOAA Fisheries also continues to implement the Dolphin SMART program in Hawaii, a voluntary education program encouraging responsible viewing of wild dolphins to help aid in wild dolphin conservation.

**McDonald, Sara,** *Duke University;* **Deborah Gallagher**, *Duke University*

**Can Stakeholder Participation Save the Harbor Porpoise?**

Harbor porpoises (Phocoena phocoena) are periodically caught in groundfish fishing gear in the northeastern U.S. (called bycatch). To mitigate bycatch, the Marine Mammal Protection Act of 1972 directs the National Marine Fisheries Service (NMFS) to convene a group of fishermen, scientists, environmentalists, and government managers, called a Take Reduction Team (TRT), to develop and execute a consensus-based Take Reduction Plan (TRP). TRTs create policy change by focusing on empirical issues and building trust. We employed multiple disciplines (natural and social sciences) to examine the impact of the Harbor Porpoise TRT on harbor porpoise bycatch. The TRT first convened in 1996 and implemented a TRP in 1999. Prior to 1999, bycatch had been declining, but was above the maximum removal level (termed PBR). Although bycatch fell below PBR early on, it has exceeded PBR in five of the most recent seven years. TRT members attributed this to non-compliance with TRP regulations. They created a new plan that was implemented in 2010. In 2012 a NMFS official altered one of the consensus-based actions without consulting the team. This undermined the TRT's long-term trust and social capital, outraged some TRT members, and triggered a boycott of one stakeholder group. Even if the TRT cannot achieve consensus in the future, NMFS must take action. These actions could lead to litigation and politicization begging the question, can stakeholder participation save the harbor porpoise?

**McFadden, Katherine,** *Clemson University;* **Eugenia Naro-Maciel,** *College of Staten Island, City University of New York*

**Green Sea Turtles and Marine Ecosystem Health: A Case Study From Palmyra Atoll**

Palmyra Atoll, a remote Central Pacific National Wildlife Refuge, is described as a pristine ecosystem because of its remarkably intact food web and the absence of current anthropogenic stressors. However during WWII it was structurally reconfigured into a military installation. Questions remain about what contaminants may have been released, and their potential effects on the atoll's ecosystems and species. We assessed the health of green sea turtles at Palmyra, a major foraging ground for this globally endangered herbivore. We sampled blood from 157 green turtles from 2008- 2012 for hematology, plasma chemistries and heavy metal exposure. Hematological and plasma chemistries were consistent with reported levels for healthy green turtles, and body condition indices indicated that less than 1% had poor body condition. Heavy metal screenings revealed low levels of most metals and toxins including arsenic, magnesium, cadmium, lead, and copper. However very high levels of iron and silicon indicated some toxins may be leaching into the food web. While these abnormal levels need to be further investigated, most health results indicate green turtles at Palmyra are free from contamination at levels one might expect in light of the Refuge's history. The research provides key insights into the previously unknown health status of a globally endangered species at an isolated protected area of complex history, with conservation and management applications.

**McField, Melanie,** *Healthy Reefs Initiative/Smithsonian;* **Lorenzo Alvarez**, *Smithsonian Institution*

**Informing Reef Management Decisions Through Ecosystem Health Report Cards And Eco-Audits In The Mesoamerican Reef.**

The Healthy Reefs Initiative (HRI) is a collaboration of 48 international, regional, and local partner organizations working to conserve the Mesoamerican Reef (MAR). HRI produces biennial Report Cards on the ecological health of the reef and Eco-Audits measuring the management response. The 2012 Report Card includes almost 200 sampling sites measuring reef condition based on a Simplified Index of reef health, which ranks values for: coral cover, fleshy macroalgal cover, herbivore biomass and commercial fish biomass. The majority of reefs were found to be in poor (40%) or critical (24%) condition, with only 10% ranked as good or very good, and 25% in fair condition. However, this report did measure a slight improvement in overall reef health compared with the 2010 assessment. In light of global coral reef declines, even such a slight improvement is noteworthy and encouraging. While the Index is useful for summarizing the complexity of reef health taking a closer look at individual indicators helps to understand the sources of declines and develop management actions. The Report Card includes reef management recommendations developed and prioritized in a regional workshop with partner organizations. The extent to which these recommendations are implemented in the MAR countries is then evaluated through the Eco-Audits, which help to catalyze stronger management actions.

**McGarvey, Daniel,** *Virginia Commonwealth University*

**Using equivalence tests to reverse the burden of proof in endangered species science - a 'BASEHIT' for imperiled species' advocates**

Conventional null hypothesis testing is inappropriate for use in endangered species management because the "no effect" null hypothesis places the burden of proof upon endangered species and their advocates. The express mission of the Endangered Species Act (ESA) is to ensure that human activities are "not likely to jeopardize the continued existence of any endangered species." Thus, the ESA dictates that the burden of proof should be reversed and re-assigned to parties whose actions may cause or exacerbate species' imperilment. Equivalence tests, which are often used in pharmaceutical research, provide fully vetted alternatives to null hypothesis tests. In an equivalence testing framework, one assumes that two experimental populations are different (i.e., a significant effect exists) until strong evidence is provided to the contrary. When applied to ESA reviews, this framework will require regulated parties to assume the burden of proof and demonstrate that proposed activities will not harm listed species. To facilitate the use of equivalence testing methods, I present BASEHIT - Best Available Science through Equivalence-based Hypothesis and Inference Testing. BASEHIT is a free software tool that uses an intuitive, graphical user interface to perform equivalence-based alternatives to common statistical methods (e.g., t-test, linear regression). It will allow managers to abandon null hypothesis tests and relieve them of the burden of proof in many ESA review scenarios.

**McGuire, Sean,** *Maryland Office Sustainable Future*

**How has Maryland's GPI been most valuable in decision-making and what are the next steps for Maryland and other states?**

State governments across the U.S. are exploring innovative measures to evaluate policy effectiveness, budget efficiency, and overall societal progress. Such measures include lists of impact indicators, valuation studies that supply full cost accounting, and aggregated valuation figures like the Genuine Progress Indicator (GPI). While states may look to such benchmarks on a specific policy topic, however, full integration of non-traditional approaches lags far behind in supplanting or even complementing metrics like the Gross Domestic Product and similar estimates of growth when making day-to-day decisions. Maryland’s Government first calculated its GPI in 2010 and now updates data annually. Even with strong high-level support and national recognition, the shift from using the GPI as an interesting lens to a dominant tool for policy and budgetary analyses and decision-making is proving difficult for many reasons: bureaucratic inertia, lack of public understanding and acceptance, the power of sound bites and media coverage, jurisdictional competition, and wariness towards change. The session will describe these barriers from a Government perspective and some of the methods Maryland is pursuing to overcome obstacles. We will encourage interaction with attendees to identify potential steps to spur future transition to adoption and use of alternative measures.

**McKee, Anna,** *USGS - Atlanta, GA*

**Developing eDNA assays for threatened amphibian species in acidic wetlands of the southeastern US**

Acidic ephemeral ponds in the southeastern US provide habitat to a number of endemic imperiled species, including four ephemeral pond-breeding amphibians: the frosted flatwoods salamander (Ambystoma cingulatum), reticulated flatwoods salamander (A.bishopi), gopher frog (Lithobates capito), and striped newt (Notophthalmus perstriatus). Using environmental DNA (eDNA) for inventory and monitoring of these species may facilitate assessing the efficacy of current management strategies; however, DNA may degrade quickly in these acidic conditions, limiting the utility of the eDNA technique. We developed quantitative polymerase chain reaction (qPCR) primers and probes (i.e. markers) specific to the gopher frog, striped newt, and both flatwoods salamander species. To test these markers under ideal conditions, we isolated eDNA from water samples collected from captive populations of gopher frogs, striped newts, and reticulated flatwoods salamanders. All markers successfully amplified target species eDNA, with minimum DNA amounts ranging from 1.1\*10-4 ng for the reticulated flatwoods salamander to 5.5\*10-3 ng for the gopher frog. Furthermore, we demonstrate the efficacy of these markers in natural, acidic ponds with known target species presence and absence. Successful detection of species with these markers should aid surveys of four of the most imperiled southeastern amphibians, and provide baselines for future work, such as assessments of reintroduction efforts.

**McKinley, Peter,** *The Wilderness Society*

**Implementing Conservation in the Context of Climate Change in a Western Maine Forested Landscape**

Implementation of conservation plans conceived outside of the context of climate change is challenging enough. Updating and implementing these plans in the context of climate change adds considerable difficulties from scientific and social standpoints. While high uncertainties regarding patterns of ecological disassembly and reassembly are a significant challenge to the science, equal or greater challenges remain in the realm of implementation. We are making demonstrable progress in both the planning and implementation of conservation in the context of climate change in a landscape of several hundred thousand acres in western Maine. Our work with partners and stakeholders has led to the identification of a potential new high elevation National Wildlife Refuge alongside a portfolio of other conservation projects ongoing or completed. This landscape has long been noted for its large blocks of contiguous forest and viable animal and plant populations from northern hardwood, mixed-wood, boreal spruce-fir, and alpine communities. These diverse attributes exist along a rather pronounced latitudinal ecological gradient and transition zone exaggerated by a mountainous topographic gradient that we contend will assist various short term and long term adaptation mechanisms. The range of ecological attributes has brought diverse factions of people together based on the range of short term and long term conservation values they recognize.

**McLaughlin, Patrick,** *Drexel University;* **Gail Hearn**, *Drexel University*

**A Multi-Species Analysis of Chytridiomycosis Infection and Resistance in West-Central Africa**

Chytridiomycosis is a disease in amphibians caused by the chytrid fungus (Batrachochytrium dendrobatidis), and is implicated in recent global amphibian declines. It is believed to pose a serious threat to over 30% of all amphibian species. There is an urgent need to identify ways to stop the spread of this fungal pathogen. The source of this pathogen is unknown, but strong evidence suggests a vector via the African clawed frog (Xenopus laevis), a popular model species for a variety of biological studies. Chytrid research in West-Central Africa may be pivotal to future conservation initiatives. Over 20 amphibian species across 13 genera were sampled in this region (Bioko Island, Equatorial Guinea) to examine chytridiomycosis infection. Skin swabs from each individual were tested for chytrid presence and infection load, while additional swabs were used to sample skin bacteria and bacterial metabolites. Sampling occurred across a wide elevational gradient during both the wet and dry seasons. Results from qPCR analysis reveal high prevalence (15+ species) across a wide elevational range. All positive individuals exhibited low, non-lethal infection loads, suggesting possible widespread resistance. Ongoing identification of skin bacteria and anti-fungal metabolites may reveal a possible mechanism for this resistance. The results will contribute to knowledge of chytrid origins and offer insight to recent efforts to develop a chytrid probiotic for threatened amphibian populations.

**McLaughlin, Shawn,** *NOAA*

**Observations on Local, Regional, and Global Declines of Marine Mollusks**

The global decline of non-marine mollusks is well documented with 1000s of species included on the World Conservation Union Red List of Threatened Species and Endangered Species List. Few marine mollusks are listed despite greater overall diversity and increased exposure to climate change, invasive species, fishing, and habitat degradation. The loss of marine mollusks on the Atlantic coast of the U.S. has been attributed to overharvesting, disease, and habitat degradation. More recently, declines in softshell clam fisheries in Maine have been reported to be linked to the inability of spat to set on acidic sediments making them more vulnerable to predation. In Chesapeake Bay, the softshell clam population is threatened by losses due to increased fishing pressure, disease, high temperature, habitat degradation, and predation. The potential impact of ocean acidification on softshell clams in Chesapeake Bay and other marine species worldwide remains to be determined. Moreover, few long term studies of climate change have been conducted in the oceans compared to terrestrial systems and the potential impacts of multiple anthropogenic stressors acting additively, synergistically or antagonistically remain largely unknown. In this study, observations on the decline of softshell clams in Chesapeake Bay are presented and compared with marine mollusk declines in other regions of the Atlantic coast. The question of a global decline of marine mollusks will also be addressed.

**McMillan, Amy,** *Buffalo State College*

**Genetic Connections: Seasonal Migration and Gene Flow in the Common Loon, *Gavia immer***

Common loons, *Gavia immer*, comprise an interesting species with which to study the genetic link between seasonal migration and gene flow (or breeding site 'migration'). Common Loons are long-lived, large piscivorous birds that breed in lakes of northern North America and Iceland. Loons are highly philopatric and territorial in breeding areas and also seem to return to the same wintering area. They are subject to multiple threats during all stages of their life (e.g., mercury poisoning, lake acidification, oil spills, botulism). In this study >600 loon samples collected from throughout the range in North America were used to determine population structure using five polymorphic microsatellite loci. Loons breeding near the east coast were strongly differentiated from loons in the rest of the range. Loons west of New Hampshire and Quebec showed a significant level of differentiation. Loons breeding in Wisconsin and New York were genetically distinct from other populations as well. This pattern of genetic differentiation can be partially explained by seasonal migratory routes; birds wintering on the west coast and in the Gulf of Mexico overlap in breeding areas but this may not be true of eastern birds. Understanding population genetic structure and relationships of both wintering and breeding populations will provide information on the impacts of stressors to loon populations. These results may also inform population genetic studies of other migratory birds.

**McMillan, Kirsten,** *Institute of Zoology*

**The dynamics of amphibian emergent infectious diseases: a multi-level approach**  
Emerging infectious diseases have significant effects on biological communities. In some cases, pathogens have caused host extinctions. The majority of research has focused on a 'one host - one pathogen framework'. However, individual hosts encounter multiple pathogens simultaneously, leading to additive, antagonistic or synergistic effects. The dynamic interaction between pathogens is an important issue in conservation biology, as it can increase infection prevalence and severity. While establishing the cause of extinction is difficult and candidate model species are few, amphibians appear to be an ideal specimen as increasing evidence suggests that we are facing a global population decline. Ranavirus and the Chytrid fungus are the primary pathogens associated with amphibian mortalities. To investigate the distribution and severity of the pathogens in Ontario, Canada, we tested 2,100 adult Northern Leopard frogs (Rana pipens) for the presence of disease. We collected our samples throughout the summer months of 2012 and 2013, from 40 different sample sites. Utilising these results, we modelled the dynamics of both pathogens simultaneously. We were interested in evaluating the dynamical impact of seclusion and disease-induced mortality on the community of pathogens. This provides us with a mechanism in which to study competitive dynamics on the scale of individuals, and their large-scale consequences.

**McNamara, James,** *Imperial College and the Zoological Society of London;* **EJ Milner-Gulland**, *Imperial College;***Marcus Rowcliffe,** *Zoological Society of London;* **Justine Shanti-Alexander**, *Bejing Forestry University;* **Guy Cowlishaw**, *Zoological Society of London*

**How Hunters and Agriculturalists are defining the Urban Bushmeat Trade in Ghana.**

It has been estimated that the annual production of bushmeat in Ghana may be as much as 400,000 tons per annum. The average annual production of fish and livestock between 1991 and 1998 was 407,000 tons and 57,600 respectively. The bushmeat trade would appear to be a major contributor to protein production in the region, yet to date, and due in part to the largely informal nature of the trade, our ability to produce detailed quantitative analyses of the drivers of supply and demand has been hindered by a lack of long-term data. We aim to address this gap; using a unique 27-year bushmeat market data set collected in the city of Kumasi, and using methods borrowed from the econometrics literature, we present the findings of a simultaneous supply and demand model, that uses complementary data on commodity prices, agricultural incomes, agricultural labour, macroeconomic indices and seasonal rainfall patterns to provide a geographically focused holistic overview of the commercial trade. Our results suggest that the commercial trade is defined more by the livelihood characteristics of the hunters and the expansion of agricultural lands, than the demands of urban consumers. Additionally bushmeat supplies are becoming increasingly inelastic, unable to respond to price signals from the market. These findings have direct implications for management, and question the degree to which curbing urban demand will feed back into a reduction in hunting pressure.

**McPherson, Tsitsi,** *NA*

**Conservation and Human Rights, an opportunity for Indigenous Peoples empowerment: a case study from Guyana, South America.**

Conservation measures seeking to protect biodiversity without considering human populations intimately associated with the lands have had limited success. Using Guyana, South America, as a case study two conservation strategies are evaluated, one focusing primarily on biodiversity, the other being an integrated framework that acknowledges the human-biodiversity dynamics of indigenous peoples and their association with the land. Areas of conservation interest were determined using Maxent to model and overlay species distributions across Guyana. Using a biodiversity-only approach to conservation and available State lands, the Government of Guyana could convert approx. 16% of its land to protected areas. Engaging Guyana's indigenous peoples in the decision making, administration, and management of protected areas would dramatically increase the percent of Guyana's lands under conservation measures to approx. 32 %. Given the remoteness of the many proposed protected areas and the limited interest in and knowledge of Guyana's biodiversity by people living along the coast, a collaboration between Guyana's indigenous peoples as primary stakeholders in the conservation process at the planning, implementation, and management phases and the Government of Guyana could greatly enhance conservation measures in the country while address underlying human rights issues associated with conservation in Guyana. This assessment is timely as Guyana has recently passed its Protected Areas Act.

**McRae, Louise,** *Institute of Zoology, Zoological Society of London;* **Ben Collen**, *Institute of Zoology, Zoological Society of London*

**Tracking change in wildlife populations: the Living Planet Index database**

Understanding the long-term dynamics of wildlife populations is integral to our understanding of past, present and future biodiversity trends. The implications for conservation of being able to track fine scale trends in population abundance are well recognized. Established in 1999, the Living Planet Index is a synthetic tool to aggregate vertebrate population time series trends to gain a broad view of biodiversity trends. It currently encompasses some 12,500 population time series across 2,800 species of vertebrate. We present a review of the data that are contained in this continuously updated online database and report on a gap analysis of its coverage as a global biodiversity indicator. Using of a number of case studies, we illustrate how population trend information can be usefully aggregated to help understand trends at several spatial scales in the past, present and predicted into the future. We recommend key areas for strengthening data coverage, and address how data from this database might be integrated with other biodiversity resources to enhance our understanding of biodiversity trends.

**MedellÌn, Rodrigo,** *Instituto de EcologÌa-UNAM*

**Latin American Bat Conservation Network: Locally-led continental collaboration**

Latin America contains more bat species than any other region in the world and they face diverse threats, from direct killing to roost vandalism to habitat destruction and misguided vampire bat control. Latin America also has a significant number of bat professionals committed to conservation. RELCOM has become an articulated, effective, continent-wide conservation effort. Through education, research, and conservation actions, RELCOM has integrated 19 countries to save bats from Argentina and Chile to Mexico and across the Caribbean. Working on migration ecology, infectious diseases, endangered species, and more, RELCOM members (all local, effective conservation professionals) share a strategy, priorities, objectives, and success indicators. Training exchanges, courses, effective communication, meetings, and a horizontal structure all contribute to the successful growth and impact of the Network. Most countries have identified the Areas of Importance for the Conservation of Bats, thus linking a continent-wide grid that highlights the importance of bats and promotes the conservation regionally and country by country.

**Meijer, Seline,** *World Agroforestry Centre;* **Delia Catacutan**, *World Agroforestry Centre;***Sileshi Weldesemayat,** *World Agroforestry Centre;* **Maarten Nieuwenhuis**, *University College Dublin*

**Farmers and forest conservation in Malawi: How attitudes and perceptions affect intentions and behaviour**

Malawi's high population pressure has accelerated agricultural expansion and increased the demand for forest resources, resulting in forest loss. This study explored farmers' perceptions and attitudes towards cutting trees from the forest and linked these to their behaviour in relation to forest conservation. Using the theory of planned behaviour as a conceptual framework, an attitude scale was developed to explore three attitude components: attitudes, subjective norms and perceived behavioural control. Household questionnaires containing the attitude scale were administered to 200 farmers in Malawi. Attitudes towards cutting trees from the forest were mostly negative. Contrary to our hypothesis and the theory, the intention to cut down trees from the forest was predicted by the subjective norm and perceived control over the behaviour, but not by the attitude. Farmers who perceived natural forest cover to be low were less likely to collect firewood from the forest and had a higher density of planted trees on their land. Although most farmers were against cutting trees from the forest and understood the negative impacts associated with it, attitude was a poor predictor of the intention to cut down trees. Instead, perceptions of forest cover were more important motivators for forest conservation behaviour such as firewood collection and tree planting in Malawi. Understanding farmers' motivations for forest conservation is vital for designing effective conservation policies.

**Melero, Yolanda,** *University of Aberdeen, Institute of Biology and Environmental Sciences.;* **Matthew Oliver**, *University of Aberdeen, Institute of Biology and Environmental Sciences.;***Xavier Lambin,** *University of Aberdeen, Institute of Biology and Environmental Sciences.*

**Turning back the tide of American mink invasion at unprecedented scales in partnership with scientists and citizens**

Successful eradications of harmful introduced invasive species have been mostly confined to islands while programs in mainland areas remain small and cost-ineffective. A fundamental applied question is thus how to optimize invasive management at large scales while minimizing costs. In 2006, we created a project to achieve large scale eradication of invasive American mink in Scotland based on a partnership of citizens and scientists. The project was initiated by us (ecological scientists), implemented by trained volunteers, and latterly supported by social and computer scientists working on motivation and digital tools for volunteers. At present, the project has attracted > 600 volunteers including conservationists, hunters, farmers and rangers and it has succeeded to remove breeding mink from 10000km2. Concurrently the scale of the task involved and the amount of data gathered allowed us to research issues in population ecology at a scale not normally amenable to investigation. We demonstrated that population productivity rates differ among areas with "hotspots" of productivity and emigrants dispersing up to 50km. However, rates of reinvasion varied among areas potentially due to density-dependent recolonization. These findings have been used to define the appropriate spatial scale of control and allocation of resources and thus, optimise conservation efforts. The success of this project relied on functional volunteer participation guided by the scientific research.

**Mendelson, Joe,** *Amphibian Ark*

**Amphibian Ark, Building an ark for 500 of the world's most threatened amphibians.**

The Amphibian Ark (AArk) is the ex situ, captive breeding, action-arm of the 2007 Amphibian Conservation Action Plan that was assembled by a diverse delegation of stakeholders. It is a global network of participants, and has no central facilities or amphibian populations. Primary activities of the AArk include prioritizing and identifying species for conservation programs, especially focusing on those that would perish in the wild in the absence of immediate placement of founder populations in safekeeping, removed from the threats in the wild. Captive programs are pro-active emergency stopgap components of the integrated conservation plan for these species, and are not considered to be the conservation plan itself. Responsible reintroduction programs and capacity building to establish the ex situ programs in the range country of the amphibian species are ongoing principle priorities of the program. AArk is a joint effort of three principal partners: the World Association of Zoos and Aquariums, the IUCN SSC Conservation Breeding Specialist Group, and the Amphibian Survival Alliance. Other programs include outreach education and advisement to policymakers and stakeholders globally. Special challenges include biosecurity of ex situ populations, with regards to amphibian diseases, and funding.

**Mendezona, Arren,** *Colorado State University*

**Working with gaining community support in coastal management and policy communication: A case study of**

**southern Cebu, Philippines**

**Merenlender, Adina,** *University of California, Berkeley;* **Shane Feirer**, *University of California*

**Integrating Habitat Linkages and Climate Space to Increase Protected Area Resilience**

Maintaining and improving habitat connectivity through the conservation of wildlife corridors or habitat linkages is the most frequently used tactic for increasing resilience of reserve networks to climate change. However, we are still in the initial stages of determining how to best design linkages to reduce the impacts of climate change in fragmented landscapes. Enhancing connectivity to facilitate predicted range shifts for species is fraught with uncertainty. Therefore, we focus on which habitat corridors in North Coast California expand the distribution and representation of climate space using down-scaled climate models. This approach examines different characteristics of climate based on distinct assumptions for improving reserve network resilience to climate change. The first is that the advantages of connectivity are greatest for areas that will experience faster rates of climate change. The second is that a reserve network that harbors greater climatic diversity will allow for greater adaptation; and the third is that maintaining access to cooler climates is a high priority. Each climate characteristic (rate of change, diversity, lower temperatures) results in a different suite of priority linkages, emphasizing the need for greater consideration of how corridors may function to increase climate change adaptation.

**Michaelis, Adriane,** *University of Maryland, College Park;* **Hillary Lane**, *University of Maryland, College Park;***Steven Allen,** *Oyster Recovery Partnership;* **Kennedy Paynter**, *University of Maryland, College Park*

**Measuring oyster (Crassostrea virginica) restoration success in the northern Chesapeake Bay.**

Restoration of eastern oyster (Crassostrea virginica) in the northern portion of the Chesapeake Bay is a complex task, requiring collaboration from a wide range of entities. With this in mind, it is critical to confirm that such efforts are effective. Quantifying restoration success recently became more clearly defined through benchmarks targeting minimum oyster densities of 15 oysters/m2 and biomass of 15 g/m2 to identify an oyster bar as restored. These metrics were generated by a partnership of federal, state, and academic scientists and officials, all associated with the Chesapeake Bay restoration effort. This study presents an overview of restoration monitoring from 2008 through 2012. Patent tong surveys revealed that within one year of planting of hatchery-reared juvenile oysters (spat-on-shell), the majority of bars showed oyster densities and biomasses exceeding minimum targets. At older bars, surveyed three or more years post-planting, a smaller proportion of sites monitored from 2008 through 2012 met or approached 15 oysters/m2 and 15 g/m2. Though the number of sites currently meeting restoration metrics are low, when paired with an adaptive planting approach and increased spat survival observed since 2010, positive trends are anticipated in oyster restoration in the Maryland portion of the Chesapeake Bay.

**Mickelberg, Jennifer,** *Zoo Atlanta;* **Jonathan Ballou**, *Smithsonian Conservation Biology Institute;***Benjamin Beck,** *Save the Golden Lion Tamarin;* **Andreia Martins**, *Golden Lion Tamarin Association*

**Evaluating the transfer of genetic diversity from the captive to the reintroduced population of golden lion tamarins, Leontopithecus rosalia**

Reintroduction can serve as a conservation tool for increasing the demographic and genetic health of a population. The golden lion tamarin, (Leontopithecus rosalia; GLT), an endangered primate native to Brazil's Atlantic Coastal forest, had been reintroduced to native habitat from 1984-2000 with the objective of increasing population numbers as well as transferring gene diversity from the captive population to the wild. In this study, pedigree analysis was used for the captive and reintroduced populations to evaluate how well gene diversity was transferred from the captive to the reintroduced population, how much of that genetic diversity has been retained and to determine if future reintroductions could further contribute to the wild population's genetic diversity. Results indicate that of the 51 potential captive founders, 42 are represented in the reintroduced population. Genetic status is generally favorable with the population maintaining 96.6% of the source population's genetic diversity. If carefully selected, future reintroductions could potentially benefit the reintroduced population's genetic diversity. This study demonstrates the power of using pedigree analysis for assessing reintroduced populations.

**Mihok, Barbara,** *SCB Europe Section, Centre for Ecological Research, Hungarian Academy of Science;* **Eszter Kovács**, *Environmental Social Science Research Group, St. István University;***Katalin Margóczi,** *University of Szeged, Department of Ecology;* **György Málovics**, *University of Szeged, Institute of Economics and Economic Development;* **Judit Gebert**, *University of Szeged, Institute of Economics and Economic Development;* **György Pataki,** *Environmental Social Science Research Group, St. István University; Department o;***Eszter Kelemen**, *Environmental Social Science Research Group, St. István University;* **Ágnes Kalóczkai,**

*Environmental Social Science Research Group, St. István University*

**Ecosystem service concept can help us better understand land use conflicts**

Trade-offs in ecosystem services (ESs) often emerge as a result of land-use changes initiated by nature conservation regulations. The aim of this research is to reveal how linking trade-offs between ESs with stakeholders at different spatial and temporal scales can become a powerful tool to analyse land-use changes and related conflicts? Three case studies from the Hungarian Great Plain were compared integrating the ESs concept, trade-offs, stakeholders and scale. In the case study areas land-use changes occurred in the 1990s' due to nature conservation restrictions and land acquisitions. Field work was carried out between 2007 and 2011 applying qualitative methods (interviews and focus groups) to identify important ESs by different stakeholder groups. History of land-use changes and related ecosystem services were assessed using archival data. Local farmers have been the main losers of the land-use change, while there are many winners both at different spatial and temporal scales. In all three areas conflicts between local farmers and the national park emerged, but no conflicts between farmers and other beneficiaries. In many cases ESs are enjoyed and perceived at different spatial and temporal scales, separating stakeholders with conflicting interests both in time and space. Building on the results of the assessment, policy and other instruments can be advised specifically to investigate and handle the scale mismatches and the conflicts.

**Miller, Daniel C. ,** *University of Michigan*

**The effect of enforcement on trade-offs between biodiversity conservation and livelihoods in the W National Parks of Benin and Niger**

A rapidly growing literature seeks to identify and explain the social and ecological impacts of protected areas in diverse settings across the globe. Although recent studies using rigorous program evaluation methods have shed new light on these impacts and the relationship between them, the mechanisms through which protected areas generate impacts are less well understood. This paper highlights enforcement—regular monitoring and sanctioning of compliance with rules— as an important mechanism shaping protected area impacts. It examines how differences in enforcement supported by the European Union-funded Protected Ecosystems in Sudano-Sahelian Africa (ECOPAS) project affected biodiversity and livelihoods outcomes in the transboundary W National Parks of Benin and Niger. Using multilevel regression analysis, I find that a greater increase in enforcement in Benin lead to greater improvements in biodiversity, but more negative impacts on household income and access to resources in comparison with Niger. However, effects were more variable in Niger: households experiencing greater increases in park enforcement in that country saw more negative livelihoods impacts, due in part to increased crop and livestock depredation by wildlife. Results suggest that protected area policy should anticipate those groups whose livelihoods are likely to be most negatively affected by changing enforcement regimes and develop strategies to offset potentially negative consequences.

**Pillip, Miller,** *IUCN/SSC Conservation Breeding Specialist Group*; **Philip Nyhus,** *Colby College*; **Pollak, John**, *Cornell University*; **Becky Raboy**, *University of Toronto*; **Sara Zeigler**, *Virginia Tech*

**Confronting the invasive species crisis with PVA: An explicit, two-species metamodel of an endangered bird and its nest parasite in Puerto Rico**

Despite the value that population viability analysis (PVA) brings to endangered species conservation planning, the approach suffers from a single-species focus, ignoring important implications of interactions among species. This is most important when considering invasive species and their impacts on native species. The practice of "metamodeling" has been recently introduced to the conservation community, featuring multiple discipline-specific models sharing information in real time to better understand complex systems. We worked with a diverse group of experts across multiple disciplines to apply this new approach to management of the Yellow-Shouldered Blackbird in southwest Puerto Rico, in response to nest parasitism by invasive Shiny Cowbirds. Separate simulation models for each species were created, with explicit functional relationships defining the demographic impact of Cowbird nest parasitism on Blackbird reproduction. When run within the metamodel framework, Cowbird abundance and parasitism rates are passed to the Blackbird model and used to modify breeding success. The analyses project a slow Blackbird population decline due to high mortality rates given the observed low recruitment. Reversing this decline will require aggressive removal of Cowbirds or the elimination of their impacts on Blackbird nests, and managing other post-fledging mortality factors. This important analysis is one of a precious few explicit, individual-based two-species PVA efforts to date.

**Miller, Tom,** *Chesapeake Biological Lab*

**Management of blue crab in the Chesapeake: Science to ensure the sustainability of a bay icon**

Recent changes to blue crab management that focus on conservation of spawning females has led to increases in adult and juvenile blue crab that set the stage for a sustainable fishery while protecting the services blue crab provide to the Chesapeake ecosystem. Despite warnings of calamity early in the 20th Century, management of this species relied little on science until the end of the century. Traditional fisheries included pot and trotline fisheries for hard and soft shell crabs and a dredge fishery that caught a disproportionate number of on egg bearing females. Beginning in 1995, efforts to integrate our knowledge through stock assessments identified important gaps in our scientific understanding and harvest data. Inter-jurisdictional effects such as the BiState Blue Crab Committee played an important role in setting goals and expectations. Key investments in research by regional science and management agencies decreased uncertainties in estimates of stock status and motivated changes in management. In 2008, conservation measures to protect egg bearing females were implemented. The most recent 2011 assessment shows signs of population recovery reflective of the impacts of the conservation measures. Challenges, including sustaining the population recovery and managing increases in effort, remain but the recent history of blue crab fisheries management in the Chesapeake Bay is a success story.

**Miller, Valerie,** *Colorado State University;* **Britt Basel**, *Colorado State University;***Michele Bratschun,** *Colorado State University;* **Jessica Fischer**, *Colorado State University*

**Cattle ranchers confront climate change and improve production: An evaluation of silvopastoral systems in the Coapa River watershed in Chiapas, Mexico**

Small-scale ranching for dairy production is the primary livelihood activity in the Coapa River watershed, in Chiapas, Mexico; located between two biosphere reserves. This master's thesis assesses whether silvopastoral systems (SPS) are a viable strategy in the watershed for climate change adaptation, the conservation of natural resources, and the strengthening of livelihoods. We used multiple methods including qualitative data coding from stakeholder interviews and a discounted cash flow analysis to evaluate the effect of SPS on adaptive capacity and on socio-ecological resilience. Results include the conservation of 39.75 ha of land. Data suggest that over 10 years SPS are more profitable and can result in a net present value that is 32.5% and 42.4% higher than conventional systems in the lower and upper regions of the watershed respectively. Dispersed trees in pasture, diversified protein banks, and rotational grazing are the most effective practices for obtaining both financial and ecological benefits. We determined that SPS build adaptive capacity by enhancing the five livelihood capitals (natural, social-political, human, physical, and financial) on which the resilience of a system depends. Important success factors were environmental education and networks formed of ranchers and conservation organizations. Continued expansion of SPS is pivotal for increasing landscape connectivity, reaching conservation targets, and increasing the resilience of the region.

**Miller, William,** *Towson University;* **Gail Gasparich**, *Towson University;***Joel Snodgrass,** *Towson University*

**The Effects of Urbanization on Gene Flow and the Genetic Structure of a Headwater Salamander, Desmognathus fuscus, Over Multiple Spatial Scales**

Many organisms are arranged in spatially explicit populations that are linked by the transfer of individuals among optimal habitat patches. Dispersal represents both spatial and temporal connectivity, and can be indirectly inferred via gene flow. Anthropogenic disturbance associated with urbanization may limit connectivity and decrease gene flow between populations. Organisms inhabiting stream networks may be particularly vulnerable to habitat fragmentation, as population processes are additionally constrained by stream network geomorphology, water flow, and individual dispersal strategies. Understanding how terrestrial and aquatic habitat fragmentation affects headwater species is of particular importance, as they experience a higher degree of isolation and more varied disturbance regimes. Microsatellite markers were used to compare patterns of gene flow in a headwater salamander, Desmognathus fuscus, between urban and rural watersheds. Gene flow was assessed using a paired spatial design across four watersheds. Preliminary results indicate the importance of both aquatic and terrestrial dispersal pathways in maintaining gene flow. High degrees of genetic differentiation between some closely located sites in urbanized areas and little difference among other, more widely dispersed sites in rural areas resulted in little relationship between Euclidian or stream distance among sites and genetic differences.

**Miller-Rushing, Abe,** *National Park Service*

**Networking across disciplines: conservation science and the field of public participation in scientific research**

Over much of history people without formal training in science were responsible for most of the science being done. Contributions from the public still make key contributions today. Until recently, their contributions were overlooked by much of the scientific community and the public, but that is changing quickly. The number of projects designed explicitly to engage the public in the scientific process has exploded in recent years, driven largely by the perceived educational benefits for participants. Additionally, scientists and conservationists are recognizing that engaging the public in scientific endeavors can help answer scientific questions and address conservation challenges that would not be possible otherwise. The rapid growth of the field of public participation in scientific research (PPSR) has brought to light several challenges faced by the field, many of which are common to other aspects of conservation biology—working in interdisciplinary teams to achieve common objectives; linking science, education, and conservation actions; evaluating project success; gaining acceptance as “real” science; and communicating across audiences that include practitioners, participants, and decision makers. Currently there is a movement to formalize the field of PPSR and create a new professional organization that will facilitate the development of solutions to these challenges and the spread of innovations, research results, and evidence-based best practices.

**Milt, Austin,** *University of Tennessee in Knoxville;* **Paul Armsworth**, *University of Tennessee in Knoxville*

**How additional rare species surveys change our conservation priorities**

Species distribution surveys are usually a central component of spatial prioritization for conservation. Additional species surveys have the potential to change the places we decide to protect. But by how much? How different would our priorities be if we updated them with the information we will have next year? In this paper we quantify the amount that new surveys of rare species change the conservation ranking of watersheds in Tennessee. We find that the results depend on the way in which watersheds are ranked. For instance, when ranking watersheds by apparent species richness, additional surveys have little effect on priorities. Further, this effect decreases as we amass survey data. When ranking watersheds by their contribution to complementary richness, additional surveys have, in many cases, an order of magnitude larger effect on priorities. As in the previous case, the effect diminishes with a growing dataset. Unlike the previous case, additional surveys may continue to change conservation priorities well into the future when prioritizing by complementary richness. These results indicate that additional rare species surveys can serve a greater and ongoing use when we prioritize complementarity across candidate sites than when we view sites in isolation.

**Mintzer, Vanessa,** *University of Florida;* **Anthony Martin**, *University of Dundee;***Vera da Silva,** *Instituto Nacional de Pesquisas da Amazônia;* **Marianne Schmink**, *University of Florida;* **Kai Lorenzen**, *University of Florida;* **Thomas Frazer,** *University of Florida*

**Interdisciplinary research on illegal harvesting of river dolphins: insights and opportunities for conservation**

Community-based initiatives are often promoted as a means of encouraging conservation attitudes and behaviors, but their effectiveness in improving ultimate conservation outcomes has rarely been demonstrated. We conducted interdisciplinary research in the Brazilian Amazon to assess the extent of illegal harvesting of Amazon River dolphins (Inia geoffrensis) for fisheries bait, its impact on dolphin mortality, and the effectiveness of community-based conservation initiatives in limiting illegal harvest. Illegal harvest was found to be widespread (reported in 62.5% of the communities visited). A mark-recapture analysis of dolphin survival indicated that illegal harvest has led to more than a doubling of dolphin mortality rates since the start of the practice in approximately 2000. Community-based initiatives associated with the Mamirauá Sustainable Development Reserve (MSDR) and Projeto Boto, a non-profit research program, were found to have been effective in promoting a positive fisher attitude toward river dolphins. By conducting interdisciplinary research, we revealed that although current harvest rates may be unsustainable, the MSDR and Projeto Boto have played an effective role in limiting dolphin mortality rates by promoting conservation attitudes and behaviors. Such initiatives provide a model to improve and expand dolphin conservation efforts in the region.

**Miteva, Daniela,** *Duke University*

**Forests & Context: Factors Shaping the Effectiveness of Indonesia’s Protected Areas**

Even though protected areas (PAs) remain the most dominant conservation intervention in developing countries, little is known about the factors affecting their performance. Focusing on Indonesia’s villages between 2000 and 2003, we examine how socio-economic context shapes PA effectiveness at preventing deforestation and alleviating poverty. We use matching methods that allow us to isolate the causal impact of protection. Post-matching, we apply nonparametric regressions to examine how the impact varies with factors that proxy for the local benefits and costs of conservation: the protected villages’ proximity to markets, poverty, electoral participation and social capital. We find that the average impact on deforestation and poverty varies by PA type. For example, while national parks significantly decreased deforestation, strict reserves had the opposite effect. Only the multi-use PAs had a significant negative impact on poverty. However, our findings indicate that the effectiveness of the different types of PAs varies significantly with the distance to markets and the socio-economic characteristics of the villages. Our results suggest PAs are effective when the benefits to local people from conservation exceed the costs imposed on them by limiting extractive activities. By highlighting which factors shape the effectiveness of protected areas in reducing deforestation and poverty, our work has important policy implications for conservation and development alike.

**Miyazaki, Yusuke,** *Kanagawa Prefectural Museum of Natural History;* **Akira Terui**, *The University of Tokyo;***Akira Yoshioka,** *The University of Tokyo;* **Izumi Washitani**, *The University of Tokyo*

**A restoration and conservation agenda for the fishes of the Shubuto River System**

Assessments of fish diversity in the Shubuto River System, Hokkaido, Japan, for the purpose of nature restoration based on the Kuromatsunai Town Biodiversity Strategy were conducted in 2010-2012, following the ecological filter concept. The aims of this study were to 1) determine the potential species pool by biogeographic surveys, 2) evaluate the present state of fish species composition by field surveys, 3) determine the past fish species composition by specimen and interview surveys and 4) provide effective restoration plans by identifying the attributes of lentic habitats with high fish diversity. For the 1st aim, the potential species pool was composed of 21 diadromous and 10 primary fishes. For the 2nd aim, all native fishes (ref. the former) except 2 species were recorded. The abundance of diadromous fishes was high, whereas that of lentic habitat users was low. For the 3rd aim, declines and population extinctions of lentic habitat users were inferred. For the 4th aim, high local fish diversities were recorded in large and deep temporary waters located in adjacent lower reach of the main river, and Lethenteron spp. and Gymbogobius opperiens were considered to be indicator species of the regional fish diversity in the floodplains. These results indicated the need for the conservation of longitudinal connectivity and the restoration of floodplain wetlands in the river system. We proposed a design for the ecological restoration of the floodplains based on the results.

**Mockrin, Miranda,** *USDA Forest Service;* **Sarah Reed**, *Wildlife Conservation Society, Colorado State University;***Liba Pejchar,** *Colorado State University*

**Conservation development: how does this alternative to rural sprawl contribute to private land conservation and residential development in Colorado?**

Over the past several decades, concerns about the environmental effects of low-density rural development have led to regulations that provide guidelines or incentives for conservation development. This alternative to rural sprawl is characterized by developments with smaller lots, clustered homes, and the preservation of a significant amount of open space (>50%). Examining the spatial relationship between conservation developments and protected areas (PAs) is an important first step towards understanding the degree to which these housing developments augment or diminish landscape-scale conservation efforts. We gathered parcel-level spatial data on 196 conservation developments, including private lots and open space, for 12 counties in Colorado (approximately 75% of the known conservation developments in the state). Although conservation development occurs on a fraction of the developable land (

**Mohamed, Nassoro,** *university of dar es salaam*

**Reintroduction of an Extinct-in-the-Wild amphibian: the return of the Kihansi Spray Toad to its habitat in the Udzungwa Mountains of Tanzania**

The Kihansi Spray Toad (Nectophrynoides asperginis) was restricted to the smallest known range for any vertebrate species, with an estimated historic wild population of 17,000 toads found within 2 hectares of waterfall spray zone in the Kihansi Gorge of the Udzungwa Mountains in south-central Tanzania. Discovered by scientists in 1996, the toad was believed to be extirpated from its small patch of habitat in 2004, and was officially declared Extinct in the Wild by the International Union for Conservation of Nature (IUCN) in October 2009. As the species was declining, the Government of Tanzania collaborated with the Wildlife Conservation Society to establish a captive assurance colony at the Bronx Zoo, and later at the Toledo Zoo and at facilities within Tanzania. In 2012, offspring produced at these institutions were used in a reintroduction effort that is ongoing and being coordinated amongst several stakeholders within Tanzania and internationally.

**Mohan, Vik,** *Blue Ventures Conservation;* **Alasdair Harris**, *Blue Ventures Conservation;***Laura Robson,** *Blue Ventures Conservation*

**Population-Health-Environment: lessons learned by Blue Ventures from five years of integrating family planning with marine conservation in Madagascar**

Blue Ventures is a marine conservation organisation that empowers coastal communities in Madagascar to sustainably manage their natural resources. In response to an expressed unmet need by the communities we partner with, we started providing family planning and other health services five years ago, then fully integrated these with our conservation work to form a Population-Health-Environment (PHE) programme. Longitudinal data from clinical records and household surveys show that this programme has resulted in a fourfold increase in contraceptive use and reduced birth rates by a third, slowing population growth to the extent that the population is now 5% less than it would have been without this intervention, thereby decreasing pressure on natural resources and supporting local conservation efforts. The programme is reaping the benefits of integration by sharing resources and skills between projects, strengthening community participation across the breadth of our activities, reaching wider audiences with combined health and conservation messages, and enabling communities to understand the complexity of environmental challenges by appreciating the links between reproductive health, food security and conservation. As a result, we are more effective in achieving both conservation and health goals than if either were tackled separately. By sharing our methods and lessons learned, we aim to inspire and empower other organisations to adopt this integrated approach.

**Mohsanin, Samiul,** *WildTeam;* **Adam Barlow**, *WildTeam;***Christina Greenwood,** *WildTeam;* **Anwarul Islam**, *WildTeam;* **Mofizul Kabir**, *Jahangirnagar University;* **Mizanur Rahman,** *WildTeam;***Alam Howlader**, *WildTeam*

**Assessing the threat of human consumption of tiger prey in the Bangladesh Sundarbans**

One of the main threats to wild tigers Panthera tigris is poaching of natural prey yet information is lacking about this threat for most of the tiger's range. For tiger conservation in the Sundarbans Reserved Forest of Bangladesh, information is needed to assess the impact of prey poaching and the effectiveness of conservation actions to reduce this threat. This study used an interview survey of people living close to the Sundarbans to estimate the scale of prey poaching, investigate factors driving prey poaching, and capture information on the nature of prey consumption. Half of the households reported consuming deer meat, with mean consumption of 1.13 kg/household/yr; equivalent to 11195 deer killed. Deer meat was generally consumed for its good taste, with households closer to the forest boundary and with higher income levels with relatively higher levels of consumption. Although cost of deer meat was higher than other available meat, 29% of households obtained deer meat for free. Deer meat tended to be obtained from personal contacts, and consumed in private. Most respondents (91.5%) knew deer consumption was illegal, but 69.4% viewed the law as ineffective. The study findings will be used to design focused regulation and awareness activities to reduce prey consumption in the area. The approach used to evaluate prey poaching through investigation of prey consumption follows studies of wild meat consumption in Africa, and can potentially be applied to all tiger landscapes.

**Molnar, Jennifer,** *The Nature Conservancy;* **Sheila Walsh**, *The Nature Conservancy;***Timm Kroeger,** *The Nature Conservancy;* **Robert McDonald**, *The Nature Conservancy;* **Peter Kareiva**, *The Nature Conservancy*

**Incorporating Ecosystem Services into Corporate Decisions: Results from site-level analysis**

The idea that nature delivers benefits to humans is an easy sell. Turning that idea into changes in business practices is not so simple. It is clear what conservationists think they are achieving by pushing for the valuation of ecosystem services. What businesses hope to gain from ecosystem valuation is not going to be easy to achieve. To address these challenges, we've evaluated 3 ecosystem services at The Dow Chemical Company's facility at Freeport, TX: freshwater supply, natural hazard protection, and air quality maintenance. Our approach demonstrates how ecological information can be tied to economics and used by a company. Our results make a business case for investing in nature to meet a business need: that reforestation can be a cost-comparative alternative for air quality compliance, before accounting for public and ecosystem benefits. We also showed that natural solutions aren't always enough: we modeled how coastal habitats reduce flood heights and economic damages from storms, but not enough to reduce a planned levee's height 10km inland. And we assessed public and ecosystem values, not just the private benefits: coastal habitats provide large benefits to local communities and habitat for wildlife, in addition to supplementing the levee's storm protection. Conservation isn't going to be a win-win solution for business and nature in every case on its own, but this methodology significantly advanced business's ability to account for nature and understand tradeoffs.

**Montambault, Jensen Reitz,** *The Nature Conservancy*

**Working science: making information valuable to conservation decision-makers**

The conservation practitioner habitat is home to diverse populations of scientists, managers, funders, governance bodies and the public. When this practitioner ecosystem is functioning well, information and other resources flow easily among these populations. Conflict occurs when investments in conservation science are not commensurate with information needs, leading to monitoring programs that flounder unbudgeted, marooned datasets that are analyzed only in salvage sessions, and management and policy decision-makers feeling stood-up by science. One solution to placing science and management on more of a “collusion” rather than “collision” course is selecting the most important conservation interventions to invest in high-inference science using risk and leverage potential as guideposts. Ongoing conservation projects involving The Nature Conservancy and partners from a broad array of geographies and ecosystems illustrate this approach. Decisions to invest in conservation science may be based on additional management rationale including information needs directed by legal entities, partners and funder interests, as well as the need to assess pervasive interventions at multiple independent field sites that would not individually have potential for risk or leverage. These social processes provide challenges and opportunities for public agency, non-profit, academic, government and funders to invest resources in science that is a keystone in the conservation practitioner ecosystem.

**Moore, Donald,** *Smithsonian National Zoo/Conservation Biology Institute;* **Mark Sturm**, *National Park Service*

**Collaborative capacity-building in the Southern Cone on behalf of endangered Pampas deer and habitat: An evolving success story.**

Our studies of endangered Pampas deer (Moore 2001, Sturm 2001) took place on Uruguayan private ranches where this "National Historic Monument" was protected by local landowners as part of their personal commitment to protecting national patrimony. Since that time, we have remained associated with stakeholders including ranchers' associations, Ministries and Institutes as well as many NGOs operating throughout the historic range of Pampas deer, and wildlife managers and academics who are consistently in-country and committed to understanding and sustaining Pampas grassland and species. Our collaborative capacity-building activities have included outreach to ranchers' association meetings, using WCS-NPS-SUNY support to host an IUCN-DSG co-sponsored, Uruguay-based Distance Sampling workshop (2002), leading a Smithsonian-led behavior workshop in Argentina (2010), and helping to anchor a Uruguayan ecotourism workshop via our NPS and Smithsonian bases of operation (2010). The positive, professional results of this interdisciplinary, collaborative capacity-building are evidenced in the all-Uruguayan-authored works by Gonzalez for adults (2010) and children (2011), as well as our assistance in PhD thesis defense by Cosse (2010). This persistent collaboration over more than two decades, with and by many of our committed colleagues from various disciplines in Argentina, Brazil and Uruguay, has the single intent of conserving one of Earth's most important grasslands and native wildlife

**Moore, Kara,** *University of California, Davis;* **Bruce Pavlik**, *Royal Botanic Gardens Kew*

**A regional approach to evaluating rare plant vulnerability to renewable energy development in the California Deserts**

Renewable energy development in the California Desert Region is advancing at a rapid pace driving a pressing need for biological information on rare species to guide conservation and mitigation. This region is home to diverse and idiosyncratic rare plants that have poorly documented biology and distributions. How can we rapidly collect the information necessary on species- and site-specific population dynamics to design mitigation and conservation measures? We have developed an integrated approach to assessing the vulnerability of a suite of representative rare plant species. We have implemented a prioritized series of demographic and experimental studies to determine the types of species and life stages most vulnerable to impact or prone to conservation efforts. We have found substantial variation in vegetative and sexual reproduction between study populations for several rare plants, including between populations that vary in putative impact by development. For a subset of species for which we are able to conduct population viability analysis, we have identified sensitive vital rates and determined and compare quasi-extinction probability under different scenarios. By utilizing practical experiments to test for the effects of real or simulated impacts, we have found differences in vital rates between natural and disturbed populations adjacent to and within solar installations and significant negative effects of panel shade on rare plant communities.

**Moore, Rebecca,** *Google Earth*

**Roadless area mapping at global scale via Google Earth Engine**

Google Earth Engine is a new technology platform that enables monitoring and measurement of the earth’s environment at global scale. The platform includes a large catalog of earth observation data and offers intrinsically-parallel computational access to thousands of computers in Google’s data centers. Earth Engine includes an application programming framework, or “API”, that allows scientists access to these computational and data resources, to scale their current algorithms or develop new ones. Methods previously developed for road disturbance mapping at small (city) scale are being implemented in Google Earth Engine, on Google’s large database of road information, to generate roadless area and road disturbance maps at country, continent and global scale. Combining science with massive data and technology resources in a cloud-computing framework can offer advantages of computational speed, ease-of-use and collaboration, as well as transparency in data and methods. This can aid in supporting a more informed and systematic global approach to conservation planning and policy.

**Moore, Robin,** *IUCN Amphibian Specialist Group*

**In Search of Lost Frogs: A backdoor approach to conservation communication**

Engaging an apathetic public in the conservation of less charismatic creatures can be a tricky business. But if we are to scale up conservation efforts for the most threatened vertebrate group, the amphibians, this is exactly what we need to be doing. So how do we engage a public that is increasingly jaded by prophecies of inevitable doom and gloom? I will discuss two campaigns designed to deliver a serious message about amphibian conservation in an unconventional package: The Search for Lost Frogs and Metamorphosis. The Search for Lost Frogs dispatched more than thirty teams in twenty countries in search of species ‘lost’ to science. The campaign was quickly picked up by the media and generated over 650 news articles in 20 countries with a potential viewership of over a billion. The initiative resonated with the public, tapping into a sense of adventure and exploration, and rediscoveries transformed amphibians from symbols of extinction to symbols of hope in Israel, Borneo and beyond. The campaign reinforced the potential of rediscoveries as a policy and publicity tool, and of amphibians as flagship species for conservation. Secondly, I will present Metamorphosis, a unique visual campaign blending science and art to explore our connection with amphibians. The series picked up first place in an International Photography Contest and continues to draw attention and stimulate discussion among a diverse audience.

**Moreira, Danielle,** *Universidade Federal do Espírito Santo;* **Clinton Jenkins**, *North Carolina State University;***Sérgio Mendes,** *Universidade Federal do Espírito Santo;* **Stuart Pimm**, *Duke University*

**What history tells us about fragmentation and regional extinction of mammals in the Atlantic Forest?**

The Brazilian Atlantic Forest has an extraordinary terrestrial biodiversity. Large mammals might be the most well-known species, but they are still poorly known when it comes to the status of their conservation. Most medium and large sized mammals are threatened, a consequence of extensive habitat destruction. This brings up the question: How many of these species are likely to be prone to regional extinction in the Atlantic Forest? We address these issues for 24 species of mammals listed as threatened. We gathered historical and current observation points from naturalists' and scientific publications and through interviews with experts. We then calculated the density of forest fragments to identify remaining suitable habitat within the species' ranges. Observation points were divided into historical (before 1990) and current records (after 1990) and then superimposed on the density maps. Mammals are currently present mostly where the forest density is higher. For some species, such as the lowland tapir, giant otter, and giant anteater, no current records were present in some areas of higher forest density. Ten species do not have current reports for the last 20 years for some regions, meaning they are very likely to become regionally extinct, if they are not already. Historical analyses like this reveal possible regional extinction of species in a simple way, especially when they are not readily apparent.

**Morimoto, David,** *Lesley University;* **Michael Martin**, *University of Waterloo;***Alice Layton,** *Rupununi Learners Foundation*

**Conservation through study abroad: Joining indigenous and global stakeholders through mutual transdisciplinary education in Guyana's Rupununi region**

The Guyana Lesley Abroad Service Semester is a novel university program that models the kinds of integrative efforts needed today for effective biodiversity conservation. GLASS simultaneously leverages assets and integrates interests of various stakeholders across multiple systems in one of Earth's most biologically diverse landscapes, the Rupununi of Guyana, South America, at a time of great and rapid change. Specifically, GLASS links the goals of indigenous Guyanese villagers seeking employment, cultural preservation, and natural resource management with those of a local NGO pursuing educational development, a social enterprise looking for ways to sustain its village-based research, education, conservation, and development programs, a university in search of students questing to enlarge and contribute to their world, and faculty with a passion for engaging students in place-based learning about the complexity of living systems and the challenges of conservation. Through four integrated classes students engage in mutual education and genuine service projects with villagers who become teachers, students, leaders, and empowered stakeholders. Students immersed in village life gain Indigenous Knowledge as they learn formally about tropical ecology and conservation, and they apply what they learn and teach across various disciplines through village-based collaborative projects focused on cultural preservation, natural resource management, conservation, education, and research.

**Morley, Craig,** *Waiariki Institute of Technology;* **Linton Winder**, *Unitec Institute of Technology*

**The effect of mongoose (Urva auropunctatus), island quality and habitat on the distribution of native and endemic birds on small islands within Fiji**

This study investigated the effect of the presence of an introduced predator, environmental quality and habitat on the distribution of native and endemic birds on 16 small islands within Fiji. Previous studies attribute bird declines and extirpation anecdotally to the mongoose. In total, 9055 birds representing 45 species were observed within four key habitats (forest, villages, crop land and coastal vegetation) on the 16 islands, half of which had mongoose present. The presence of mongoose, environmental quality and habitat type had a measurable influence on observed extant native and endemic bird communities. We conclude that three ground birds were negatively influenced by the presence of mongoose and that eight birds were particularly dependent on good quality forest habitat. Conservation priorities in relation to protecting Fiji's endemic birds (and other endemic species)from the effect of mongoose and habitat modification are discussed and preventative measures suggested.

**Morris, William,** *The University of Melbourne;* **Michael Runge**, *US Geological Survey, Patuxent Wildlife Research Center;***Peter Vesk,** *The University of Melbourne*

**The value of information for Box-Ironbark forest and woodland management**

When management is done under uncertainty, monitoring or experimentation can facilitate management decisions with greater expected benefits. But it is only rational to monitor if the expected net gain of sampling is positive. A value of information analysis can a priori assess the efficacy of reducing uncertainty via sampling. We performed value of information analyses for Box-Ironbark Forests and Woodland management in central Victoria, Australia. These analyses revealed whether to experiment and monitor to reduce uncertainty in a system model, as well as which aspects of model uncertainty and sampling strategies are most cost-effective to address. We found that the outcome of forest management was much more sensitive to some model parameters such as the rate at which harvested or thinned trees coppiced, than it was to others, like the rate of wildfire disturbance. Of a set of plausible sampling strategies there were clear winners in terms of which aspects of the system should be the focus of monitoring to achieve the greatest cost effectiveness. Our analyses show it is more cost-effective to monitor certain aspects of the system and employ a targeted sampling design than monitoring with a view to reducing uncertainty in all dimensions of model space simultaneously.

**Morson, Jason,** *Rutgers University;* **Hal Brundage**, *Environmental Research and Consulting, Inc.;***Eleanor Bochenek,** *Rutgers University*

**Movements and Habitat Use of Juvenile Atlantic Sturgeon in the Delaware Estuary**

Atlantic sturgeon belong to a prehistoric group of fishes that existed for more than 70 million years. A principal fishery in the Delaware Estuary was supported in the late 1800s and early1900s. Populations of Atlantic sturgeon are at historically low levels along the Atlantic coast of North America. Considerable research on the biology of sturgeon in the Delaware River and Bay has been performed. However, little is known regarding the occurrence, distribution, and movements of juveniles. Knowledge of the seasonal utilization of different parts of the estuary by, and habitat requirements of juvenile sturgeon is critical to the species' protection, management, and recovery. The lack of informed knowledge of their essential habitats precludes the implementation of appropriate protection and enhancement management strategies. In order to address this we collected and acoustically tagged juvenile Atlantic sturgeon (n =56) in the Delaware estuary. Sturgeon tagging took place between October 2008 and November 2011. Sturgeon movements were monitored using a network of 127 receivers throughout the estuary from October 2008 through January 2012. Atlantic sturgeon utilized different parts of the estuary at different stages of juvenile development. The implications of these findings for management strategies of Atlantic sturgeon in the Delaware estuary are discussed.

**Moseby, Katherine,** *Arid Recovery;* **John Read**, *Ecological Horizons;***David Paton,** *The University of Adelaide;* **Adam Bester**, *Arid Recovery;* **Steven Delean**, *The University of Adelaide*

**Keep on Counting; the importance of long term monitoring in reintroduction programs**

Arid Recovery is an Australian conservation organisation that benefits from long term support from mining, government, community and university partners. This strong partnership provided rare logistical support to enable long term post-release monitoring of four species of IUCN- listed reintroduced mammals. Population indices of the bilby, burrowing bettong, stick-nest rat and western barred bandicoot were measured up to 39 times over 12 years after release and compared with environmental variables using generalised additive models. Interestingly, even over a 12 year timeframe, there was strong evidence for an overall temporal increase in density for three out of four species, suggesting that reintroduced populations may take decades to stabilise. Interspecific differences in population fluctuations were due to varied responses to rainfall, summer temperatures and time since release. These differences helped formulate species-specific future release strategies including release timing and size of release sites. We suggest that after the initial intensive monitoring of reintroduced individuals to determine short term success, a second phase of population monitoring should be conducted seasonally until strong temporal population increases after release are no longer apparent. Long term monitoring should also encompass several cycles of environmentally-induced fluctuations to enable reintroduction success to be effectively evaluated.

**Moura, Alexandrina,** *Joaquim Nabuco Foundation and Federal University of Pernambuco*

**Conservation Units in the biome Caatinga, Brazil**

The Caatinga is the only tipically Brazillian biome and it occupies 11% of the country, located in the Northeast, one of Brazil's poorest area. The Caatinga displays a wealth of species and environments, with a unique biodiversity. It is the most populous semiarid region of the worlds and most of its 27 million habitants use natural resources to survive. The Brazilian semiarid region is known for its adversities of climate order, low water availability and irregular rainfall distribution. There is a process of desertification as a result of climatic factors and inadequate management of land that require social policies for benefiting the population and, at the same time, to preserve the Caatinga. In this context, this paper analyzes the Conservation Units under the governmental administration and focuses on the impacts of these protected areas in the socio-environmental agenda of Brazil and its contribution to improving the quality of life of local population.

**Muffett, Carroll,** *Center for International Env'l Law*

**The Role of Science in International Legal Action on Climate Change**

The prospects for an ambitious and binding global agreement on climate change have grown increasingly uncertain, even as the evidence of serious climate impacts grows around the world. These impacts are being felt from Arctic communities to African villages to small island nations, many of which are struggling for their very survival. As political processes have stalled, State and non-State actors are exploring new legal strategies to transform the climate debate and drive meaningful policy change to address the climate threat. These strategies involve a huge array of forums, plaintiffs and defendants—from legal opinions at the International Court of Justice, to appeals to human rights bodies by individuals and communities, to consideration of transboundary climate impacts in environmental impact assessments under regional treaties. Along with the traditional legal hurdles faced in all litigation, potential plaintiffs in transboundary climate litigation must confront intense diplomatic and economic pressures, the limited jurisdiction of tribunals and the complexities of proving cause and effect in the climate context. International trade law and its fora must learn to accommodate climate policies as well. By building our understanding of the linkages between global trends and local impacts, scientists will play an important role in the development and utilization of these new legal approaches to addressing climate change, and in their outlooks for success.

**Muhling, Barbara,** *NOAA NMFS SWFSC, Miami, FL*

**Spawning of Atlantic tunas in the northern Gulf of Mexico: environmental constraints and response to climate change**

Atlantic bluefin tuna (Thunnus thynnus) are widely distributed throughout the Atlantic Ocean, however spawning is mostly restricted to the Mediterranean Sea and the Gulf of Mexico. Historical cruise data from the Gulf of Mexico show that bluefin tuna larvae have primarily been collected between early May and mid June, within a defined temperature range. In contrast, spawning of tropical tunas such as yellowfin tuna (T.albacares), blackfin tuna (T. atlanticus) and skipjack tuna (Katsuwonus pelamis) commences in spring and continues through summer, without a strong upper temperature limit. Given their different thermal tolerances and spawning requirements, it is likely that bluefin tuna and tropical tunas will show different responses to the effects of climate change. To investigate this, we applied future predictions of water temperature sourced from a dynamically downscaled climate model for the Gulf of Mexico and Caribbean to spawning habitat models. Potential changes in spawning habitat for each species in the Gulf of Mexico were then quantified for the middle and end of the 21st century. While spring spawning grounds for bluefin tuna were predicted to increase slightly in March, and decrease through April, May and June, spawning grounds of tropical tunas were predicted to increase. These results have significant implications for the future management of highly migratory tunas in the north Atlantic. In addition, our work also serves as a useful test case showing the advantages and disadvantages of using correlative, temperature-based models to predict future impacts of climate change on marine species.

**Mulvaney, Kate,** *Purdue University;* **Linda Prokopy**, *Purdue University;***Seungyoon Lee,** *Purdue University;* **Tomas Hook**, *Purdue University*

**Hauling in a Net(work) of Information: Utilizing Affiliation Networks to Better Understand Great Lakes Fisheries Governance**

Although Great Lakes fisheries management has expanded to include multiple governmental jurisdictions and stakeholders, an understanding of how many organizations are involved in governance and the relationships among those organizations remains unknown. Based on an email survey of policy and decision makers from the Great Lakes Fishery Commission (GLFC), we investigated the affiliation network of formal and informal relationships with organizations throughout the Great Lakes region. The respondents identified relationships with 149 organizations. This large number of organizations could provide many opportunities for sharing information with and soliciting information from stakeholder and research organizations, but it could also add political pressures from these groups. The GLFC network has specific communication roles including the important coordinating role of the GLFC staff and connections to fishing organizations through stakeholder representatives. In addition to formal relationships, informal relationships are an important component of the affiliation network with more than 1/3 of all relationships identified as informal and 16 organizations identified only through informal relationships. Affiliation networks are just beginning to be utilized in natural resource governance, but could be a useful tool for understanding the connection between diverse stakeholder organizations and natural resource managers.

**Munkittrick, Malcolm,** *University of North Carolina at Chapel Hill*

**At the Intersection of Megaregions and Ecoregions**

Are nascent "megaregional" demarcating efforts guided by economic development considerations with minimal concern for environmental issues? Do megaregional delineations materially reflect patterns of population agglomeration and density, transportation and transit infrastructure, and political borders, but ignore natural and ecological boundaries? Do they offer an effective platform for managing anthropogenic and natural threats to the environment and implementing sustainable and resilient growth strategies? This study uses GIS overlay mapping techniques to identify intersections of megaregions and Level I, II, and III Omnerik ecoregions. It uses the megaregion boundaries identified by America 2050 (a joint project of Regional Planning Association and Lincoln Institute of Land Policy) and the ecoregional delineations espoused by the Commission for Environmental Cooperation. The results of overlay mapping are subjected to a battery of descriptive statistics to determine the viability of each megaregion for future environmental management efforts.

**Muñoz, Lorena,** *University of Tromsø;* **Vera Hausner**, *University of Tromsø*

**Monitoring human disturbances in protected areas using distance sampling methods**

Monitoring of human disturbances is important to assess the effectiveness of protected areas (PA). Indicators for trail evolution, informal trails and trampling have been widely studied, but they rarely have been connected to the dispersion of recreational use in the PAs. Distance sampling of recreational cues allow for spatial analyzes of the non-consumptive disturbances in protected areas. We recorded cues of recreational use around point of interests (parking lots, cabins, lakes) and trails (formal and informal), using a distance sampling design in 12 protected areas in Norway. In general there were few recreational cues in the Norwegian parks; only 4020 cues were recorded in the 426.7 km line transects sampled. Most of the cues were found in the frontcounty (

**Muralidharan, Leena,** *V.K.K.Menon College*

**Diversity of spiders (Arachinida) in the Sanjay Gandhi national park,dist.Mumbai,Maharastra,India**

Deforestation,human encroachment,use of pesticide has seriously affected and threatened spider species. An attempt was made to investigate spider fauna from Sanjay Gandhi National park area to study its distribution and abundance. Spiders in its natural habitats were surveyed according to Tikader (1962,1973 ,1982.).The spider fauna was rich. Present study could study 88 spider species from 16 Families belonging to 40 genera.Family Araneidae represented 18 species belonging to8 genera,Family Salticidae, including 16 species under 8 genera, Family clubionidae consisted 5 species belonging to5 genera,Thomsidae 8 species under 5genera,Erasidae,Nephilidae,Oxyopidae,Pholeidae,Uloboridae,Lycosidae and Gnaphosidae of 3 species of 2 genera each.Tetragnathidae species of 3 genera was detected .One new species of spider was also detected. Rich diversity of spiders indicated species richness of ecosystem. Key words-spider,species,genera,diversity

**Murphy, Melanie**, *University of Wyoming*

**Planning Future Restoration for Long Term Persistence of a Declining Species**

In the intermountain west, energy development is a large driving force of landscape change that could be limited by potential listing of a species: the Greater-Sage Grouse. Our goal is to understand how habitat amount, configuration, and quality influence distribution and connectivity of sage-grouse leks in Northern Wyoming. We predicted lek distribution across the study area using 460 leks, 81 pseudo-absences, and important environmental (i.e., topography, percent sagebrush) and anthropogenic (i.e., well density) characteristics. To assess connectivity, we collected DNA samples from 68 sites and estimated genetic distance. We present a lek distribution prediction and population network model based on relating 2012 field data to limiting factors across the landscape. Both amount and configuration of disturbance surrounding leks decreases probability of lek occurrence. Connectivity of sage-grouse leks is positively associated with undisturbed areas of contiguous sagebrush habitat and negatively associated with disturbance. Clumped configuration of development reduces connectivity of leks. The lek distribution and population network model will be used to predict changes in lek occurrence and functional connectivity in the face of different scenarios of landscape change. Our research will provide a scientifically-based decision-making tool for prioritizing development, protection, and restoration that will drive stakeholders to work together for a successful outcome.

**Murphy, Melanie,** *University of Wyoming;* **W. Chris Funk***; Colorado State University;* **Erin Muths***,* *USGS;* **Jeffrey Evans***, The Nature Conservancy*

**Embracing climate change uncertainty: chorus frog functional connectivity in a changing environment**  
The Front Range of the Rocky Mountains is likely to see dramatic effects of climate change with warmer temperatures and shifts in both amount and timing of precipitation. These effects may dramatically impact persistence of amphibian populations. We assess functional connectivity (estimated by genetic distance) for boreal chorus frogs (Pseudacris maculata; 15 microsatellite loci, 98 locations, 1533 samples) in Larimer County, Colorado USA using Random Forest. We then use these models to areas of high and low connectivity under future climate scenarios. We then use variation across climate scenarios to identify spatial areas of uncertainty. We find that boreal chorus frogs are highly structured (6 clusters), supporting previous evidence of limited dispersal ability. In the current landscape, we find that ratio of rain/snow (pratio), development, high temperatures (dd5), and isolation impede functional connectivity while moist areas (CTI) are associated with enhanced connectivity. We then predict functional connectivity under 3 general circulation models (GCMs). We find high rates of change in connectivity are associated with both high and low elevations, while mid-elevation connectivity has high uncertainty (i.e., variation across GCMs). Based on these results, we rank the importance of spatially explicit habitats for maintaining functional connectivity under future climates and areas where future condition is highly uncertain.

**Murray, Kris,** *EcoHealth Alliance;* **Luis Verde**, *University of Queensland;***Martina Di Fonzo,** *University of Queensland;* **Ana Davidson**, *Stony Brook University;* **Moreno di Marco**, *Sapienza University of Rome*

**Addressing the neglected role of threats in comparative extinction risk analysis**

Comparative extinction risk analysis is a common approach for assessing the relative plight of biodiversity and making conservation recommendations. However, the usefulness of such analyses for conservation practice has been questioned. One reason why comparative extinction risk analysis may underperform is that threats (e.g., habitat loss, invasive species) are often overlooked, despite being widely regarded as proximal drivers of species' endangerment. We review the use of threats in this field from the literature, and investigate via two case studies the practical effects of threat exclusion on the interpretation and application of model results. Threat variables are routinely (59%) identified as significant predictors of extinction risk, yet while most studies (78%) include extrinsic factors of some kind (e.g., geographic or bioclimatic information), the majority (63%) ignore threats. In our case studies, omitting threats reduced model predictive performance and management relevance of results, and lead to considerable disagreement in a downstream conservation application (species ranking). We conclude that the use of threats in comparative extinction risk analysis is important and increasing but currently in the early stages of development. Better threat quantification and the development of more appropriate conceptual and statistical frameworks are priorities for improving the practical value of future studies.

**Mwampamba, Tuyeni,** *Unvivers Nacional Autonoma Mexico*

**Kasigau, Kenya: Field visit to the 2011 SCB Africa Section offset project**

Emissions associated with the 2011 meeting of the Africa Section of SCB are being offset by the Kasigau Corridor Project located in southeast Kenya. The primary objective of the Kasigau Project is to conserve a wildlife corridor consisting of tropical dry forest that would otherwise be cleared or degraded for cattle grazing and agriculture. Thus, it is a project that generates credits primarily from avoided emissions, i.e. from reducing deforestation and forest degradation (REDD). Selling offset credits into the carbon market is one of numerous activities that the Project undertakes to ensure year-round supply of jobs and revenue conducive to community and conservation objectives. The Kasigau project is successful in many ways; it is the first REDD project to receive VCS accreditation. As with all projects it also faces challenges and those of the Kasigau are particularly interesting. In this presentation, we will introduce the audience to the interesting elements of the Kasigau Project and make the case for why we (SCB) would want projects we support so demonstrate some of these elements.

**Mwangi, Kiragu,** *BirdLife International;* **Iain Dickson**, *BirdLife International*

**Supporting capacity building for biodiversity conservation - lessons from a 28 year NGO business partnership.**

Given the precarious state of much of the world's biodiversity prioritising where and how to invest limited conservation resources is of the utmost importance. Here we present the key results from a review of the Conservation Leadership Programme, a 28 year old award scheme which currently operates as a partnership between BirdLife International, Conservation International, Fauna & Flora International, the Wildlife Conservation Society and BP plc. Since it began the programme has evolved from awarding one-off expedition grants for UK students to providing sustained support to developing world projects led by early-career, in-country nationals. Using a review of the programme's outputs and results from a 2010 survey of programme alumni we aimed to investigate what this evolution has meant both for biodiversity conservation and local capacity building. Results suggest that this shift has had a positive effect on in-country conservation capacity with 98% of county nationals currently working in conservation within their project's target country compared with 36% of non-country nationals, projects led by county nationals were also more likely to result in the creation of an NGO. A further result was that projects receiving the highest level of support were far more likely to deliver in terms of protected area designation, NGO creation and species discovery. These findings demonstrate the importance of sustained, targeted support in maximising the contribution of such projects.

**Mwavu, Edward,** *Makerere University, Kampala;* **Edith Ayikoru**, *Makerere University, Kampala*

**Contribution of urban road-side plant nurseries to plant conservation and human well-being in the face of climate change, Uganda**

Plant diversity is one of the fundamental cornerstones for human well-being and sustainable development particularly in developing countries where the majority of the household livelihoods are dependent on natural resources. This calls for increased efforts to conserve biodiversity ex-situ strategies like plant nurseries establishment and maintenance. We surveyed 70 urban road-side plant nurseries in Kampala District, with a view to understand their contribution to plant conservation and human livelihoods in the face of increasing natural habitats loss and climate change. A total of 79 species were recorded, of which 18 were indigenous and 61 exotics. However, the most frequent indigenous species across the nurseries were Musanga cecropioides, Lantana camara, Elaeis guinensis, Maesopsis eminii, and Encephalartos hildebrandtii. Customer demand appears to be the main factor influencing the choice of the plants species raised by the nursery owners/operators. The results further showed that 94% of the respondents interviewed relied mainly on the nursery business for their economic needs. If properly managed these road-side plant nurseries can enhance plant conservation as well as acting as green businesses that may contribute to improvement of the livelihoods of the low-income urban households. They may also contribute to achieving the assisted colonization as an adaptation strategy for plant conservation in the face of global climate change.

**Nail, Kelly,** *University of Minnesota;* **Karen Oberhauser**, *University of Minnesota*

**How cold is too cold? Cold tolerance of immature monarchs in North America**

Eastern North American monarchs are well known for their long-distance annual migration to high elevation overwintering sites in Mexico, a journey that can cover over 4500 km. However, climate change models indicate these sites may not be suitable for monarchs within as little as 40 years. Citizen science reports from Gulf Coast states have shown some monarchs are now present and breeding throughout the winter, where immature monarchs may be exposed to freezing temperatures. To test immature monarch cold tolerance, I exposed monarchs to freezing temperatures and recorded both the supercooling point (SCP) and lower lethal temperature (LT50) for different developmental stages. Median SCPs for immature monarchs range from -26.1° to -9.6° C, with eggs having the coldest SCP and third instar larvae having the warmest SCP. Although the LT50s for larvae are below each stage's respective median SCP, no survival was observed below the lowest recorded SCP, suggesting that larvae are freeze-intolerant. However, eggs seem to be chill-intolerant, with an LT50 occurring at a temperature higher than their median SCP. While most monarchs tested were summer monarchs lab-reared in Southern US winter conditions, these results were further verified by testing wild winter monarchs raised on native milkweed in Texas. These findings can help inform future modeling and conservation efforts for monarchs throughout their life cycle, in particular guiding host plant restoration and habitat management.

**Naro-Maciel, Eugenia,** *College of Staten Island, City University of New York;* **Jimiane Ashe**, *Graduate Center, City University of New York;***Juan Sebastian Mafla,** *College of Staten Island, City University of New York;* **Jenna Pantophlet**, *College of Staten Island, City University of New York;* **Jarred Sutton**, *College of Staten Island, City University of New York;* **Ella Viola,** *College of Staten Island, City University of New York;***Seth Wollney**, *College of Staten Island, City University of New York*

**Feeding ecology of freshwater turtles at the reclaimed Freshkills Landfill: Insights from stable isotope analysis**

The vast Freshkills site on Staten Island, NY, until recently the world's largest landfill, is being transformed into a park. Habitat alteration is the top threat to biodiversity globally, yet whether reclamation efforts like this one can reverse losses is poorly known. Turtles are relatively sedentary, long-lived reptiles capable of occupying high positions in the food web, and can be monitored to investigate restoration. Therefor in 2012 we initiated a comprehensive freshwater community research program at Freshkills and the nearby Long Pond Park reference site. Here we tested the null hypothesis of no differences in trophic position, habitat, or prey at the two study sites by analyzing stable isotope signatures from painted (n = 29) and snapping (n = 14) turtle blood. We rejected the null hypothesis and found that both turtle species had significantly higher trophic positions at the former landfill than the reference site, as revealed by δ15N signatures. Painted turtles at Freshkills also had higher δ13C values indicating they consumed more non-meat items and/or had different habitats than at Long Pond. However these values were not significantly different among snapping turtles at the two sites, nor was there variation among individual turtle values obtained at different times during the season. So little is known about these communities that we are providing entirely new information on this once destroyed but now reclaimed parkland, with management applications.

**Naujokaitis-Lewis, Ilona,** *University of Toronto;* **Marie-Josee Fortin**, *University of Toronto;***Hugh Possingham,** *University of Queensland;* **Tara Martin**, *CSIRO*

**Conservation planning for migratory bird species under climate change**

Seasonal migrants present a unique challenge for conservation planning under climate change. As migratory bird species rely on distinct breeding and nonbreeding habitats across their annual cycle, both threats to climate change and the cost of protecting lands may differ substantially depending on the seasonal range considered. Ultimately, these factors can influence the prioritization of lands for conservation. We used the potential range dynamics of Nearctic-Neotropical Parulidae migrants under future climate changes across both breeding and nonbreeding ranges to contrast static and dynamic conservation scenarios on conservation priorities. Using Marxan, we evaluated two climate change adaptation strategies: protection of climate refugia and the promotion of connectivity across environmental gradients. Inclusion of potential range shifts under climate change strongly influenced sites prioritized and emphasized the need to adopt a dynamic conservation planning framework. Differences between the two climate change adaptation scenarios were magnified depending on the seasonal range under consideration, in part related to smaller nonbreeding range size relative to the breeding range and the magnitude of northern projected shifts for breeding ranges. Our results highlight the importance of integrating habitats required across the annual cycle into systematic conservation planning scenarios as they result in stark regional differences in climate change vulnerabilities.

**Neel, Maile,** *University of Maryland*

**Refining recovery under the U.S. Endangered Species Act**

Nearly forty years after passage of the U.S. Endangered Species Act, recovery prospects for listed species remain mixed. Recovery requires that a species be sufficiently abundant and that threats are reduced such that it is neither “in danger of extinction throughout all or a significant portion of its range” nor likely to become so “within the foreseeable future”. Achieving these goals is challenged from the outset because species are too severely imperiled by the time they receive the Act’s protection. Extreme data deficiency has been a major barrier to developing quantitative criteria and evidence indicates that traditional surrogate approaches are likely to fail. Individual and populations abundances (the most common recovery criteria) that have been required are criticized for being too low to provide high probability of persistence and for lacking a biological basis. Despite clear theoretical predictions for general risks of small and declining populations, there has been little scientific guidance for exactly how many individuals and populations are sufficient for recovery, and no specific abundance is appropriate across all taxa. We suggest holistic assessment of recovery based on habitat and range as well as individuals and populations is necessary for improvement of condition of species listed under the ESA. Further we suggest a means of evaluating how particular changes in these abundances that would result from threat abatement would translate into a change in extinction risk. Such an evaluation framework that can be used with varying amounts of data could support quantifying acceptable risk and yield objective and measurable criteria in a transparent manner.

**Nelson, Joanna,** *The Natural Capital Project, Stanford University;* **Leah Bremer**, *The Natural Capital Project, Stanford University;***Rebecca Chaplin-Kramer,** *The Natural Capital Project, Stanford University;* **Heather Tallis**, *The Natural Capital Project, Stanford University;* **Jonathan Higgins**, *The Nature Conservancy*

**Monitoring watershed ecosystem services in Latin America: connecting investors, conservation activity, and water outcomes in water funds**

The risk of water scarcity is a rising threat in a rapidly changing world. Communities and investors are using the new institution of water funds to enact conservation practices in watersheds to bolster a clean, predictable water supply for multiple stakeholders. We operationalize monitoring standards for ecosystem-service reporting, from experimental design to supporting field implementation, in two case studies: Quito, Ecuador, and Cali, Colombia. In the big picture, we ask: a) Do water funds' restoration and protection actions work at the plot scale? b) Does the suite of investments work at the basin scale or point of use? We partnered with nine water funds to move from theory to practice, from new monitoring standards to field implementation, in a statistically robust and cost-effective way. Capitalizing on a tool to optimize water funds' investments in nature (RIOS), we report on the process of creating the monitoring scheme and subsequent metrics for water fund performance. For example, model estimates suggest that the Quito Water Fund's restoration of all degraded floodplain areas would increase the annual dry-season base flow by 21 million cubic meters, with a 75% reduction in sediment loads. Previous monitoring plans have not matched the scale of desired results, due to resource constraints and access to land under different ownership types. Our results highlight the need to draw on innovative data collection and analytic methods to improve monitoring action.

**Nelson, Mark,** *NOAA NMFS Office of Sustainable Fis*

**Assessing the Vulnerability of Fish Stocks to a Changing Climate**

Climate change is already impacting fishery resources and the communities that depend on them. Environmental changes have been implicated in the shifting distributions, abundances and phenology of fish stocks in many marine ecosystems. These impacts are expected to intensify in the future, increasing the need to understand which fishery resources are the most vulnerable to environmental change. We have developed a tool for conducting a rapid vulnerability assessment for a large number of stocks to create an index of relative vulnerability. The index can help fishery managers identify high vulnerability stocks and more effectively target limited research and assessment resources on stocks of highest concern. The vulnerability assessment uses expert elicitation methods to quantify a stock’s exposure and sensitivity to expected climate change. Pilot tests have found the methodology to be robust across temperate and tropical ecosystems.

**Ness, Ryan,** *Toronto and Region Conservation Authority;* **Meaghan Eastwood**, *Toronto and Region Conservation Authority*

**Reconceptualizing Urban Biodiversity: An Evolving Approach to Urban Landscape Ecology in the Toronto Region**

The Toronto and Region Conservation Authority (TRCA) is a watershed-based public agency dedicated to conserving, protecting and managing renewable natural resources within the largest metropolitan area in Canada. Over the last 30 years the TRCA approach to urban biodiversity management has evolved significantly, from an emphasis on rare species and significant natural features toward a holistic approach that considers the function, character and value of the entire landscape. This has been catalyzed by a recent re-examination of the goals of urban conservation management and a greater understanding of the role played by urban ecosystems in human well-being. The presentation will illustrate this progression in management practice by utilizing an urban forest spatial analysis case study, describing the methodology used to develop a decision-making tool that guides tree planting efforts of local conservation managers in both urban and natural areas. This tool aims to identify and prioritize spatially explicit tree planting locations that best satisfy local demands for ecosystem services based on the social-ecological characteristics of each unique neighborhood within the study area. While there are challenges associated with balancing stakeholder perspectives, the outcomes are an important first step towards managing urbanized landscape for optimum function and ecosystem services.

**Neugarten, Rachel,** *Consevation International;* **Conrad Savy**

**High Conservation Value Forest Assessments and Other Tools for Geographic Priority Setting**

High Conservation Value (HCV) provides a framework for identifying, managing, and monitoring areas of critical importance or outstanding significance for biodiversity or ecosystem services or for supporting the basic needs or cultural identity of local communities. The concept of HCV originated as part of certification standards for sustainable forestry, but has seen increasing application in certification standards for sustainable agriculture, including the Roundtable for Sustainable Palm Oil (RSPO) standards. The concept has also been applied in conservation planning, including an ongoing national-scale HCV assessment in Gabon. We will provide an overview of the six categories of HCV and a review of current issues (such as the application of the HCV concept to palm oil landscapes) and recent research. We will also discuss our own review of 20 national HCV toolkits, including a discussion of inconsistencies between toolkits and links to international biodiversity standards such as the IUCN Red List of Threatened Species.

**New, Leslie,** *US Geological Survey;* **Emily Bjerre**, *US Fish and Wildlife Service;***Brian Millsap,** *US Fish and Wildlife Service;* **Mark Otto**, *US Fish and Wildlife Service;* **Michael Runge**, *US Geological Survey*

**Adaptive Management of Golden Eagles on Wind Farms in the U.S.**

In the United States, a substantial proportion of the country's renewable energy is expected to come from wind power. Despite rapid development, our understanding of wind facilities' environmental impact is poor. A particular source of apprehension is avian mortalities due to collisions with rotating turbine blades. A great deal of uncertainty surrounds the factors contributing to bird collision risk; environmental-decision making in this context is difficult. Yet, government agencies and project proponents will be faced with recurrent decisions on project operations, siting and design, compensatory mitigation and permits for lethal take. Adaptive management is beneficial in these circumstances, since it incorporates uncertainty into the decision making process in a structured way, and provides a mechanism by which it is possible to simultaneously learn about and manage natural systems. Using golden eagles, we show how pre-construction monitoring can be used to predict a project's annual eagle fatalities, how learning occurs through management and post-construction monitoring designed to address the known uncertainties, and how this information can be used to reassess and adjust management actions for individual projects and wind farm development as a whole. Although we focus on only one aspect of wind farms' environmental impact, our case study exhibits the broad potential for adaptive management to aid the progress of renewable energy development in the face of uncertainty.

**Newman, Greg,** *Colorado State University;* **Russel Scarpino**, *Colorado State University*

**Participatory approaches to community based monitoring using CitSci.org: The value of integrating many public**

**voices**

The growing patchwork quilt of self-organized community-based monitoring programs is diverse in terms of both the breadth and depth of topics covered and issues addressed. Each of these programs represents socio-ecological systems that are locally relevant and participatory in nature. Consequently, these programs become increasingly self- motivated. However, many of these programs are ill-equipped to effectively manage the data they collect and wish to analyze. We built a cyber-infrastructure support system for citizen science programs (www.citsci.org) to support the full spectrum of program management and data management needs. The system affords program coordinators the opportunity to create their own projects, manage project members, build their own data entry sheets, streamline data entry, visualize data on maps, automate custom analyses, and get feedback. Thus far, CitSci.org has engaged 55 programs resulting in some 8,000+ natural resource observations. We describe the variety of participatory approaches that have used and customized the CitSci.org system to suit their needs – including examples from stream monitoring, pika monitoring, invasive species mapping, amphibian monitoring, and floral biodiversity assessments – and discuss how integration of these seemingly disparate local efforts inform larger scale research objectives. These diverse examples illustrate how differences in culture, places, and problems represent opportunities to develop creative alternative techniques for, and approaches to, public participation in scientific research that collectively advance science.

**Ng, Annabell,** *National Parks Board, Singapore;* **Karen Lim,** *National Parks Board, Singapore*

**Towards Conservation and Education - Development of a bio-monitoring toolkit for Singapore's coastal and marine habitats**  
As a small urban city-state with limited land and sea space, Singapore's coastal and marine habitats need to be conserved and managed wisely. Although regulations are in place to regulate point-source discharge from industrial activities, the presence and effects of these compounds in the coastal and marine environment and organisms has not been comprehensively surveyed and monitored. The National Parks Board, in collaboration with the Nanyang Technological University's National Institute of Education (NIE), has embarked on a project to develop a bio-monitoring toolkit for Singapore's waters. Using the Green-Lipped Mussel, Perna viridis, as an ecotoxicological bioindicator, the presence of various contaminants in the intertidal shore communities of Singapore was investigated and determined. A handbook of chemical and biological assessment techniques will be developed for use in the science laboratories of secondary schools and tertiary institutions. Workshops will be held to train educators to teach and carry out these techniques in their classes.

**Nichols, Margaret,** *Landcare Research*

**Optimising camera traps for monitoring small mammal**

Invasive animals require applied techniques for observation and management. However, low densities and secretive behaviours make monitoring some species difficult. Camera traps have mostly been used to spot large animals, but until recently field staff have shied away from their use with smaller species. We sought the most economical and effective camera traps to monitor small and medium-sized mammals. The experiments consisted of multiple pen trials using stoats (Mustela erminea), cats (Felis catus) and hedgehogs (Erinaceus europaeus). We tested: 1) still photographs vs. video, 2) trigger speed (0.2-2.1 seconds), 3) passive infrared (PIR) vs. microwave sensor, and 4) white vs. infrared flash. The white flash produced the most identifiable photographs of species, but also frightened some test animals.The microwave sensor had a low success rate in contrast to the PIR sensor. Video cameras had comparable success rates to still footage, however much more effort was required in processing and computer time. We see camera traps as a promising tool for monitoring invasive species. Detection rates may be improved by eliminating visible and audible cues emitted by cameras. Also, standardising the field of view for each camera will help to make results more comparable between different locations and times.

**Nichols, Liz,** *American Museum of Natural History;* **Andres Gomez**,

**Parasite conservation and the reality of trade-offs in health-based ecosystem services**

Environmental change drivers (e.g. land-use change) influence the biotic interactions between free-living and parasitic species that play key roles in ecological processes, and that have important consequences for animal and human welfare. When and where parasitic diseases directly impact humans and domestic animals, the reduction of disease transmission risk by non-parasitic species can be considered a health-related ecosystem service. Observed inverse relationships between free-living biodiversity and parasitic disease transmission represent a common ‘win-win’ ecosystem service scenario used to incentive biodiversity conservation. However relationships between free-living and parasitic diversity are also commonly positive, particularly when species that act as intermediate hosts are abundant, and because most free-living species interact with multiple parasites in complex interaction networks. Using novel data from a model dung beetle – parasitic nematode system, we (1) illustrate how biodiversity can simultaneously buffer and amplify disease, (2) highlight how species traits may be useful in predicting ecosystem service trade-offs, and (3) discuss how one particular parasite management strategy (i.e. intermediate host management) can produce unintended and negative disease regulation outcomes in agricultural landscapes.

**Nickerson, Brandon,** *Oregon State University;* **Clinton Epps**, *Oregon State University*

**Isolation Predicts Both Neutral and Adaptive-linked Genetic Diversity of Desert Bighorn Sheep Populations**

Previous research investigating the influence of population isolation on genetic diversity has largely focused on neutral genetic diversity, assuming that adaptive genetic diversity follows similar patterns. However, natural selection on adaptive variation could mediate loss of genetic diversity through drift in some cases. We examined patterns of neutral and adaptive-linked genetic diversity using fecal DNA systematically collected from 13 populations of desert bighorn sheep (Ovis canadensis nelsoni) in the Mojave Desert of California. Using samples previously genotyped at 14 neutral microsatellite loci, we genotyped 5 additional neutral microsatellites and 4 microsatellite loci linked to adaptive immune system genes. Genetic diversity (allelic richness and heterozygosity) of neutral and immune-linked loci were correlated. As previously established for neutral diversity in this study system, genetic diversity of immune-linked loci declined as isolation (distance between populations and anthropogenic barriers to movement) increased. Our results suggest neutral diversity can accurately reflect consequences of habitat fragmentation for adaptive diversity, at least when populations are small and fragmentation is extensive, which could in turn affect individual fitness and population persistence. These findings are particularly relevant to conservation of desert bighorn sheep in the Mojave, where proposed renewable energy developments may cause further habitat fragmentation.

**Nilsson, Danielle,** *University of Queensland*

**How do you effectively incentivise and motivate local communities to adopt conservation behaviours? A case study of the Sumatran orangutan**

Conservation programs often target local communities with the aim of altering their behaviours for conservation purposes. However, many of these programs underestimate the complex nature of human behaviour, jeopardising their sustainability and effectiveness. This project uses the Sumatran orangutan as a case study to investigate the socio-psychological factors and processes involved in conservation programs. Specifically the role of motivation, incentives, attitudes, social norms and perceptions of control in influencing the adoption of conservation behaviours are explored. This is presented in a theoretical framework for achieving behaviour change through conservation programs, which is tested, and refined using stakeholder interviews and community questionnaires in three comparative case study areas. Pilot studies have been conducted and the initial findings showed themes supporting the theoretical framework and hypothesis that autonomous motivation and autonomy supportive environments are a key factor to program effectiveness and positive community perceptions. It is expected that follow up data and analysis will further support and confirm this hypothesis, and ultimately generate a framework for creating sustainable and effective community based conservation programs. These findings will have further implications for the possible effectiveness of other incentive based programs such REDD+ and PES schemes at the community level.

**Nolte, Christoph,** *University of Michigan*

**Ecological, social, and demographic impacts of protected areas in the Brazilian Amazon**

Ongoing research has demonstrated the success of protected areas in reducing deforestation in the Brazilian Amazon. Less is known about their economic and social impacts. We use census and satellite data to examine how protected areas and indigenous lands affected deforestation rates, economic poverty and population growth in 6728 Brazilian census units between 2000 and 2010. We base our impact estimates on differences between census units with high coverage of protected areas or indigenous lands and matched control groups of otherwise similar census units with low coverage. We find that all protection types have significantly reduced deforestation rates, although with variable social and demographic impacts. Strictly protected areas were associated with reductions in demographic growth, while sustainable use areas were not. Neither category was estimated to have affected economic poverty. However, census units under indigenous lands exhibited significantly higher economic poverty and lower demographic growth than similar unprotected census units. Our findings underscore the importance of protection type in jointly affecting ecological, economic and demographic outcomes of spatial conservation policies.

**Norse, Elliott,** *Marine Conservation Institute*

**MPAtlas.org: Better Understanding the Current State of Ocean Conservation**

The Marine Conservation Institute, in partnership with the Waitt Foundation, has developed an online digital atlas that assembles key information on marine protected areas (MPAs) around the world (MPAtlas.org). MPAs are an essential tool to halt and reverse the oceans’ downward trajectory. The benefits of MPAs have motivated a number of nations to set goals for establishing MPAs that cover a portion (10-20% or more) of their ocean territories, and international bodies are working to establish MPAs on the high seas. Currently, less than 2% of the world’s oceans are in MPAs; far less than the 12% of land area that is protected. Of the world’s total area protected about 1% exists in areas designated as no take marine reserves, places where fishing is prohibited and all marine life is protected from exploitation. The vast majority of the ocean area that is in no-take MPAs exists in a few very large areas that are far from coasts and not necessarily representative of the oceans’ biodiversity. Many marine ecosystems are currently not protected and others are vastly underrepresented in existing MPAs. Currently ocean protection if far short of stated goals.

**Novack, Anthony,** *WA State Dept of Fish and Wildlife*

**Profiling Poachers: Using Randomized Response Technique to Assess Rates of Hunting Violations by Deer and Elk Hunters in Washington State**

**NTAKIRUTIMANA, Egide,** *Association pour la conservation de la nature au Rwanda;* **Gaspard Rwanyiziri**, *National University of Rwanda*

**The role of UN Agencies in the management of protected areas in Rwanda: Case study of UNDP in and around Nyungwe National Park through PAB Project**

Community conservation as an approach to conservation of wildlife was adopted in Rwanda and many African countries as a means of involving local communities participate in decision making and management of protected areas. I further explore the different ways through which communities living around protected areas in Rwanda like Nyungwe National Park have benefited from participating in both tourism and conservation. The method we used to collect data in this research was data collected using formal interviews with park officers, local community, Field observation, questionnaire administration, and published documents review. The results of our study show that, communities living in the villages around Nyungwe national park have been involved in different projects like PAB aimed at conservation and development. I further reveals that there have been benefits accrued from participation delivered through the work of conservation organizations. Despite the benefits, people still feel they deserve more opportunities for employment than they are at present getting from the national park. Generally this research found out that when community conservation is well implemented with the involvement of local communities, it provides benefits to those communities through tourism, minimizes conflict between local people wildlife.

**Nunez, Cassandra,** *Virginia Polytechnic Institute and State University;* **James Adelman**, *Virginia Polytechnic Institute and State University;***Daniel Rubenstein,** *Princeton University*

**Linking social environment and stress physiology in feral mares (Equus caballus): group transfers elevate fecal cortisol levels**

With a broad understanding of species' physiology and behavior, managers and conservationists can better predict species' response(s) to perturbation, achieving results that more fully address stakeholder interests. The management of feral horses (Equus caballus), for example, is a contested issue: despite years of debate, Congress, the Bureau of Land Management, and horse advocates have yet to come to a tenable solution. Feral horses have a complex social structure: decreases in social stability reduce female fitness. However, the physiological mechanisms linking social stressors and fitness remain unknown. We studied group changes in feral mares (an activity that induces social instability) on Shackleford Banks, NC. During group changes, mares exhibit elevated fecal cortisol, a physiological marker of stress. In addition, mares making more group transfers show higher cortisol levels. Our results suggest that social instability is integrated into an animal's physiological phenotype and have implications for feral horse management. Shackleford mares contracepted with porcine zona pellucida make 10 times more group changes than untreated mares. Such animals may be at higher risk of chronic stress, which can impair cardiovascular and immune function. Our results support the growing consensus that links between behavioral and physiological systems should be considered when establishing the effective, humane management and conservation of animal populations.

**Nuno, Ana,** *Imperial College London*

**Applying novel approaches to assess the prevalence and drivers of illegal bushmeat**

Assessing anthropogenic effects on biodiversity, identifying drivers of human behaviour and motivating behavioural change are at the core of effective conservation. Yet our knowledge about people's behaviours is often limited because the true extent of natural resource exploitation is difficult to ascertain, particularly if this is illegal in nature. To obtain estimates of rule-breaking behaviour, several disciplines have developed indirect questioning techniques for asking sensitive questions. Using bushmeat hunting in the Serengeti as a case-study, we investigated how techniques developed in the social sciences may be applied to minimize survey bias and increase respondents’ willingness to share sensitive information. We piloted the performance of four indirect questioning techniques in terms of respondent perceptions, and then applied the unmatched-count technique (UCT) to provide estimates of poaching, its motivation and seasonal and spatial distribution, and to characterise poaching households. We also assessed the potential for survey biases based on respondent perceptions. Our results suggest that poaching remains widespread in the Serengeti and current alternative sources of income may not be sufficiently attractive to compete with the opportunities provided by hunting. We demonstrate that the UCT is well suited to investigating non-compliance in conservation because it reduces evasive responses, resulting in more accurate estimates and is technically simple to apply.

**Nutter, Felicia,** *Tufts University Cummings School of Veterinary Medicine;* **Richard Kock**, *The Royal Veterinary College;***Scott Newman,** *Food and Animal Organisation of the United National (FAO);* **Samuel Muriuki**, *African Union InterAfrican Bureau for Animal Resources;* **Thomas Nyariki**, *African Union InterAfrican Bureau for Animal Resources;* **Lindsey McCrickard,** *Food and Animal Organisation of the United National (FAO);***Serge Nzietchueng**, *Univeristy of Minnesota;* **Tracy McCracken,**

*Virginia-Maryland Regional College of Veterinary Medicine*

**WILD: An Introductory One Health Course on Wildlife Health and the Human-Livestock-Wildlife-Environment Interface, and how it supports conservation**

Infectious diseases in wildlife are important ecologically for population regulation. There is increasing recognition that disease transmission at the human-livestock-wildlife-environment interface is a significant problem mainly driven by human and domestic animal population growth and behavior, impacting biodiversity conservation, food security, livelihoods, livestock and human well-being. Disease prevention, control and management across sectors is a complex problem requiring an integrated approach. A One Health training module, WILD (Wildlife Investigation in Livestock Disease & Public Health), encourages collaboration across sectors to improve response to challenges at this interface. Participants from ministries of health, agriculture, wildlife, and environment are exposed to processes that drive disease emergence from wildlife and challenged to collaboratively devise solutions. Learning is transdisciplinary and forges cooperation in the classroom and beyond. WILD has reached more than 125 participants in over 30 countries, who continue to communicate through a project network. The course approaches health uniquely from the perspective of the environment and biodiversity context in which humans and animals co-exist. Inclusion of wildlife disease ecology in the design of human and domestic animal health systems, surveillance, and outbreak response training is a significant advancement over current practice and a major milestone towards the holistic One Health approach.

**Nyamweru, Celia,** *St Lawrence University*

**Multiple stakeholders, diverse agendas: conservation and development of natural cultural sites in Kenya**

Kenya is the home of over 40 ethnic groups of different cultural backgrounds. In pre-colonial times each group had its own belief system, incorporating natural sites to which they ascribed cultural significance. Many of these ‘natural cultural sites’, which include forests and small patches of trees, rocky outcrops, hills, mountains and lakes, have been destroyed or severely degraded over the last century. Others survive, though the meanings attributed to them may have changed. In pre-colonial times some were recognized as ‘sites of origin’ or first settlement of a group in a particular area, others had religious significance or were the location of institutions of indigenous governance. Some such meanings survive, but some sites now play a role in Kenyan local and national politics, are recognized for their biodiversity by the global environmental movement, and are being marketed as eco- and cultural tourism destinations. Most sites were formerly under the control of senior male community members, who controlled access to the site and its resources and carried out ceremonies and rituals, often at times of crisis such as drought and sickness. In recent decades many other stake holders have claimed an interest in the management of these sites, including local youths and women, representatives of Kenyan government agencies (Forestry, National Museums, Wildlife Conservation), international conservation organizations and multilateral agencies such as UNESCO. Drawing on my own field work and on published and unpublished materials, I trace the relationships, both competing and co-operative, between the different stakeholders and show how they have influenced the conservation and development of several natural cultural sites as pressure on natural resources continues to intensify in 21st century Kenya.

**Nye, Janet,** *NOAA NMFS NEFSC, Sandy Hook, NJ*

**Cusk and Climate Change: assessing the threat to a candidate marine fish species under the US Endangered Species Act**

Cusk (Brosme brosme) is a deepwater fish species associated with high complexity seafloor habitat. Population abundance of cusk in both US and Canada has declined over the last 40 years as a result of fishing activities and there is growing concern about the status of this species, although it is not formally assessed or managed. In addition to pressures from fishing, climate change may affect cusk especially because the southern limit of its range in the Northwest Atlantic is in the Gulf of Maine. We modeled the habitat of this species using US and Canadian trawl survey data using a Generalized Additive Model (GAM). Although many factors were considered, temperature and bathymetric complexity (based on a topographic roughness index) were the most important variables in the prediction of cusk occurrence. We used statistical downscaling of 11 global climate models to predict temperature change in two future time periods (2020-2060 and 2060-2100) for 3 climate change scenarios (B1, A1B, and A2). We then used the ensemble climate model projections to project suitable cusk habitat in these two time periods under the three different scenarios. Results suggest fragmentation of habitat and reduced connectivity between Canadian and US populations that may diminish the resilience of cusk populations. This fragmentation occurs because of a spatial mismatch between areas with high complexity seafloor habitat and areas with suitable temperature.

**O'Bryan, Christopher,** *Clemson University;* **Robert Baldwin**, *Clemson Universty;***Jessica Homyack,** *Weyerhaeuser Company*

**Apparent Resilience of a Freshwater Turtle Population to a Reconfigured Forested Landscape**

Habitat fragmentation is a leading cause of global declines of reptiles. Spotted turtles (Clemmys guttata) are considered threatened or endangered in portions of their range and primarily have been studied in wetland-dominated, forested landscapes. We investigated movement patterns of this freshwater turtle species in an intensively managed forested landscape with highly-altered aquatic systems. Using radiotelemetry, we located turtles (n=28, approximately 95 locations per individual) and found them to primarily use ditch networks within loblolly pine (Pinus taeda) plantations. Clustering of locations in and near ditches and the high connectivity the network provides suggests their importance for recruitment and survival. Over eighty-five percent of locations were linearly oriented in and along the ditch system. Annual home ranges averaged over sixty percent larger than those reported for a wetland-dwelling population. Additionally, mark-recapture of 153 individuals revealed robust population structure. Despite extensive movements, we recorded only one mortality event. In more natural settings, movements of spotted turtles among wetland sites expose individuals to road traffic or predation. In this system, those risks may be minimized by the ditch network suggesting careful ditch system management may be important. Our study suggests that some risks may be greater than others and phenotypic variation may allow a certain level of resilience to intensive human activities.

**O'Carroll, Aaron,** *Canadian Boreal Forest Agreement Sc*

**Innovative, practical, applied conservation models and agreements forged from a truce between forestry companies and conservation organizations in the Canadian Boreal Forest.**

In 2010, the majority of Canada's forest industry, as represented by the Forest Products Association of Canada (FPAC), and a coalition of leading Canadian and International conservation organizations signed the Canadian Boreal Forest Agreement (CBFA). The CBFA commits the FPAC forest companies and conservation organizations to work together in the Canadian Boreal to, among other things, develop proposals for protected areas, plans for woodland caribou conservation, plans for reducing greenhouse gas emissions across the full life-cycle of forest products, an auditable, world-leading set of standards for forestry management practices and measures to ensure marketplace benefit for the implementation of these conservation plans. I report here on the circumstances that led to the Agreement, progress towards achieving the Agreement goals and discuss lessons learned from the process to date.

**Ocampo-Penuela, Natalia,** *Duke University;* **Stuart Pimm**, *Duke University*

**Setting practical conservation priorities for birds in Colombia and then implementing them**

Colombia has >1800 bird species, 70 are endemic, while IUCN considers 10% to be threatened. We identify priority areas for bird conservation and scale down to effect practical solutions. For all terrestrial endemic and small-range (

**Odewumi, Oluyinka,** *FUTA*

**The impacts of medicinal uses of West African Manatee (Trichechus senegalensis) on its Conservation status in Nigeria**

The impacts of medicinal values of West African manatee on its conservation were investigated in some selected towns in Nigeria. Oral interview and 300 self administered structured questionnaires were used to collect information from fishermen (270), and traditional herbalist (30) in these areas. 40% of the fishermen agreed that they kill manatee mainly for sale for medicinal purposes, 40% for consumption as food and 20% for both Manatee parts are known to be useful in 13 different ways as recorded in the study, some of which include; treatment of eye diseases, dislocation and fractures, all forms of skin diseases, mental disorders, impotency in men, used as an aphrodisiac and increase intelligent quotient of unborn child when eaten by pregnant woman. The estimated average yearly killing of manatee in the study areas in the past 1-10 years is put at 100-200, while it was greater in the past 11-20 years. This killing combined with the animals ecological limitations and reproductive habits have pushed the population to the brink of extinction in most of their natural ranges in Nigeria.

**Ofori-Boateng, Caleb,** *Forestry Research Institute of Ghana;* **David Amaning**, *Herp Conservation, Ghana;***Prosper Antwi-Baffour,** *A Rocha International, Ghana Programme*

**Innovative Conservation Awareness Program Increases Stakeholder Participation and Protection for a Critically Endangered Frog In West Africa**

Rediscovered in 2007 after nearly four decades, the critically endangered Togo slippery frog (Conraua derooi) faced an imminent extinction threat due to habitat loss and high hunting pressures. To conserve this species, we initiated a novel conservation program in Ghana. A key aspect of this program is an outreach program dubbed 'conservation evangelism'. The 'conservation evangelism' capitalizes on the highly devout nature of the local people to integrate conservation practices into religious belief systems. The approach has proven to be most effective with respect to both impact and cost. Through this program, local communities have adopted this frog, reduced its exploitation, and taken great pride in its conservation. In order to ensure continuous local support, we combine our community outreach with field surveys and report back to the communities about the progress they have made in protecting their frogs! The intervention has seen a dramatic frog population increase (from 45 to ~ 335). Our success remains a classic example of how conservation biologist can work with indigenous communities to increase protection of species.

**Ojha, Nabaghan,** *IPE Global Pvt Ltd*

**Forest Conservation: Changing Dynamics in a Changing World**

In India the enactment of proactive forest conservation policies and changes in management approaches from 'timber' to 'forest ecosystem' during the last few decades have promoted conservation and sustainable management of forest. The country is promoting afforestation on an unprecedented scale. Huge amounts of money are also being pumped in to increase the green cover in the country. Recognizing the carbon storage and sequestration potential of forests, India has given a new impetus to the forestry sector and has more than doubled the forestry budget. These laudable measures notwithstanding, there are certain developments that cause serious disquiet - none of them more worrying than the attempts at privatization of common property resources (CPR). What is most worrisome is the fact that many such attempts are ordinarily invisible, sugar coated as they are with terms like plantation to check global warming, compensatory afforestation to enhance forest cover etc. Large tracts of CPR are being taken away without the knowledge of the local community. Conserving forest resources sustainably is a bigger challenge for the country now than it has been ever before. Designing interventions for conservation and management of forest resources is becoming more complex by the day in the light of the fast changing global scenario. The paper tries to highlight the conservation and management issues in Indian Forestry sector with a set of recommendations for future.

**Ojoyi, Mercy,** *National Museums of Kenya;* **Onnie Mutanga**, *University of Kwazulu-Natal;***Odindi John,** *University of Kwazulu-Natal*

**IMPACTS OF LAND USE/LAND COVER CHANGE IN THE ULUGURU-KITULANGALO ECOSYSTEMS IN MOROGORO REGION, TANZANIA**

The East African biodiversity hotspots continue to experience rapid environmental degradation due to climate change and intense pressure from human-induced processes. Uluguru-Kitulangalo forest-woodland ecosystems are regarded as key biodiversity hotspots in East Africa, Tanzania. In this paper, we apply a set of three LANDSAT images namely: 1975, 1995 and 2012 to assess land use land cover changes, and identify possible causes to these changes based on change results. This is important in assessment of the extent of damage and threats posed to biodiversity conservation in these fragmented ecosystems. Data validation was conducted using ground truth data collected in July 2012. The land change modeller process in IDRISI was applied in assessment of land cover conversion from one type of class to the other. Results obtained identify loss in dense forest and woodland over the years from 1975-2012, emerging from agricultural practices, development of built up areas and bareland. The study discusses likely projected scenarios particularly impacts and risks to biodiversity conservation if such changes persist. This information is important in planning and conservation of similar vulnerable habitats.

**Olakolu, Fisayo,** *Nigerian Institute for Oceanography and Marine Research(NIOMR);* **Oyeronke Adegbile**, *Nigerian Institute for Oceanography and Marine Research(NIOMR)*

**Marine Conservation;Status and Challenges in Nigerian Coastal Environment**

Nigeria is a maritime state with a coastline approximately 853km and an exclusive economic zone(EEZ) of 200 nm. The Nigerian Marine Environment is in close proximity with the gulf of guinea of the south eastern Atlantic Ocean. It is endowed with numerous living and non-living resources.Nigerian marine species are listed in IUCN red list as endangered and critically endangered. Nonetheless fishing effort in Nigeria is rising rapidly, fishing is the major livelihood in Nigeria coastal communities with the use of gill net, and fishery in this sector(artisanal) has contributed the highest percentage(75%) to the Nigerian domestic fish production. However,the major challenge is an accidental catch of some vulnerable marine resources(including sea-turtle, marine mammal) with gill net during fishing when the net is set and incidental capturing of female sea-turtle on beach during egg laying. Sea-turtle and other commercially important fish species are also caugth as by-catch in industrial shrimp trawl fishery. Some conservation effort are on-going including awareness and sensitization of fishermen and community members on monitoring and release of these vulnerable species in some of these coastal communities, also by-catch and sea-turtle excluder devices for industrial shrimp trawl fishery. However, stakeholders and volunteer involvement through integrated approach to conservation can bring about effective maintenance and restoration of biological diversity.

**Olander, Lydia,** *Duke Univversity*

**The National Ecosystem Services Partnership: Lessons for a National Conservation Network**

If we take it as given that, “There is a clear need for a national conservation support-program that promotes large scale biodiversity conservation through information sharing and capacity-building,” the next questions we might ask are “How do we build such a program and how would it work?” I will describe a process that might be used to build out a national conservation support program by sharing a model that we have used at the Nicholas Institute for Environmental Policy Solutions at Duke University for a new project we are coordinating with federal agencies through the National Ecosystem Services Partnership (NESP). Coordinating ecosystem services programs across federal agencies presents similar challenges to those facing a national conservation network: reconciling and managing differences in data collection and interpretation across geographic regions and political jurisdictions, transferring tools successful in one agency or region to others, and building technical and managerial capacity among partners through training. The experience we are gaining through NESP can help inform the design and implementation of a national conservation network of federal, state and private partners.

**Olival, Kevin,** *EcoHealth Alliance;* **Jon Epstein**,

**Integrating wildlife conservation and zoonotic disease surveillance**

At a time when wildlife are increasingly scrutinized in zoonotic disease investigations, it is important to consider conservation messaging and public outreach in these efforts. In particular, preventing the vilification of wildlife in the face of discovering potentially pandemic pathogens is critical. We will highlight examples of infectious disease research involving bats in several countries where conservation studies have been integrated with disease investigations. Bats have been historically reviled by the public, yet provide valuable ecosystem services such as pollination, seed dispersal, and insect control. Bats have also become a high profile taxonomic group as they are reservoirs of several emerging zoonotic diseases of high consequence. Of the more than 1,200 species of bats >25% are endangered, making integration of conservation efforts more critical. Typically wildlife departments in developing countries are mandated to manage wildlife and not to investigate disease issues. We highlight examples from three countries, Malaysia, Thailand, and Bangladesh, where Ministries of Environment/Departments of Wildlife have recently become active participants in health studies that successfully integrate bat conservation. Each of these countries has experienced the emergence of zoonotic diseases, which fostered the adoption of a One Health framework involving participation from the wildlife sector in disease surveillance. In each case, epidemiological studies have included detailed research on bat ecology, demography, and behavior of direct conservation value. Despite these successes there is room for better messaging between health and conservation sectors.

**Oliveira-Miranda, María A.,** *Provita;* **María A. Oliveira-Miranda**, *Provita;***Jon Paul Rodriguez,** *IVIC;* **Marisol Aguilera**, *Universidad Simón Bolívar*

**Risk of collapse of Venezuelan terrestrial ecosystems and the relationship with extinction risk of mammals and birds**

Using the categories and criteria of the IUCN Red List of Ecosystems, we assessed the risk of collapse of Venezuelan ecosystems and compared it to the risk of extinction of mammals and birds. Using a GIS, we established the boundaries of ecological units. Changes in surface and degree of intervention by human activities were estimated for each units (1988 and 2011). The numbers of mammal and bird species were also estimated, as well as the number of threatened species. The risk of species and ecosystems were compared. We identified 27 "natural" vegetation units and one transformed land cover (spanning 20% of the national territory). Roughly 51% of remnant natural vegetation shows visible human impact. Fifteen natural vegetation units are threatened, and they are mainly located north of the Orinoco River and poorly represented in protected areas. Five natural vegetation units are near threatened. The overlap of 346 mammal and 843 bird distribution maps show that threatened species richness is higher in threatened ecosystems. We suggest that 47 mammals and 14 birds are part of the extinction debt of threatened ecosystems. Ecological units that occur in northern Venezuela require urgent conservation actions in order to mitigate their degradation and to decrease their rate of transformation in the short term. Maintaining updated vegetation or ecological unit maps is key to monitoring ecosystems and their species, and to assess the effectiveness of conservation measures applied.

**Olsen, Glenn,** *Patuxen Wildlife Research Center*

**The role of conservation medicine in whooping cranes in North America**

The whooping crane (Grus Americana) is the most endangered crane species in the world, numbering only 22 birds in 1941. Today numbers are around 550 birds, with close to 400 in the wild. The species is sensitive to a number of disease agents, some of which, such as eastern equine encephalitis and West Nile virus, are zoonotic. Toxins or contaminants and even climate change, as it affects the water levels in the Guadalupe River in Texas or the Platte River in Nebraska, impact whooping crane survival. Recently black fly species breeding in Wisconsin have been implicated as causing disturbances to nesting whooping cranes. The whooping crane recovery team, formed jointly by the U.S. Fish and Wildlife Service and the Canadian Wildlife Service has one veterinarian as a member and has an advisory team of veterinarians and wildlife biologists working to improve survival of the wild birds and to develop new and safer reintroduction techniques using captive reared birds.

**Olson, Deanna H. ,** *US Forest Service*

**A global monitoring system to map the spread of emerging diseases**

The rapid global emergence of highly virulent multi-host pathogens has altered the science and management of wildlife diseases. Rapid data aggregation, syntheses, and analyses are needed to advance both science and management of such diseases. This dynamic is further challenged when disease infection and mortality incidences are cryptic, such as in the case of the amphibian chytrid fungus, Batrachochytrium dendrobatidis (Bd). We have led a community surveillance effort for Bd since 2007 aimed at understanding its global distribution and to contribute to hypotheses that may explain patterns of occurrence geographically and taxonomically. We produced an interactive web-based system (www.Bd-maps.net) for compilation of Bd sampling efforts and associated metadata. To date, over 36,000 sampled individuals have been included in the online database, with over 1,200 amphibian species at >4,000 sites in 82 countries sampled. At the world and USA spatial scales, we have developed odds of occurrence models using geographic, environmental, and biological attributes. Our results can inform down-scaled hypothesis testing of factors that may drive infectivity patterns. Improvements to the online database include development of a smart phone data uploading application, facilitated data importing and exporting capabilities, and zoo and captive animal data mapping. Extended community partnerships can improve the realtime capacity of this disease reporting system.

**Omland, Kristian,** *Stantec;* **Philip Molloy,** *Stantec*

**Non-inferiority testing: Answering the right question in ecological restoration**  
The purpose of assessing a restoration effort is to evaluate whether an ecological community has been restored to some prescribed condition. Since we can only reject or fail to reject the null hypothesis, posing the null hypothesis in terms of inferiority corresponds to asking the right question. The prescribed condition is defined either by conditions at the site prior to disturbance or conditions at an otherwise comparable site that has not been disturbed. The null hypothesis for such an analysis should be that the condition at the restored site is inferior to the prescribed condition by more than a pre-specified tolerable amount. If the null hypothesis is found to be improbable based on observed data, then we infer that the restored site is significantly non-inferior to the undisturbed site and that restoration was successful. The non-inferiority test is a special case of an equivalence test, which is distinct from the more familiar difference test. Applying a difference test in assessing restoration is prone to two pitfalls. One may infer that the restored site is not significantly different than the undisturbed site but have to qualify the conclusion based on uncertainty; commonly researchers describe that outcome in terms of insufficient statistical power. Conversely, one may infer that the restored site is significantly different than the undisturbed site but have to qualify the conclusion observing that the magnitude of the difference is not ecologically meaningful.

**Onial, Malvika,** *Nature Science Initiative;* **B Phalan**, *University of Cambridge*

**Food production and biodiversity conservation: Reconciling farming with nature?**

A rapidly growing human population and increasing expectations for the amount and quality of food in many parts of the world will drive a rising demand for food and other agricultural goods. Increasing intensification of agriculture to meet this demand is expected to impact biodiversity. Two contrasting approaches that address this issue are 'land sharing' and 'land sparing'. The first approach advocates retaining natural habitat patches and maintaining less intensive farmed land within the agricultural landscape while the latter suggests increasing yields on existing farmland, thus preventing further loss of non-farmed habitat and creating the potential for making farmland available for restoration to a more natural condition. My study assesses these two contrasting approaches by analysing responses of biodiversity across low to high yielding land-use intensities through an empirical study of the relationship between agricultural yields and population densities of birds and trees in northern India. Results indicate that many bird species dependent on forest and wet grassland and a majority of native tree species are likely to have higher regional populations under 'land-sparing' rather than under 'land sharing'. This study makes an effort to provide an understanding of the effects on biodiversity of different production systems and land use intensities to evaluate possible options that can benefit biodiversity conservation while also achieving desired yield targets.

**Oriel, Elizabeth,** *Social and Environmental Research Institute*

**What Three Social Science Theories Applied to Animals and Human-Animal Relations Reveal About Gray Wolf (Canis lupus)Conservation**

Wildlife management falls into the rapidly advancing field of human-animal relations. Three constructs in the social sciences have recently been applied to this arena, making them relevant to consider in wildlife management practices. Research on animal language, cognition and abilities has facilitated applications of these theories or constructs. Social exchange theory, the capabilities approach, and post-traumatic stress disorder all arose originally from human-centered studies, but now apply to animals and human-animal relationships. Each of these theories has important insights, which may inform gray wolf (Canis lupus) conservation, especially when marred by human-wolf conflict. The first from Anthropology explains the reciprocality in human-animal relationships, the second from Philosophy and Economics recommends understanding wellbeing as the ability to express one's capacities (both for humans and wolves), and the third from Psychology speaks to the injuries that result from violence or from witnessing injury or death. We will examine a particular case study of wolf conservation in the Yellowstone National Park area and draw both critique and strategies from these theories.

**Ormsby, Alison,** *Eckerd College*

**Conservation and Conflict: Sacred Groves of Sierra Leone**

Sacred groves in Sierra Leone, West Africa, are small community-managed forests that are linked to cultural traditions. These groves harbor natural resources, including diverse flora and fauna. Research was conducted in the Tonkolili District of central Sierra Leone in June and July 2012. A semi-structured questionnaire was used to interview 99 residents in 16 communities about natural resource use and rules regarding local sacred groves. The presence of small mammal populations and human uses of natural resources within the groves was documented. The historic role of sacred groves and their use during the recent 11-year war was also investigated. Societal traditions and rituals are key to the continued protection of the groves. The groves’ cultural significance and local management help ensure conservation of these small forested areas.

**Ortega-Argueta, Alex,** *El Colegio de la Frontera Sur;* **Ana Allen-Amescua**, *Pladeyra*

**Recovery planning for threatened species in Mexico: achievements, challenges and the future**

Recovery planning is a major strategy in biodiversity conservation. The Program for Recovery of Species at Risk (PRSR) in Mexico is now 15 years old. We identified key achievements, challenges and lessons in strategic planning, management and program implementation of the PRSR, through analysis of documentation, interviews and participatory observation. The PRSR was initially limited to 14 taxonomic groups of iconic species but now includes 30 groups. Program operation delivers recovery actions within six themes: protection; management; restoration; knowledge; culture and administration. 70-80% of actions target social issues. Budgetary and personnel constraints, and the strong relationship between biodiversity and socioeconomic issues, have led to a strong participatory approach. In some cases, non-governmental stakeholder participation has implemented 60-70% of recovery actions. Strengths of the PRSR include stakeholder integration over the entire policy cycle, strong social participation in program implementation and improved conservation status of many species. Potential improvements include greater federal funding for recovery activities, and training of government personnel and community participants in planning, monitoring and program evaluation. Governmental strategy now recognizes the importance of a co-management approach by establishing several policy mechanisms that integrate community participation into the conservation of threatened species.

**Osunsina, Israel,** *Federal University of Agriculture, Abeokuta. Nigeria*

**Indigenous People and Conservation Education and Awareness in Some National Park in Nigeria**

The involvement of local people in Environmental education and awareness and its role in Biodiversity conservation around some National parks in Nigeria were investigated. Questionnaires were administered to elicit information from the villages around the parks viz: CRNP (985 respondents); GGNP (1079 respondents); KLNP (1134 respondents) and OONP (1013 respondents). Environmental education programmes and conservation attitudes were assessed and responses elicited. In CRNP, 53.9% respondents indicated that environmental education had been conducted in their area, while in GGNP, KLNP and OONP, the respondents who indicated that environmental education was done in their villages were moderately low (39.3%, 36.2% and 41.1% respectively). The result of the Chi- square shows that there is significant relationship between the age (X2 = 90.222, p

**Ovando, Dan,** *Univ. California Santa Barbara;* **Christopher Costello**, *;***Ray Hilborn,** *;* **Steven D. Gaines**, *;* **Oliver Deschenes**, *;* **Sarah E. Lester,**

**Measuring Benefits To Food Security And Conservation From Reforming Data-Poor Fisheries**

Data-poor fisheries are a critical source of livelihoods for coastal communities and play key roles in the health of marine ecosystems. However, we have very little data on the state of these fisheries. We have developed a new assessment technique that uses basic data to evaluate the health of thousands of previously unassessed fisheries. At a global level, our results show that the world’s data-poor fisheries are in much worse condition than stock assessed fisheries. Small-scale unassessed fisheries are in particularly poor health, and are trending downwards. This has serious implications for the future of ocean ecosystems and coastal communities. There is still time to act and reforming these data-poor fisheries could provide tremendous benefits to food security and marine conservation. Our results show that recovering these fisheries from their current trajectory could provide a 40% increase in global fishing yields, while simultaneously increasing the biomass of live fish in the sea by 50%. We can also assess the health of fisheries at the scale of regions or species types. For example, many developing countries facing growing food demand would especially benefit from fisheries reform. Our method provides a clear step forward in identifying critical targets for marine conservation, as well as detailing benefits to both ecosystems and food security from rebuilding data-poor fisheries.

**Owens, Jacob,** *Drexel University*; **Gail Hearn**, *Drexel University*; **Shaya Honarvar**, *Drexel University*

**Integrating dietary and intestinal parasite data to improve the conservation strategies of the Bioko Island drill**

Despite once ranging across Equatorial Guinea's Bioko Island, drill monkeys (Mandrillus leucophaeus poensis) are now limited by intense bushmeat market hunting to the southern third of the island (550 km2). Within this limited area, drills can be found at elevations ranging from sea level to more than 2200m asl and in corresponding habitats ranging from the monsoon forests of the coast to the montane forests of the Gran Caldera. We investigated the diets and gastrointestinal parasite infections of un-habituated drill groups at higher (montane forest, 900-1100m asl) and lower (monsoon forest, 0-300m asl) altitudes to identify areas of conservation priority for this highly endangered insular subspecies. During three consecutive dry seasons (January-March, 2010-2012) we obtained data on the diet and parasitic infections of drills through opportunistic feeding observations and the collection and analysis of fecal samples. Our results show drills diets to differ significantly with altitude: Low altitude drills ate significantly more fruit (95% mean dry weight of fecal remains), while high altitude drills ate significantly more non-fruit fiber (66.7% mean dry weight). However, we found no difference between the richness or prevalence of parasite infections between these areas. These results, and their implications on drill group size and abundance, indicate the monsoon forests to be of particular importance for the future conservation efforts for this highly endangered species.

**Oyamaguchi, Hilton,** *UCLA;* **Thomas Smith**, *UCLA*

**Importance of the Amazon-Cerrado gradient in preserving adaptive variation in a changing world**

Conserving adaptive variation is extremely important in the face of climate change. Environmental gradients have been shown to be critical regions for harboring adaptive variation and speciation. Our research investigates the evolutionary processes important in generating morphological, vocal and genetic differentiation in the frog Dendropsophus minutus along the gradient between the Amazon rainforest and the Cerrado in Brazil. Multivariate analyses of morphological data shows significant differences between habitats and that divergence between habitats is greater than within. In addition, we find vocal and genetic divergence between both habitats. These results suggest that natural selection is important in the divergence process between populations and suggests that the Amazon-Cerrado gradient may play an important role in the speciation process. Conserving this gradient will be important for maximizing adaptive variation under climate change. Results underline the importance of preserving not only the pattern of biodiversity, but also the processes that produce and maintain it.

**Oyler-McCance, Sara,** *USGS - Ft. Collins, CO*

**Development and validation of environmental DNA for detecting invasive pythons in southern Florida**

Several species of non-native giant constrictor snakes have become established in southern Florida and appear to be moving northward. The Burmese python (Python molurus bivittatus) and the northern African python (Python sebae), in particular, pose significant threats to the native animal communities. Information on where these two pythons are and where they are not is needed to help manage and control these invasive species. We are using environmental DNA (eDNA) to help determine the presence or absence of these species in certain locations, which would add to the knowledge of the changing distribution of these species in Florida. We have developed several sets of PCR primers specific to each of these pythons that amplify short regions of the mitochondrial genome. These primers provide a presence/absence determination for pythons in these water samples. We are also developing quantitative PCR probes that would allow for an assessment of the quantity of DNA in each sample. These methods are being validated using controlled experiments with pythons in water tanks. In addition to verifying the efficacy of the PCR tests, we are investigating DNA degradation rates under various environmental conditions. Once our laboratory methods are validated, they can then be used to test water samples from different locations and map the occurrence of these invasive species.

**Paquet, Paul,** *Raincoast Conservation Foundation*

**Ecological effects of marine waterways in Canada's roadless Great Bear Rainforest**

Landscape fragmentation affects wildlife population viability, in part, through the effects it has on individual dispersal. In addition, some forms of human disturbance impinge on dispersal without physically fragmenting habitats. For example, connectivity for terrestrial and marine mammals that rely on water passageways for travel can be adversely affected by human disturbances such as boat traffic. In Canada’s Great Bear Rainforest, traffic on inland marine waterways is increasing and potentially interfering with movement of large terrestrial mammals (e.g. wolves, grizzly and black bears, deer) among islands and the mainland. Boats pose lethal threats to mammals via collision and impede movements by direct interference. Humans in boats occasionally harass and kill deer, bear, and wolves as these animals travel between landmasses. In addition, ocean channels, coastlines, and river systems provide humans access to remote areas and opportunities for killing wildlife not otherwise available. In southeastern Alaska, for example, people who gained access by boat to areas otherwise secure were responsible for more than 50% of all wolves killed by hunters and trappers. These disturbances are analogous with the adverse influences in terrestrial systems associated with roads, railways, and other linear infrastructure. Focusing on ecological implications of increasing marine traffic, we provide a novel overview of connectivity in the marine and terrestrial interface along British Columbia's central and north Pacific coast.

**Parkins, Kaitlyn,** *Fordham University;* **J. Clark**, *Fordham University*

**Green roofs provide foraging habitat for insectivorous bats in New York City**

Insectivorous bats are in decline in the United States due to habitat loss, urbanization, and the spread of white-nose syndrome. Understanding bat use of human-altered habitat is critical for developing effective conservation plans for this ecologically important group. Green roofs, building rooftops covered in growing medium and vegetation, have become increasingly important conservation tools that make use of available space to provide breeding and foraging grounds for urban wildlife. They are especially important in highly urbanized areas such as New York City (NYC), which has more rooftop (34%) than green space (13%). To date, no studies have examined the extent to which bats utilize these microhabitats. To investigate the role of green roofs in supporting urban bat populations, I monitored bat activity using ultrasonic recorders on four green and four traditional roofs in NYC, which were paired to control for location, height, and local variability in surrounding habitat and species diversity. I then analyzed and identified calls to the species level. Preliminary results indicate the presence of four of the eight bat species found in New York State, higher levels of forging activity over green roofs than traditional roofs, and higher species richness on green roofs. This ongoing study provides evidence that, in addition to many other ecosystem benefits, urban green roofs provide important patches of habitat that support a variety of migrating and breeding bat species.

**Parrish, Julia,** *University of Washington*

**Is there science in citizen science? Perceptions, myths and realities**

In an era of increasing biodiversity loss the ability of professional scientists to document, much less ameliorate, these trends is quickly diminishing. Can non-scientists provide a solution? Results from a web-based meta-analysis of citizen science (CS) programs and follow-on surveys of program managers, and separately of biodiversity scientists, suggests that these programs remain largely untapped by professional science. Although 97% of surveyed programs indicated increased scientific understanding as a goal, scientists felt that the main goal of CS is not research, but outreach and education. Scientists indicated they would trust programs housed within academic institutions and data collected by young adults (college students or adults with a college degree), whereas most programs were actually housed within the non-profit sector (NGOs) and contained a preponderance of adult learners, especially retirees. A mere 12% of programs were searchable in Web of Science, and publication propensity was tied to program age, spatial scale, QAQC, and headquarter type. However, biodiversity CS program growth is exponential, involving millions of citizens collecting data on diverse taxa, systems, and issues. The majority of programs are 10+ years old, have a spatial extent of >100km, make their data available, and have QAQC procedures in place. Ignoring this burgeoning public, as biodiversity and ecosystem services continue to erode, makes science inefficient and potentially irrelevant.

**Parsons, E.C.M.,** *Department of Environmental Science & Policy, George Mason University;* **A Shah**, *Dept of Environmental Science & Policy, George Mason University;***P. Karaffa,** *Dept of Environmental Science & Policy, George Mason University;* **C. Scott**, *Dept of Environmental Science & Policy, George Mason University*

**It's all in the name - public attitudes to the conservation of biodiversity, habitats and charismatic-sounding species**

A series of 3 public surveys were conducted in the Washington DC area on concern for the conservation of species & habitats: 61% had heard of biodiversity & 36.7% could correctly define it, but only 31% thought biodiversity was "very important" to conserve versus 52% for a habitat such as rainforest. Concern for charismatic species (elephants, pandas) was greater than for biodiversity. When asked which species were most important to conserve & were offered a selection of real & fictitious species, species of greatest concern were often fictitious. Fake names with patriotic/nationalistic terms were of highest conservation concern (patriot falcon) whereas negative-sounding names (killer falcon, sheep-eating eagle) evoked least concern. Concern for a charismatic group of species (otters) was examined more closely: both actual & fictitiously-named otters were of concern, but positive (rainforest otter) & negative (snake otter, sharp -clawed otter)-sounding names changed concern levels: changing the name of the hairy-nosed otter to "furry-nosed" increased those giving this species the highest conservation concern by 13%. Changing giant otter to rainforest otter increased concern by 8%. The public has heard of biodiversity, but they are less concerned about it than habitats (e.g. rainforests) & charismatic species with positive-sounding names. This suggests that greater conservation support could be gained by using charismatic species & also by better "marketing" at-risk species..

**Partridge, Dustin,** *Fordham University;* **J. Alan Clark**, *Fordham University*

**Urban Green Roofs and Wildlife Conservation**

Urban environments are generally comprised of impermeable surface and often lack suitable stopover and breeding bird habitat. For example, 34% of Manhattan's surface is rooftop, while only 13% is green space. This study examined if green roofs can be a viable bird conservation tool in an otherwise depauperate urban environment. A green roof is a roof covered with a waterproof membrane and growing medium, and planted with vegetation. Green roofs reduce the cooling and heating needs of buildings, minimize stormwater impacts, and reduce urban heat island effects. However, no study to date has evaluated avian use of multiple green roofs in a highly urbanized area. I compared bird and arthropod diversity on green roofs in New York City with nearby non-green roofs. To document the presence of birds, I used direct observations and deployed acoustic recorders to monitor bird vocalizations. I collected arthropods with bowl and sticky traps. I identified over 35 bird species using green roofs in New York City and have found that arthropods are more than 6 times more abundant on green roofs than non-green roofs. This is the first study to examine the role of green roofs as stopover habitat for migrating birds. The number of green roofs in New York City is increasing, yet the amount of unused available roof space remains high. This research demonstrates that green roofs can provide valuable wildlife habitat in heavily urbanized environments, and can be a successful conservation tool.

**Pastorini, Jennifer,** *Centre for Conservation and Research;* **Peter Leimgruber**, *Smithsonian Conservation Biology Institute;***Tharaka Prasad,** *Department of Wildlife Conservation;* **Prithiviraj Fernando**, *Centre for Conservation and Research*

**Conserving Asian elephants requires the coordination and integration of multiple agencies and stakeholders**

Across Asia 'development' is rapidly changing the landscapes occupied by elephants. However, data on elephant ecology and behavior in this dynamic environment is lacking, resulting in ineffective management and conservation. We tracked 22 female and 13 male elephants in Sri Lanka with GPS-satellite collars, and obtained data on demographic and health indicators. On average each elephant walked 2-6 km per day. Elephants showed restricted movements from 0930 to 1330 and were most active nocturnally, especially from 1730 to 2130. Some had little variation in the daily distance walked through the year while a few had very seasonal movement patterns. Elephant home ranges extended from 44.9 km2 to 755.3 km2. Females on average occupied larger areas than males. Most elephant home ranges encompassed multiple landholders including the Department of Wildlife Conservation (DWC), Forest Department, other state agencies and private lands. Landuses within home ranges extended from relatively undisturbed forest to secondary forest and scrublands to agriculture and human settlements. Elephants in low conflict and high resource areas had the best demographic and health indices while those restricted to undisturbed forests under the DWC had relatively poor indices. We conclude that elephants are adapting to the changing landscapes but that their conservation in Sri Lanka and possibly the rest of Asia requires the coordination and integration of multiple agencies and stakeholders.

**Patricio, Harmony,** *SCB FWWG Board, FISHBIO*

**Relationships between threats to rare wildlife from human consumption and availability of fish for villagers in Lao PDR**

The Mekong River hosts well over 850 fishes, with the second highest species diversity and the most productive inland fishery of any river on Earth. The aquatic resources of the lower basin support over 60 million people with food and income. The region is undergoing rapid change, associated with concerns over impacts on fisheries and related food security. With increased development there is also growing pressure on rare terrestrial wildlife that has historically been part of the local diet. We have worked with villagers in the Lao People’s Democratic Republic to establish community-based participatory research on fisheries and sustainable livelihoods. Teams from four villages were trained to monitor the fishing catch, household food consumption, and fish sales at local markets. Despite targeted conservation efforts such as outreach and establishment of National Protected Areas, food consumption surveys have shown that rare or endangered terrestrial wildlife continues to be present in diets. Here we discuss the relationships between fisheries harvests and the consumption of rare terrestrial animals. We conclude that in remote areas of the Mekong Basin, conservation of fishes and rare terrestrial animals are inherently linked.

**Patrick, David,** *Paul Smith's College;* **Elizabeth Harper**, *Paul Smith's College;***Viorel Popescu,** *Simon Fraser University*

**The frog of the north: mink frog ecology and climate change**

Populations of the cold-adapted mink frog, Lithobates septentrionalis, are likely to be highly threatened by climate change, but little is known about this species. Our research goal was to evaluate the effects of climate change on the range and persistence of the mink frog. Objectives included: (1) understanding how changes in water temperature and dissolved oxygen (DO) influenced larval survival; (2) establishing the current occurrence of this species in the Adirondack Park, NY; and (3) predicting the effects of climate change on the range and persistence of the species. We initially employed a combination of laboratory studies and artificial mesocosms to determine relationships between aquatic conditions and growth and survival of larvae, and field studies at ~80 wetlands to evaluate the current occurrence of the species. Our results indicated that species occurrence was not solely a function of abiotic conditions in the aquatic environment, but likely driven by indirect effects of climate change. Based on these results we evaluated the role of climate-induced shifts in competition and predation using similar controlled experimentation. The results of these studies indicated that temperature-induced shifts in predator communities have the potential to dramatically influence survival of the focal species. Our results show that changes in amphibian populations as a result of shifts in global climate are likely to be driven by complex indirect effects across trophic levels.

**Payan, Esteban,** *Panthera Colombia;* **Karen Perez**, *Orinoquia Biodiversa;***Carolina Soto,** *Panthera Colombia;* **Angelica Benitez**, *Panthera Colombia;* **Angelica Diaz**, *Panthera Colombia*

**The jaguar corridor in Colombia: from ideas to implementation**

We show the first implementation of the Jaguar Corridor Initiative in Colombia that seeks long term jaguar (Panthera onca) conservation at a continental scale. A tenuous link between Andes and the eastern llanos jaguar population shown in a least cost corridor, model was chosen as project site. The area, a livestock and agricultural landscape on the foothills of the eastern Andes, was validated for jaguar and key prey presence through ground truthing surveys (75 grids; 5km x 5km) and by occupancy analysis (5 covariables). Six pilot farms where chosen by means of a participatory method and the inclusion of key biological criteria for intervention: livestock intensification (rotation methods, silvpastoral techniques [4,400 planted trees]), antipredator strategies (solar powered predator resistance electric fencing design) and restoration (10,000 native trees). The local community contributed labor and the project provided materials. These benefits enabled zoning and fencing off of the conservation riparian areas along a connecting river totaling 8.2 km dedicated to the jaguar corridor. Participants signed a conservation agreement where they adhere to no jaguar hunting and the application of learnt methods. This project represents the first stretch of implemented jaguar corridor in Colombia and an example for Latin America in applied conservation: reducing jaguar hunting, connecting associated wildlife, benefiting local stakeholders and improving sustainable development

**Pearce, Monica,** *Rare*

**A New Framework for Identifying and Applying Social Resilience in the Context of Climate Change**  
As applied conservation science continues to enhance and incorporate social aspects into its solutions, the term "social resilience" is often identified as a valuable byproduct for improving ecological integrity in communities whose livelihoods depend on natural resources. However, the lack of clarity in what constitutes social resilience as well as potential mismatches between adaptation and resilience makes the formal application and assessment of this concept challenging. There is uncertainty associated with the magnitude and duration of climate change impacts in vulnerable areas. Therefore, understanding how to simultaneously apply aspects of social resilience while promoting adaptation, will be critical for a community to respond to disturbances and stresses brought on by climate change. Though being adaptive is a key component to becoming resilient, how can a community avoid crises by planning for something we cannot predict? This meta analysis synthesizes the use of social resilience through an in-depth literature review and an evaluation of two case studies. Based on that analysis, this paper provides a definition and a new systematic Social Resilience Framework. This paper aims to provide a consistent social resilience framework that is critical for reducing vulnerability to climate change and accounts for the following key elements: innovation, ecological health, crisis response, infrastructure, economics, governance and policy, and social capital.

**Pelz Serramo, Karla,** *CBS, Universidad Autónoma Metropolitana-Lerma;* **Charles van Riper III**, *Sonoran Desert Research Station;***Melanie Culver,** *SRNE, University of Arizona;* **David Bergman**, *USDA APHIS Wildlife Services Arizona*

**Adaptive Research management and conservation genetics of the American beaver across borders**

The American beaver was considered an important fur-trading item in the late 1800's, which resulted in the near eradication of the species. Efforts to restore beaver populations began in early 1900's, but almost no attention to the genetics or biology of the beaver was considered. After populations recovered, their management changed, ranging from lethal control to conservation. The purpose of this study was to assess if there was an impact of overexploitation and different management actions on the genetic diversity of the beaver in seven areas across North America. We used nine microsatellite loci, control region and cytochrome b mitochondrial gene fragments, to assess genetic diversity measures of 153 individuals from seven areas in the U.S. At the microsatellite loci, results across populations show high genetic diversity (HO = 0.613, HE = 0.740), and high genetic differentiation (FST =0.128, RST =0.199, P

**Perlut, Noah,** *University of New England;* **Allan Strong**, *University of Vermont*

**PVA's beware: Greater than expected first-year survival rates for migratory songbirds**

Due to long-distance natal dispersal, recent advances in quantifying survival rates have largely focused on adults and ignored the first annual cycle. Many PVA's, including by the authors, estimate first-year survival (1st) as 50% of adult survival (a), and find high sensitivity to variation in first-year survival. In 2002-12 we studied a and 1st of two species of migratory grassland songbirds, bobolinks and Savannah sparrows, breeding in an agricultural region of Vermont. With Cormack Jolly-Seber models in Program MARK, we improved our accuracy by increasing detection rates by searching for natal dispersers within 1.5 km of our study fields, and applying molecular sex identification to the nestling data set. Both species and sexes showed low natal dispersal (BOBO = 1275m ± 1354 SD, n=94; SAVS = 1401m ± 4037 SD, n=71). Across all years, and for both species and sexes, 1st and adult differed by only 34.7%; 1st averaged 0.412 (range 0.322-0.577) while adult averaged 0.633 (range 0.518-0.812). Adult survival was negatively affected by total reproductive effort, but positively affected by reproductive success. 1st was higher for heavier nestlings that fledged earlier in the breeding season. Adults that lived longer had higher fitness by successfully fledging heavy offspring early in the breeding season. The processes that affected 1st and adult differed, and failure to account for these differences has the potential to severely bias population projections.

**Persha, Lauren,** *University of North Carolina*

**Forest sector decentralization in Tanzania: Unpacking the role(s) of governance for improved livelihoods and conservation**

Governance issues are central to much empirical conservation research and policy action, particularly in the context of decentralized strategies which ostensibly aim to use governance changes to deliver improved conservation and livelihoods. Governance failures anywhere on the institutional spectrum can serve as enduring barriers to effective conservation, and good governance - particularly at local levels - is seen as crucial for improved equity and sustainability around livelihoods and resource use. But the elements which underpin these broad generalizations are poorly understood. For instance: 1) Under what conditions and by what mechanisms does decentralization successfully promote more effective resource governance? 2) What are the income and equity impacts of improved governance across households in terms of resource-based livelihoods and altered conservation and use dynamics? I draw on preliminary data from an ongoing impact evaluation of Tanzania’s forest sector decentralization to examine how variation in two governance components (strength of participation in local forest institutions by forest users; institutional nestedness) relate to key social and ecological objectives: contribution of forest products to livelihoods, harvest intensity and legality, and forest sustainability. Analyses draw on data from households, local governance institutions, and forest plots collected from some 50 villages and forests and 1500 households across 10 districts in Tanzania.

**Peterson, Angelie,** *University of the West Indies, Cave Hill Campus;* **Clare Fitzsimmons**, *Newcastle University;***Johanna Forster,** *Newcastle University;* **Selina Stead**, *Newcastle University;* **Rachel Turner**, *University of the West Indies, Cave Hill Campus;* **Robin Mahon,** *University of the West Indies, Cave Hill Campus*

**The role of bridging organisations in Caribbean coral reef governance**

Caribbean coral reefs are extremely important to the region's tourism, fishing industries, and coastal protection, yet reef degradation continues due to a variety of threats. In the region many actors are involved in or related to reef use, research, management, and decision-making. Organisations that can bridge among these diverse actors have been associated with enhancing adaptive capacity and achieving better management outcomes. This study uses social network analysis (SNA) to investigate the bridging roles of organisations in communication and information-sharing networks. Representatives (n=262) from multiple actor groups, including local and national government, NGOs, community organizations, and resource user groups from 12 communities across four Caribbean countries (Barbados, Belize, Honduras, and St Kitts and Nevis) were interviewed to determine their roles in reef governance. Networks show bridging organisations, the bridging properties of these organisations, and the role these organisations have in coral reef management. This information can help further the understanding of the roles and effectiveness of these organisations and can lead to better support of bridging organisations in facilitating enhanced reef management outcomes.

**Petracca, Lisanne,** *Panthera;* **O. Eric Ramirez-Bravo**, *Durrell Institute for Conservation Ecology;***Lorna Hernandez-Santin,** *Departamento de Ciencias Quimico-Biologicas*

**Occupancy estimation of jaguar Panthera onca in east-central Mexico: A corridor uncertain**

The use of wildlife corridors to maintain landscape connectivity has become increasingly relevant to the conservation of wide-ranging species, including the jaguar Panthera onca. Jaguars are particularly threatened in Mexico, where corridor linkages are tenuous due to habitat fragmentation. Our study assessed a section of potential corridor south of the Sierra Madre Oriental in eastern Mexico. We conducted 245 interviews with local inhabitants in 140 36 km2 sampling units and compiled detection histories for jaguar and five prey species: the collared peccary Tayassu tajacu, red brocket deer Mazama americana, white-tailed deer Odocoileus virginianus, spotted paca Agouti paca, and armadillo Dasypus novemcinctus. These detection histories were then analyzed via site occupancy modeling. Each sampling unit was assigned a probability of habitat use based on (1) both smaller prey species (paca, armadillo) and (2) at least two of the larger prey species (collared peccary and two deer species) using habitat in that unit. This probability estimate was considered a proxy of each sampling unit's prey base and therefore its suitability as a jaguar corridor. Though the prey base in some areas appears adequate to support a jaguar population, the paucity of jaguar sign over the past year and presence of large-scale development projects are major roadblocks to this region's potential. We suggest that the eastern coast of Mexico may not be a priority area for range-wide jaguar conservation.

**Pettorelli, Nathalie,** *Zoological Society of London*

**Earth observations: An overlooked potential to support species reintroduction programmes**

Global biodiversity is under increasing threat from anthropogenic impacts, and the unprecedented rate of species loss is a major concern to ecologists and wildlife managers. To counteract current and projected levels of species loss, human intervention, in the form of reintroductions, may be a solution. Reintroductions however tend to have a low success rate, with one of the most acknowledged impediments to reintroduction success being inadequate planning. Habitat evaluation is considered an essential step for assessing the potential for an area to support a viable reintroduced population. Remote sensing techniques can support such investigations, by greatly enhancing the temporal and spatial coverage of habitat assessments. Using the planned reintroduction of the Scimitar-horned oryx in the Ouadi Rime-Ouadi Achim Game Reserve in central Chad, we demonstrate how such an integrated approach to conservation can support the effective restoration of local biodiversity, by showing how satellite based information can provide a preliminary insight into the nature of ecosystem functioning within the considered area and offers a starting point to discuss future implications for the reintroduction of the species.

**Pfaff, Alex,** *Duke University*

**Decentralization & Development-Environment Tradeoffs: federal versus state conservation choice & impacts on Amazonian deforestation**

We model federal versus state location of protected areas in Brazilian Amazonia then empirically examine impacts on 2000-2004 deforestation. States are hypothesized to weight local costs more, relative to external forest benefits, than the federal government. We examine the differences in decisions empirically for two types of protected areas, the Integral (strict) and the Sustainable Use (permitting some deforestation by people who were already resident), while comparing them both to more exogenously determined Indigenous protected lands. In doing our comparisons, we control explicitly for different land characteristics between protected and not. Including those controls halves the estimates of deforestation reduction, since protection tends to locations with low deforestation threat. Federal and Indigenous areas reduced deforestation but State areas did not, due to a lack of enforcement plus cost-avoiding location for Sustainable Use. Within Federal areas, Sustainable Use areas significantly block deforestation. They are oriented around people and thus deforestation pressure, which gives them something that can be blocked. The more isolated Integral locations are much more likely to be forested even without protection. As global funds may compensate REDD, these results inform domestic policy design given local tradeoffs. Global actors may heed differences across local actors when agreeing to an institution.

**Pfeifer, Marion,** *Imperial College, London*

**The fate of forests in and around East Africa's Protected Areas - are buffer zones needed to mitigate or prevent encroachment?**

Tropical evergreen forests in East Africa are highly biodiverse carbon sinks and provide natural capital to millions of people. They represent c. 6% of the terrestrial surface, being found mainly in Eastern Congo, Rwanda, Burundi and Tanzania. However, the forests are declining due to increased demand for land and resources. Many forests are gazetted as locally managed, mixed-use or strictly enforced protected areas (PAs). Using remotely sensed data spanning 2001-2009, we evaluate the success of East Africa’s PA network in abating forest loss. We account for forest trends within PAs of increasing protection status, separating parks into ‘effective’ and ‘non-effective’ based on their ability to maintain forest cover. To account for ‘leakage’ (displacement of forest loss to surrounding landscapes), we also quantified forest trends in buffer zones (1 km, 1–5 km, 5–10 km) around park edges. PAs in East Africa lost little of their forest cover (-378 km 2 , -0.6%) compared to unprotected land (-17,167 km2 , -9.3%). However, spatial and temporal variability in PA effectiveness was high; leakage was detected near effective parks, especially in areas of high human population density. Forest accessibility, controlled by protection status and topography, is an essential component of forest conservation. Since buffer zones suffer elevated forest loss, management must do more to address local people’s continued resource needs and links between livelihoods, natural capital and poverty.

**Phillips, Tina,** *Cornell Lab of Ornithology*

**Setting professional metrics: articulating conservation outcomes for integrated social-ecological systems**

Within natural resource management, conservation outcomes are conceived on a variety of levels, but typically measured directly through habitat and species assessments (Kapos et al. 2008). Citizen science, however, tends to affect conservation indirectly through application of research findings, education of stakeholders, and individual and community-level actions. Despite the increased pressure by funders and other stakeholders to influence conservation outcomes, few citizen science projects have been able to demonstrate conservation outcomes at the socio-ecological level (Jordan, Ballard, and Phillips, 2012). One reason for this is that project leaders and practitioners have not adequately articulated what those conservation outcomes are and how they align to project activities. Moreover, few project leaders have identified how they would measure success. During this session I will define the challenges and opportunities for evaluating conservation outcomes of citizen science across different models of engagement and describe how using approaches from evaluation and conservation biology can help professionals articulate their conservation outcomes for social ecological systems. I will also highlight a few case study examples demonstrating how evaluation can be used in the design and implementation of a project to provide context specific strategies for articulating and measuring conservation outcomes in citizen science.

**Piascik, Paul,** *University of Toronto;* **Jay Malcolm**, *University of Toronto;***Sandy Smith,** *University of Toronto*

**Responses of Ground Beetles (Coleoptera: Carabidae) to Experimental Manipulation of Woody Debris Supply in Boreal Northeastern Ontario**

Maintenance of woody debris supplies is increasingly being recognized as an integral part of forest management. In order to better manage this resource, it is important to understand its role in supporting biodiversity. We investigated the responses of carabid beetles to experimental manipulation of downed woody debris supply in variously aged mature mixedwood boreal forests that provided qualitative differences in woody debris types among stands. Total carabid abundance and abundances of eight species declined significantly with decreasing wood volumes, whereas abundances of four species increased. The change in community composition under decreasing wood volumes reflected a shift from species more characteristic of mesic habitats to those more characteristic of xeric habitats. For species that decreased in abundance, various types of woody debris were important, but particularly large-diameter, late decay coniferous wood. This type of wood is a primary target of harvesting operations and is most likely to become limiting in managed forests of boreal Ontario. These findings suggest that reductions in woody debris will have negative consequences for carabids and indicate the need to ensure a diverse and abundant supply of woody debris in managed landscapes. Our results suggest that the more intensive harvest operations become (such as through decreased rotation lengths, more intensive fiber removal, and less residual leave), the greater the impacts will be on carabids.

**Pilliod, David,** *USGS - Boise, ID*

**Successes and challenges of using eDNA to monitor amphibians in high-gradient streams**

Environmental DNA (eDNA) methods have been successfully used to detect amphibians in high-gradient streams, but several challenges remain for implementing this approach to monitor native and invasive vertebrate species. To test the efficacy and limitations of this method, we designed molecular qPCR assays for two amphibians (Idaho Giant Salamanders, Dicamptodon aterrimus; Rocky Mountain Tailed Frogs, Ascaphus montanus). We then tested how water collection methods affected detection probabilities and eDNA concentrations in 1L water samples pumped through cellulose nitrate filters. Preliminary results suggest minimal differences between sample collection methods, allowing the user to choose the most convenient method for their particular application. When eDNA was at low levels in the stream, or when few replicates were collected, eDNA concentration estimates had relatively low precision due to occasionally high or low amounts of eDNA in replicate samples. We found that eDNA concentrations were positively associated with field-based estimates of density, biomass, and proportion of transects occupied across 13 streams, especially when outlying replicates were removed. We expected eDNA concentrations to be higher when water samples were collected just downstream from animals, but our analyses suggest that eDNA concentrations were not influenced by distance from animal, location in the stream, or time of day. We detected an increasing amount of eDNA within 6-24 hours after animals arrived into a previously unoccupied stream and we found that eDNA degraded exponentially until it was undetectable within 8-18 days depending on exposure to sun and temperature. More work is required to test the limitations of eDNA applications; however, our preliminary findings suggest that this technique has the potential to be a highly sensitive and cost-efficient tool for monitoring aquatic species, even in high-gradient streams.

**Pimm, Stuart,** *Nicholas School of the Environment*

**The Cape Sable seaside sparrow: a case study of Endangered Species Act implementation**

Cape Sable seaside-sparrows live in the freshwater marshes of the Everglades. These seasonally flood as rains resume in early June. Water levels start receding early in the year. The deepest part of the Slough may remain flooded for years on end. Peripheral areas are dry March to May and the sparrow nests there. Up to 1992, range-wide surveys found most birds west of the Slough. This changed from 1993 onwards, when water managers released historically unprecedented water flows across the water control gates, which are due north of these western sparrows, flooding them during the breeding season, and destroying ~95% of this area’s birds. The proposed critical habitat designation included all the areas where surveys had found birds. The final designation eliminated the populations in the west — where the majority of the birds and potential habitat occurred. FWS provided three rationales for excluding these areas: (1) opposition from other agencies, including the Army Corps of Engineers, (2) limited palynological data that suggested some of the area may not have historically supported the sparrow, and (3) an assertion that designation of the area as critical habitat may limit Everglades restoration. FWS provided no evidence that any agencies would cease their participation were critical habitat to be designated. Their scientific evidence was deeply flawed. When challenged legally, they did not defend it, arguing instead for their rights to make decisions without explanation.

**Pinsky, Malin,** *Princeton University;* **Boris Worm**, *Dalhousie University;***Thomas Frölicher,** *Princeton University;* **Michael Fogarty**, *NOAA Fisheries;* **Simon Levin**, *Princeton University;* **Jorge Sarmiento,** *Princeton University*

**Using local climate velocity to guide North American marine conservation planning**

Marine conservation strategies worldwide are designed around species distributions and biogeographic patterns, often under the assumption that these patterns are relatively stable. With climate change, however, distributions are shifting as species seek more suitable conditions. There is an urgent need for credible predictions of future species distributions to guide conservation planning. We therefore tested projection methods against four decades of scientific surveys for 360 marine taxa on the continental shelves of North America. We found that much of the variation in species shifts in both latitude and depth could be explained by the rate and direction of local climate velocity. We also found evidence that fishing affected range shifts and that bottom-dwelling taxa lagged behind their thermal niches more than other taxa. Our results suggest that species shift at different rates, and even in different directions, because they are tracking the complex mosaic of local climate velocities. These findings imply that projections of species distributions based on downscaled IPCC-class climate models will be useful tools for evaluating existing conservation plans and for guiding a new generation of climate-ready marine conservation and fisheries management.

**Pintea, Lilian,** *the Jane Goodall Institute;* **Jovin Lwehabura**, *the Jane Goodall Institute;***Timothy Akugizibwe,** *the Jane Goodall Institute;* **Yaw Anokwa**, *Nafundi*

**Community-based Monitoring of Chimpanzees, Habitats and Threats in Tanzania Using ODK and Android-based Smartphones and Tablets**

ODK is a free set of tools for: building a data collection survey form; collecting the data in the field on an Android mobile device, smartphone or tablet; aggregating the collected data on a server, locally or in the cloud; and extracting it in useful formats for analysis and visualization. The ODK approach has been successfully used worldwide in a variety of applications from socio-economic and health surveys to decision support for clinicians. In this presentation we will discuss one of the first applications of ODK to conservation in practice. Since 2009, the Jane Goodall Institute has been building capacity in 52 villages in western Tanzania to use ODK to monitor wildlife and threats on their village lands, with an emphasis on chimpanzees and forest habitats. Currently more than 90 Village Forest Monitors have been trained in the use of ODK running on 27 smartphones and 19 tablets. Communities use five forms to collect and report data on: patrolling efforts, presence of more than 20 species of wildlife, details on chimpanzee presence, more than 20 human activities identified as threats, and any other information that forest monitors consider important but that is not captured in other forms. The data are stored, managed and visualized on the Google Earth Engine/Maps Engine APIs and exported to Esri ArcGIS for further analysis. We will discuss lessons learned from community engagement, technology transfer, logistics, and the actual use of data in conservation decisions.

**Pitt, Amber,** *Clemson University;* **Robert Baldwin**, *Clemson University;***Benjamin Stegenga,** *Clemson University*

**Amphibian Movements Suggest Isolated Wetlands Should Be Regulated under the Clean Water Act**

Wetland conservation in the U.S. often focuses on distinct aquatic features that fit into particular delineation categories based on geophysical characteristics and plant communities. Federal wetland policy does not protect isolated wetlands, despite their importance for maintaining biodiversity, unless a "significant nexus" with a traditional navigable water body is established. Determination of a significant nexus is currently based largely on surficial hydrological connectivity. However, if biodiversity conservation is to be a major goal of federal wetland policy, biological connectivity requires attention. We used radio-telemetry to track three anuran species to assess biological connectivity of aquatic features in two index landscapes with a variety of water bodies. Anurans moved among isolated wetlands and traditional navigable water bodies, suggesting a significant nexus based on biological connectivity exists among isolated wetlands and traditional navigable water bodies. Our results suggest that a significant nexus can exist among isolated wetlands and traditional navigable water bodies and it may be appropriate to regulate at least some isolated wetlands under the Clean Water Act. The regulation of isolated wetlands under the Clean Water Act may provide a powerful tool for protecting imperiled isolated wetland-dependent species that are not currently protected under policies targeting endangered species (e.g., Endangered Species Act).

**Pokras, Mark,** *Tufts University Veterinary School*

**Lead, health and the environment**

Despite centuries long understanding of the toxicity of lead (Pb) and some regulatory successes in limiting dispersal into the environment (e.g. removal from some paints and gasolines), substantial dispersal from mining, smelting, shooting sports and other sources continues. Large numbers of people and other animals are still being poisoned and serious low-level effects have been described in numerous species. Fragments of Pb ammunition in prey and offal are a major route of exposure in raptors and scavengers. Such Pb poisoning is a major impediment to the conservation of the California condor and kills large numbers of bald eagles annually. Investigations show that people consuming game hunted with lead ammunition risk Pb exposure. Ingestion of Pb fishing gear is a major cause of toxic mortality in common loons and other species. This presentation will review current knowledge on the lifecycle of Pb and its ecological effects, as well as legal, policy, and community initiatives to move towards non-toxic alternatives.

**Polaina, Ester,** *Doñana Biological Station (EBD-CSIC);* **Eloy Revilla**, *Doñana Biological Station (EBD-CSIC);***Manuela Gonzalez-Suarez,** *Doñana Biological Station (EBD-CSIC)*

**Which socioeconomic characteristics make a country more susceptible to harbor threatened mammals?**

Threats suffered by vertebrate species, including mammals, are predominantly induced by human activity. Although the main immediate causes of decline are habitat modification and direct prosecution, behind every direct threat there are political, economic and social decisions made by humans. The present work aims to clarify how these socioeconomic decisions influence the presence and abundance of threatened mammals at a country scale. We obtained several socioeconomic indicators for every country, grouped into seven categories according to the World Bank: agriculture, population, economy, environment, health, labour and social protection, and private sector. Mammals vulnerability to extinction was assessed using the Red List and distribution maps of the International Union for Conservation of Nature (IUCN) to assigned species to countries. Results from generalized linear models show that the economic (mainly trade of goods and services indicators) and population features of a country (e.g. percentage of urban/rural population) are those that best explain the presence and abundance of threatened mammals within its borders. These results show the relationship between socioeconomic human decisions and extinction risk at a global scale, and could aid in defining the changes to our lifestyle necessary to preserve the world mammals.

**Polak, Tal,** *The University of Queensland;* **Jonathan Rhodes**, *The University of Queensland;***Darryl Jones,** *Griffith University;* **Hugh Possingham**, *The University of Queensland*

**Optimal planning for mitigating the impacts of roads on wildlife**

Roads have a major effect on wildlife worldwide. Two of the ways to mitigate the impact of roads are to improve connectivity or reduce mortality. However these are expensive actions that show varying levels of success. Thus deciding where and how to act in order achieve the greatest return on investment is crucial. Currently, there are no quantitative approaches to priorities different mitigation options or assess their cost-effectiveness. Here we use a decision theory framework to determine the most cost-effective combination of actions to mitigate the effects of roads on wildlife under budget constraints. We illustrate our approach using a case study of the threatened koala (Phascolarctos cinereus) population in South-East Queensland. We applied a spatially-explicit population model to explore the benefits of two kinds of mitigation, fences and/or crossings, for each road segment. We explored the trade-off between population viability and budget, and found that there is a strong need for mitigation, as the cheapest option (no mitigation) resulted in an unacceptably low population size. Additionally, species attributes (velocity and growth rate) affected population viability but not the choice of the optimal mitigation actions. Finally, the almost linear shape of the trade-off curves between investment and population viability indicates that a low cost solution is improbable and any reduction in the budget will result in a significant reduction in expected population size.

**Pompa, Sandra,** *Fondo Mexicano Conserv. Naturaleza*

**Mesoamerican Reef Conservation: A New Generation of Leaders in the Caribbean**

The current loss of biological diversity is one of the most severe global environmental problems. Despite their value, marine ecosystems are rapidly deteriorating; this is partly because roughly 60% of the world’s human population lives within 100 km of the coast line, and 20% of ecosystems adjacent to oceans have been highly modified. Because of those anthropogenic environmental changes, many marine species and populations have undergone local, regional, or global extinctions. Given this scenario, the NGO Fondo Mexicano para la Conservación de la Naturaleza (FMCN), The Summit Charitable Foundation, and the Mesoamerican Reef Fund (MAR Fund) partnered to form The Mesoamerican Reef Leadership Program (MAR Leadership), to boost reef conservation by empowering emerging leaders from the four nations of the MAR (Mexico, Belize, Guatemala, and Honduras) with bolstered professional skills to develop innovative and replicable projects to conserve the region's coastal and marine ecosystems as well as improving the livelihoods of local communities that depend on this threatened marine resource. The Program operates via annual “cohorts” of 10-12 Fellows, whose professional endeavors bear a connection to the health and integrity of the coastal-marine environment. Each cohort cycle runs for 18 months and features group training, individually tailored training, seed funding for project design, peer-to-peer learning, mentoring, technical assistance, and other networking opportunities.

**Pont, Ana,** *Unisinos;* **Mônica Engel**, *Unisinos;***Silvio Marchini,** *Escola da Amazônia;* **Rodrigo Machado**, *Unisinos;* **Larissa Oliveira**, *Unisinos*

**Conflict between fishing and conservation interests: attitudes and behaviors towards sea lions in a fishing community in southern Brazil**

The conflict between South American sea lion (Otaria flavescens) and fishermen on the southern coast of Brazil is characterized by dispute for fish and damage to fishing nets. This interaction with the fishing activity is considered a major conservation problem currently faced by sea lions. In order to assess emotions, attitudes and behaviors of the fishery community of Passo de Torres (29°19'S; 49°43'W), related to the conflict with sea lions, we conducted 35 interviews. Data were recorded on a Likert scale and analyzed by average and frequency. The results showed that the fishermen who had been fishing for a longer time (51%), and had spent fewer years in school had more negative attitudes (52%). The most salient feeling was anger (60%) towards the sea lion; respondents said they would like them to disappear from the area (69%). The behavior suggests that the fishermen would kill one in a moment of anger or if needed (63%). It is noticed that the community has a negative stance on the scenario, but at the same time, interest in participating in the decisions. As for the participation in decision-making regarding the management of the area, the fishermen are interested in attending to decisions (94%), they find it important to be heard (89%) and want to help in the decisions on the future of the area (83%). Thus, the practice of participatory management in the area may be the key to mitigating the conflict, since the stakeholders will feel as an important part of the system.

**Popescu, Viorel,** *Simon Fraser University*

**Climate change and the efficacy of the Natura 2000 network for protecting reptiles and amphibians in Romania**  
Rapid climate change represents one of top threats to biodiversity, causing declines and extinctions of many species. Range shifts are a key response, but in many cases are incompatible with the current extent of protected areas. In this study we used ensemble species distribution models to identify range changes for 21 reptile and 16 amphibian species in Romania for the 2020s and 2050s time horizons and three emission scenarios. We then used irreplaceability analysis to test the efficacy of the Natura 2000 network to meet conservation targets under current and future conditions. Under all scenarios and time horizons, 90% of the species suffered range contractions (up to 90%), and four reptile species expanded their ranges. One reptile and two amphibians are predicted to completely lose climate space by 2050s. Currently, <10% of species meet conservation targets, but it increases up to 38% for future scenarios. The Carpathians and SE Romania (Dobrogea) have the highest irreplaceability scores under future conditions, suggesting that two regions act as refugia for many reptiles and amphibians. Thus, conservation actions for herpetofauna in Romania need to focus on these regions and on facilitating range shifts. Overall, the Natura 2000 network performs better for achieving herpetofauna conservation goals in the future, but this is an artifact of range contractions that restrict many species to the two regions, which already have extensive Natura 2000 coverage.

**Possingham, Hugh,** *The University of Queensland;* **Michael Bode**, *The University of Melbourne;***Carissa Klein,** *The University of Queensland*

**Optimal conservation outcomes require both restoration and protection**

Conservation outcomes are principally achieved through the protection of intact habitat or the restoration of degraded habitat. Restoration is only recommended where protection is no longer practicable, because protection is thought to provide superior outcomes, at lower costs, without the time-delay required for restoration. Yet while it is broadly accepted that protection safeguards more biodiversity and generates greater ecosystem services per unit area, conservation lacks a theory that can coherently compare the relative outcomes of protection and restoration. Here, we use a dynamic habitat model to integrate these two actions into a unified conservation theory. Using nonlinear benefit functions, we show that both protection and restoration are crucial components of a conservation strategy that seeks to optimize either biodiversity conservation, or ecosystem services provision. In contrast to conservation orthodoxy, it can be optimal to begin restoration before all intact habitat is protected, and in some circumstances restoration should take precedence over protection. The relative priority of protection and restoration depends on their costs, and also the relative time-lags inherent in both actions. We use two examples to demonstrate these conclusions: bird conservation in tropical rainforests, and coastal protection from mangrove forests.

**Post, Gerald S. ,** *Duke University*

**Increasing Conservation Effectiveness: What Medicine and Business Can Teach Us**

To avoid a dramatic loss of biodiversity we need to know what interventions are effective. Because conservation of biodiversity occurs within very complex socioeconomic and geopolitical spheres, where incomplete knowledge is the norm, the evaluation of interventions and outcome success is difficult. Evidence-based medicine and comparative effectiveness research have transformed both medical and veterinary oncology. Similarly, the use of methodologies ranging from Positive Deviance to the Success Case Method and Benchmarking, have altered how the most effective complex social and business practices can be identified. Utilizing systems borrowed from both medicine and business, I evaluated the most and least successful tiger reserves in India. We used the Cambridge Conservation Forum’s definition of success as increasing the likelihood of persistence of the tiger population and failure as the decline in the tiger population within the protected area over the period 1995-2005. The use of these techniques allowed us to compare variables with conservation outcomes, and determine that one can achieve tiger conservation success even within a densely populated human landscape where a high percentage of the population is involved in agriculture. The most important implication of this work is that this inter-disciplinary technique can be used to evaluate conservation interventions in a complex biologic and socioeconomic environment.

**Poudel, Abishek,** *Department of National Parks and Wildlife Conservation,Nepal*

**Human-Tiger Conflict in Chitwan National Park,Nepal**

Human- tiger conflicts are serious issues of conflicts between local people and park authority and the conflicting situation potentially play negative role in park management. This study aimed (1) To determine the trend and nature of human-tiger conflicts (2) To understand peoples' perception and mitigation measures towards tiger conservation. Both primary and secondary data were used to determine human- tiger conflicts in Chitwan National Park. Systematic random sampling with 5% intensity was done to collect the perception of the villagers regarding human-tiger conflicts. The study sites were selected based on frequencies of incidences of human attacks and livestock depredation in Rajahar and Ayodhyapuri Village Development committes. The trend of human casualties by tiger has increased in last five year whereas the trend of livestock has decreased. Reportedly, between 2008 and 2012, tigers killed 22 people, injured 10 and killed at least 213 livestock. Conflict was less common in the park and more intense in the sub optimal habitats of Buffer Zone. Goat was the most vulnerable livestock followed by cattle.The livestock grazing and human intrusion into tiger habitat were the major causes of conflicts. Developing local stewardship and support for tiger conservation, livestock insurance, and compensation policy simplification may help reduce human-tiger conflicts.

**Powell, Luke,** *Louisiana State University;* **James Nichols**, *Patuxent Wildlife Research Center;***James Hines,** *Patuxent Wildlife Research Center;* **Andres Zurita**, *Instituto de Biología Subtropical, Universidad Nacional de Misiones;* **Phillip Stouffer**, *Louisiana State University, School of Renewable Natural Resources*

**Forest recovery in post-pasture Amazonia: Testing a conceptual model of space use by insectivorous understory birds**

Although the Brazilian Amazon has lost more than 328,000 km2 of rainforest over the last 20 years, abandonment of deforested lands has created a vast network of secondary forests (SFs)?161,000 km2 by 2002?size of Florida. To quantify spatiotemporal patterns in space use of birds along edges of primary forest and a gradient of SFs (1-30 years old), we radio-tracked three understory insectivores at the Biological Dynamics of Forest Fragments Project: Glyphorynchus spirurus (n = 23), Xiphorhynchus pardalotus (n = 23) and Formicarius colma (n = 27). Birds in young SF had larger home ranges, core areas and movement rates than those in primary forest. G. spirurus was first to recover, showing no edge response to SF 11-14 years old; X. pardalotus recovered at 19-24 years and F. colma at 28-30 years. Young F. colma concentrated their activity along edges, just inside primary forest adjacent to young SF?these subordinates are likely pushed to edges by dominant adults, but are unable to penetrate young SF. Finally, using novel transition probability models in MARK, we estimated that even after 27-31 years, F. colma was still less likely to transition into SF from primary forest, suggesting that even our oldest SF had not yet recovered in terms of use by obligate rainforest species. By understanding the dynamics of movement by specialized rainforest birds, we will be in a strong position to conserve rainforest biodiversity as landscapes continue to change in the Anthropocene.

**Pressey, Bob,** *James Cook University;* **Paul Ferraro**, *Georgia State University;***Valerie Kapos,** *United Nations Environment Programme World Conservation Monitoring Centre;* **Georgina Mace**, *University College London;* **Madeleine Bottrill**, *Conservation International;* **Michael Obersteiner,** *International Institute for Applied Systems Analysis;***Alex Pfaff**, *Duke University*

**The mismeasure of conservation**

Protected areas are the cornerstones of the global conservation strategy but have a serious failing. They are concentrated in areas that are remote and have least value for subsistence or commercial uses. Therefore, they tend to occur where threats to biodiversity are low while losses of biodiversity continue unabated elsewhere. Importantly, this failing is hidden by common measures of conservation progress that emphasize the number and extent of protected areas rather than how much loss of biodiversity their establishment has avoided. We begin with examples of "residual" systems of protected areas (those dominantly in areas with least need for protection) that fail to live up to their promise of protecting nature. We then identify key characteristics of conservation measures needed to focus attention on avoided loss which is, after all, the real purpose of conservation. We place existing measures and recommended new measures in the context of a results chain that includes inputs, outputs, outcomes, and effects. Current measures focus on outputs (protected areas) but there are tractable methods for measuring effects, or how much difference protected areas make (additionality). The new measures can be applied retrospectively to existing reserves and projected into the future to identify where new protected areas can make the most difference. We conclude by outlining the opportunities for and obstacles to bringing these methods into policy and practice.

**Pressey, Bob,** *ARC COE for Coral Reef Studies*

**What would a generic implementation strategy look like?**

Many people involved in conservation planning have views on the requirements for effective implementation, and most of them are right. An effective implementation strategy has many facets, and conservation planners have limited experience in making them all work together. This presentation is an attempt to sketch out the main facets of an implementation strategy and the ways they interact. Broadly, we can think of facets related to anticipation (preparing the ground) and application (moving from a regional design to local actions). Progress in understanding aspects of anticipation can be seen in the refinement of operational models for conservation planning since the late 1990s. These include involvement of stakeholders and assessments of opportunities and constraints for conservation management. Progress in understanding aspects of application has also been made, but the experiences are dispersed and not well documented. Broadly, application involves decisions and feedbacks around translation of designs into management units on the ground or in the water, coordination of managers at several spatial scales, identification of feasible and effective actions identified for each unit, and a funding strategy to make it all work. Moving forward with all this requires debate about generic, comprehensive approaches that can be adapted to particular circumstances.

**Pressey, Bob,** *James Cook University*

**An attractive but unsupported idea? Moving from case studies to insights into environmental surrogates for conservation planning**

Environmental or coarse-filter surrogates are widely used in conservation planning, sometimes as a sole guide to the distribution of biodiversity, but more often as parts of larger, composite data sets. However intuitive their utility might seem, the evidence base for their effectiveness in depicting the distributions of species is inconsistent. Underlying the lack of strong generalisations about the effectiveness of surrogates are important factors that have almost never been standardised in their testing: study region, spatial extent and resolution, types of surrogates, types of species against which surrogates are tested, and the analytical approach for testing. Case studies will continue to emerge demonstrating the effectiveness, or lack of it, of surrogates. But what do these case studies actually mean? Understanding surrogates requires more comprehensive methods in tandem: 1. Review of ecological theory to understand why surrogates should work and what limitations can be expected; 2. Meta-analysis to identify what factors relate to effectiveness; 3. Artificial data sets that can be manipulated to identify aspects of data structure related to effectiveness; 4. Comparison and better understanding of testing methods (covering both pattern-based and selection-based tests), linking each method to one or more explicit questions. These comprehensive approaches offer the only way of making sense of the hundreds of case studies that tell different, unconnected stories.

**Price, Catherine,** *University of Sydney;* **Peter Banks**, *University of Sydney*

**It just makes scents - manipulating predator foraging tactics to protect prey**

Targeting the foraging biology and behavior of predators offers conservation biologists novel approaches to protect species at risk. Many of the world's worst alien predators, e.g. black rats Rattus rattus and stoats Mustela erminea, use olfaction to find prey and rely on odor cues to assess prey quality and abundance. Drawing from ecological and psychological theories, we show how patchy, conspicuous odor cues place prey at increasing risk but can be spatially and temporally manipulated to undermine predator motivation, alter foraging behavior and reduce prey vulnerability. In controlled enclosure experiments using wild mice Mus musculus, we applied a form of 'chemical camouflage' by creating a uniform odor background and slowed prey detection by an average of 11% (19% for lower quality prey). In a multi-prey system, chemical camouflage increased search costs and reduced the foraging efficiency of stoats searching for mice, a primary prey and locusts, a model alternate prey. Finally, prey survival was significantly increased by pre-exposing wild black rat populations to bird odor. Subsequently introduced birds' eggs survived 62% better than those in controls. When odor was introduced early, rat activity waned after approximately three days, after which time rats ignored the bird odor and did not find eggs introduced subsequently. The ubiquitous nature of olfactory foraging means that these techniques should be applicable to a wide range of ecological applications.

**Primack, Richard,** *Boston University*

**Getting Your Article Accepted into a Leading Conservation Journal**

In this session, designed especially for graduate students and other young researchers, the Editors of Biological Conservation (BC) and other international journals will provide pointers on how to get papers accepted into conservation journals; and what to do when papers get rejected. Such information is valuable, as the acceptance rate of BC and other journals is below 25% and will likely decline to 20% in coming years. Over 50% of submitted articles are rejected without review, and authors can seek advice from the Editors on the suitability of articles before submitting. In this session, we will discuss ways to make your article more appealing to Editors and a broad scientific audience, including writing a strong cover letter, working with colleagues to improve your article, and writing different types of articles, including Review Articles that have a higher acceptance rate and Perspectives that can include a personal viewpoint. Other strategies include matching your paper to what the journal publishes and making sure the work is substantial enough for publication. Issues to be discussed include having a good experimental design, improving the writing and organization, demonstrating relevance to management, and the need to place the work in a broad context in the introduction and discussion. On rare occasions an author may be successful in changing an editorial decision, but typically a paper rejected from one journal is revised and submitted to another journal.

**Primo, John,** *Bureau of Ocean Energy Management;* **Brian Krevor**, *Bureau of Ocean Energy Management*

**Renewable Energy Siting: Understanding the lay of the land and the sea on the U.S.'s Atlantic Coast**

This presentation describes how the Bureau of Ocean Energy Management (BOEM) is meeting significant socioeconomic information needs to inform the development of offshore renewable energy. BOEM's studies on ocean space-use, the vulnerability of coastal economies, and facility siting support the informed development of offshore renewable energy resources by providing high quality scientific information. This research provides baseline information on humans and their relationship with the coastal and ocean environment; answering such questions as, 'Who uses ocean space?', 'How do beach visitors perceive and react to offshore wind facilities at varying distances?', and 'Which coastal economies are particularly vulnerable to impacts in their tourism and recreation sectors?' Answers to these types of questions help the bureau understand complex socioeconomic issues, and assist the Bureau's leadership in making informed OCS planning decisions.

**Prugh, Laura,** *University of Alaska Fairbanks;* **Stephen Arthur**, *Alaska Department of Fish and Game*

**Wolves as shepherds: Optimal predator management for mountain sheep conservation depends on the strength of mesopredator release**

Despite a long history of persecution, top predators such as wolves and mountain lions are making a comeback in North America, fueling heated clashes among scientists, policy makers, and the public about how to best manage these species. Successful conservation in these changing landscapes therefore requires a robust understanding of the ecological, social, and economic consequences of predator presence. We used empirical data and a stage-structured stochastic population model to examine the effect of wolf removal on Dall's sheep populations, considering both negative effects of wolf predation on sheep and indirect positive effects of wolf suppression of coyotes. Coyotes, wolves, and Dall's sheep ewes and lambs were radiocollared in the Alaska Range from 1998-2004 to determine survival rates and causes of mortality. Wolves were the main predators of adult Dall's sheep, coyotes were the main predators of lambs, and wolves were the main source of mortality for coyotes. In the absence of coyotes, the model predicted that wolf removal would cause a stable sheep population to grow by 3% per year. In the presence of coyotes, however, the model predicted that wolf removal would cause the sheep population to decline by 4% per year. These results highlight the importance of considering the response of mesopredators to large predator management, because accounting for their response can alter the predicted impact of management actions on sensitive prey populations.

**Pullin, Andrew,** *Bangor University*

**Collaborative evidence syntheses: the foundation stones of evidence-based conservation.**

Abstract: Conservation science continues to grow in terms of data generated, papers published and journals established but the potential of this science to inform practice and policy is not fully realized. A concerted effort is required to synthesise the available evidence with respect to questions of concern to conservation decision makers. Although a culture of systematic review and evidence synthesis is embedded in other sectors, such as health, it has only recently emerged in conservation. To stimulate the growth and impact of evidence-based practice the Collaboration for Environmental Evidence (CEE) was established as a not-for-profit organisation in 2009. CEE’s purpose is protection of the environment and conservation of biodiversity through preparation, maintenance promotion and dissemination of systematic reviews (SRs) of the effectiveness and impacts of environment management interventions. Key achievements of CEE will be described, such as establishing guidelines, open-access to systematic reviews and growing a network of centres, review groups and methods groups. Key challenges remain, including creation of incentives to engage with SR activity, embedding a culture of evidence-based practice at organisational level and provision of training in SR methodology. A critical challenge still remains of achieving effective communication between the commissioners, conductors and users of evidence syntheses.

**Quilodran, Claudio,** *University of Geneva;* **Mathias Currat,** *University of Geneva;* **Juan Montoya-Burgos*,*** *University of Geneva*

**Modeling extinction risk due to distant interspecific hybridization**  
Interspecific hybridization is enhanced by human activities, such as translocation of invasive species or habitat modification, and may threaten species persistence. Hybridization between distantly related species often leads to infertile hybrids or fertile hybrids without chromosomal recombination during gametogenesis. We present a model describing those types of hybridization, which considers density-dependent competition, assortative mating and dominance/recessive inheritance. We illustrate its use for assessing extinction risk by two examples. We first modeled the asymmetrical reproductive success between Atlantic salmon and brown trout, whose hybridization has been increasing due to releases of domestic fish in the wild. Second, we studied the impact of the invasive frog Pelophylax ridibundus on two western European endemic waterfrogs, Pelophylax lessonae and Pelophylax esculentus, when introduced from different geographical origins having singular hybridogenetic properties. The results of our model give the conditions under which interspecific hybridization can lead to population extinction, providing clues for conservation actions. In both examples, the threat is demographically mediated, either through wasted mating potential or through demographic displacement between species. Our results highlight why distant hybridization should be considered in conservation assessments, one of the fields in which our model constitutes a valuable new tool.

**Quinn, Samuel,** *The Farm at Sunnyside*

**Growing Food and Biodiversity: Integrating Conservation and Agriculture in Northern Virginia**

Given the multitude of studies on the agriculture/conservation relationship, the next step toward encouraging widespread application of this research is to create the framework for integrating conservation practices into a farm business strategy. The Farm at Sunnyside, an organic fruit and vegetable farm in Rappahannock County, VA, is exploring this new model of agriculture in which conservation is an explicit part of the food production system. In 2010 the farm created the position of "conservation manager," a full-time biologist who works alongside farm staff to guide conservation initiatives such as inventorying biodiversity, monitoring ecological health, enhancing habitat for native species and quantifying interactions between agricultural and natural areas of the farm. The conservation manager directly contributes to the farm business by providing the expertise with which to maximize benefits from ecosystem services while acting as a first responder to address challenges such as pests and invasive plants. The program generates revenue through the sale of "wild products" like forest fruits and wildflowers from restoration areas, simultaneously promoting the value of native species while helping to recuperate the costs of restoration work. By relating our methodology for developing, applying and funding a farm conservation program we will make the case that agriculture can strongly benefit both ecologically and economically from a conservation perspective.

**Quintero Angel, Andrés,** *Pontificia Universidad Javeriana.;* **Néstor Ospina-Reina**, *Fundación OIKOS*

**Distribution and Conservation State of the Small Wild Cats in the Cauca Valley, Colombia**

The lack of knowledge of the distribution and conservation status of the species of small wild cats (Leopardus pardalis, L. wiedii, L. tigrinus and Puma yagouaroundi) in the Cauca Valley and the possible degradation of habitats used by these species is a conservation concern. The records of these species are generally encounters with humans (where they usually die) and come from different types of habitats (forests, crops, pastures and plantations). The aim of this work is to make an approach to the current state of the Small Wild Cats, by checking historical reports and current records of these species. Historical information was obtained through the review of collections and databases, current reports were made with the help from field biologist. With this information were made potential distribution maps for each species. Ten historical sites of occurrence and seven sites that had more than 70% probability of occurrence were selected and visited in 2010 and 2012 to verify the presence of the species with camera traps. We confirmed the presence of the four species in the region with 32 new records. L. pardalis and P. yagouaroundi were the most recorded species and with the greatest distribution. We expose the elimination of L. wiedii and L. tigrinus in some of its historical sites, due to habitat destruction. We conclude that the main threat to the species in their distribution in the Valley is habitat loss, hunting resulting from human-wildlife conflict and road kill

**Raghunathan, Nima,** *University of Liege;* **Louis François**, *University of Liege;***Alain Hambuckers,** *University of Liege*

**Modelling climate change impacts on key tree species used by lion tamarins in the Brazilian Atlantic Forest**

We used 3 IPCC climate change scenarios (A1B, A2, B1) in a dynamic vegetation model (CARAIB), to determine the potential future distribution of biomes and 75 species of trees used as food sources or sleeping sites by endemic primates, the golden lion tamarin (Leontopithecus rosalia) and the golden-headed lion tamarin (L. chrysomelas), in the Brazilian Atlantic Forest (BAF). Habitat conservation is a vital part of strategies to protect endangered species, and this is an approach to understand how key plant species needed for faunal survival might be affected by climate change and what changes to their distribution are likely. CARAIB computes the main physiological reaction of plants, e.g. water absorption or photosynthesis, as a response to temperature, precipitation, or CO2 partial pressure. The model accurately predicted the current distribution of BAF vegetation types and for 66% of the individual tree species with 70% agreement obtained for presence. In the simulation experiments for the future, 72 out of 75 tree species maintained more than 95% of the original distribution and all species showed a range expansion. The results suggested that the trees may benefit from an increase in temperature, if and only if soil water availability is not altered significantly, as was the case with climate simulations that were used. However, the results must be coupled with current and planned land-uses to maximise the usefulness to conservation, as the BAF is subject to many threats.

**Rahagalala, Tiana,** *WCS;* **Christopher Holmes**, *WCS*

**Putting a hyphen between trainings and competencies to improve marine protected areas management effectiveness in Madagascar**

In 2008, Madagascar undertook an overhaul of its progress in PoWPA (program of work in protected areas) implementation. The initial analysis concluded that key PA managers lacked core competencies in protected area management. This paper presents Madagascar exercise to identify appropriate capacity building program for PA managers. To help build capacity in PA management, various approaches were developed. Training modules were freely distributed. Various institutions ran several short practical training courses. Trainings of trainers were also organized. In 2011, The Wildlife Conservation Society (WCS), in partnership with the System of protected areas management (SAPM), and the international Network of conservation educators (NCEP) run SWOT analysis of professional trainings programs. Trainings rarely come with follow up system aiming to assess impacts on PA management. The completion of a training course does not totally guarantee competence to practice and training alone does not ensure that PA is effectively managed. WCS and partners created a critical bridge between trainings and competencies by slotting in the WIO-COMPAS program (Western Indian ocean certification of marine protected areas professionals). The program assesses marine PA performance based on professional competency Standards, and identifies objectively gaps in competencies. Next step consisted in developing a platform of exchange to carry on trainings

**Rainey, Meredith,** *Center for Large Landscape Conservation;* **Erica Fleishman***, University of California Davis;* **Rob Ament***, Center for Large Landscape Conservation;* **Gary Tabor***, Center for Large Landscape Conservation*

**A proposed classification of corridors for wildlife movement**

Animals have a fundamental need to move, and areas likely to support animal movement are often referred to as corridors. However, corridors have been defined inconsistently, and different corridors are intended to support different movement processes occurring over a range of spatial and temporal scales. Confusion surrounding what is meant by 'corridor' impedes communication among scientists, practitioners, and policy makers, and may result in ineffective planning and management. We developed a categorization of corridors, which we offer as one possible solution for improving communication and practical applications of the corridor concept to management and policy. We focus our categorization on corridors supporting movement of wild animals, and model our approach on the International Union for Conservation of Nature (IUCN) protected area management categories, which provide a global standard for defining protected areas according to their management objectives. We define five categories of corridors on the basis of the primary movement process they are intended to maintain. We focus on examples of each and discuss how management action is expected to vary as a function of the target movement process. Our intent is to bridge the gap between the ecological concept and the practice of corridor conservation, enhancing communication and management and ultimately aiding development of a global corridor inventory.

**Rakotobe, Domoina,** *American Museum of Natural History;* **Ony Rabearivololona**, *Durrell Wildlife Conservation Trust;***Tiana Rahagalala,** *Wildlife Conservation Society;* **Solofo Ralaimihoatra**, *Conservation International;* **Kimberley Landrigan**, *American Museum of Natural History*

**Towards an Integrated Approach to Conservation: Lessons learned from a National Capacity Building Project in Madagascar**

Due to its hotspot status, Madagascar has become the operating field of numerous conservation projects and practitioners. Among these efforts, the Network of Conservation Educators and Practitioners-Madagascar (NCEP-MD) was among the first to endeavor to de-compartmentalize disciplines, institutions, visions and methods. NCEP-MD aims to improve professional conservation capacity within the country through increasing access to high-quality teaching resources and training opportunities, and fostering collaboration beyond traditional frameworks. Since its inception in 2003, NCEP-MD has striven to implement an integrated approach to biodiversity conservation through the development and dissemination of trans-disciplinary training modules, trainings events for multi-level and multi-disciplinary academic and professional audiences, and the organization of exchange platforms for NCEP-MD network members. This presentation focuses on lessons learned during the past ten years. Project evaluations show that NCEP-MD has contributed to significant increases in conservation knowledge and opportunities for collaboration among conservation educators and practitioners in Madagascar. However, improvements in individual or institutional performances were difficult to measure. Therefore, in 2011, NCEP-MD began developing certification programs that assess individual performance and reinforce shared responsibilities between public institutions, conservation NGOs, training centers and communities.

**Ramos, Oscar,** *Fundación Conserva/Universidad de Los Andes;* **Jorge Parra**, *Fundación Conserva;***Alexandra Delgadillo,** *Fundación Conserva;* **Sandra Valderrama**, *Fundación Conserva;* **Marcela Beltran**, *fundación Conserva;* **Diana Guzman,** *fundación Conserva;***Johana Delgadillo**, *fundación Conserva*

**Updating the geographical distribution of the critically endangered Niceforo's Wren (Thryothorus nicefori)**

The Niceforo's wren (Thryothorus nicefori) is an endemic bird of the Chicamocha Canyon (Colombia), which is classified as critically endangered due to habitat degradation and restricted geographic distribution. To date, it is necessary to gain insight of their distribution, which will be base for future protection plans. Applying the maximum entropy analysis (MaxEnt), and using 44 historical records for the initial distribution, three sequential versions of the potential geographic distribution of this species were generated, as new records were collected over three fieldwork explorations. Each distribution version was used to select the localities for the next exploration. After the three exploratory phases, 74 records were accumulated, which were used to generate a final updated geographic distribution for T. Nicefori. The final distribution shows that the potential distribution of this species is restricted to 3200 Km2 and concentrated mainly in the mid-west region and south-east region within the distribution. With the update of the distribution of this species, it is confirmed that this species remains in the critically endangered condition because its distribution continue restricted and the degradation of their habitat continues due to fragmentation

**Ramp, Daniel,** *University of Technology, Sydney*

**Bringing Compassion to the Ethical Dilemma in Killing Kangaroos for Conservation**

Conservation biologists seek to conserve and protect biodiversity but face considerable challenges because prevailing land-use practices are at odds with biodiversity conservation. Solutions are needed to redress the imbalance and practitioners employ a wide range of strategies to mitigate the effects of the many challenges faced. Problematically, environmental decision-making is not devoid of human interests, and strategies are commonly employed that suit entrenched positions and commercial gain, rather than valuing the needs of the non-human animals intended to be protected. We explore this by discussing the killing of kangaroos for conservation in Australia using the principles of ‘Compassionate Conservation’. Ethical debate on the killing of kangaroos has polarised conservation and welfare scientists, yet the unifying aim of reducing harm to non-human animals of both conservation and animal welfare provides an opportunity to redefine the debate. Here we use a compassionate framework to explore restoration activities employing the principles of conservation through sustainable use within the heavily degraded rangelands of Australia. We contrast the dominant paradigm of consumptive use versus the more compassionate approach of eco-tourism. In doing so, we highlight some of the frailties in the arguments and suggest a way forward for conservation in Australia’s rangelands.

**Ranaivonasy, Jeannin,** *Forestry Dept, School of Agronomy University of Antananarivo, Madagascar;* **Joelisoa Ratsirarson**, *Forestry Dept, School of Agronomy University of Antananarivo, Madagascar*

**Biodiversity conservation and livelihood adaptation in the context of changing climate in eastern Madagascar**

Multidisciplinary research initiatives (climate monitoring, ecological monitoring, participatory action research) have been undertaken in eastern Madagascar to better understand impacts of changing climate on biodiversity conservation and community livelihood. Local monitoring with local perceptions show increased frequency and intensity of cyclones on the last three decades, as well as seasonal decrease of rainfall. These also demonstrate importance of climate variability with recurrent droughts and heat waves. In this context, adaptation strategies and related decision processes may need to address divergent conclusions and recommendations through multidisciplinary approach. Indeed, studies show that lesser rainfall and more cyclones perturb forest ecology, and could threaten productivity and sustainability of farming systems. However, results also demonstrate that warmer temperatures that are observed these last thirty years could induce better opportunities for rice and cash crops productivity.

**Randrianandrasana, Maminirina,** *University of Illinois;* **May Berenbaum**, *University of Illinois;***Mamy Ratsimbazafy,** *SEPALI*

**Eating insects for forest conservation in Madagascar**

Madagascar is known for its rich natural biodiversity although its status as a hotspot is threatened by human activities. Integrated conservation approaches have been implemented in the past, such as earning money through unconventional sericulture involving rearing Antherina suraka (Saturniidae), near riparian forests for commercial silk production. In our study, we investigated the feasibility of adding another alternative income stream from sericulture by utilization of the pupae for human consumption. As entomophagy has been a common practice since ancient times, we set out to confirm whether insects remain a constituent of contemporary diets and whether new species could be incorporated in the diet. We designed a survey of local people in potential or current sites of sericulture located near endangered forests of Madagascar comprising interviews of households and collections of edible insects. Evaluating preferences for particular species and willingness to try new ones, especially A. suraka pupae, was our chief objectives. Varieties of insects are known to be consumed by local people. Consuming the pupae of A. suraka would not be too great a cultural challenge as a new food in view of the fact that the same life stage in other Lepidoptera has been consumed before. This study may potentially contribute to more widespread adoption of sericulture of native species, increasing the economic value of local biodiversity and reducing overexploitation of forests in Madagascar.

**Ransom, Tami,** *Salisbury University*

**Local distribution of native and invasive earthworms and effects on a native salamander**

Earthworms are widely recognized as ecosystem engineers through their modifications to soil structure. North America is home to both native and invasive earthworms, providing a good system to compare effects between closely related native and invasive engineers. Here I determined where and what earthworm species occur near Mountain Lake Biological Station in Virginia, and compared effects of native and invasive earthworms on the woodland salamander, Plethodon cinereus. Earthworms can positively affect P. cinereus by providing burrows for shelter and as prey, but may negatively impact this species by decreasing microinvertebrates, another key prey, in the soil and leaf litter. The native worm Eisenoides carolinensis was the most common earthworm found, occurring on 41% of 48 plots. The invasive earthworms Dendrobaena octaedra and Octolasion tyrtaeum occurred on 27% and 16% of plots, respectively. Using SEM, I found O. tyrtaeum was negatively correlated with nighttime salamander counts, mediated by negative effects on O-horizon depth and microinvertebrate numbers. In the lab, O. tyrtaeum and D. octaedra consumed more leaf litter per g of worm per day than the native E. carolinensis. However, salamanders consumed and used burrows of all earthworm species similarly. Seemingly small differences between native and invasive ecosystem engineers have the potential to significantly alter the effects of these closely related organisms leading to larger conservation implications.

**Rasser, Michael,** *Bureau of Ocean Energy Management*

**Applied Science for Management of Marine Offshore Energy Resources**

The United States Outer Continental Shelf (OCS) consists of approximately 1.7 billion offshore ocean acres. Compared to coastal areas, relatively less scientific data is available on the distribution, abundance and diversity of marine organisms in the offshore marine environment. The Bureau of Ocean Energy Management's Environmental Studies Program (ESP) develops, conducts and oversees science designed to inform policy decisions for managing offshore energy and mineral resources on the OCS. Specific examples of applied research conducted by the ESP will be discussed, including projects focused on investigating arctic fish community ecology, mapping deep water corals, and determining the abundance and distribution of birds with high resolution aerial imagery. These examples will illustrate how the ESP is using the latest remote sensing technology and other advanced methods to collect and analyze scientific information over large areas of OCS in a cost effective manner. Results from studies such as these are continually enhancing the quality of resource management and stewardship decisions for the vast offshore environment.

**Rastogi, Archi,** *McGill University;* **Gordon Hickey**, *McGill University;***Ruchi Badola,** *Wildlife Institute of India;* **Syed Hussain**, *Wildlife Institute of India*

**Diverging viewpoints on tiger conservation: A Q-Method study and survey of conservation professionals in India**

Biodiversity conservation often involves urgent, yet complex decision-making dilemmas that do not have clear solutions. Such problems typically involve stakeholders with divergent viewpoints and interests, leading to disagreement, controversy and political dispute. In these situations it becomes critical for conservation managers and policy-makers to distinguish the worldviews driving the debate. Focusing on the case of tiger conservation in India, we combined the Q-Method with a traditional survey instrument to explore the diverse viewpoints of conservationists in India. The results indicate five dominant viewpoints: 1) community-centered; 2) tiger-centered; 3) science and tourism-led; 4) instrumental approach; and 5) moral-centered. Further, our research suggests that despite 'tiger-tribal' issues often overwhelming conservation debates in India, there are important areas of overlap within the tiger-centered and community-centered viewpoints, and with other independent (albeit rarely evident) viewpoints. To help foster consensus, we suggest the need to avoid framing conservation policy discussions along the tiger-tribal debate and instead focus on existing areas of agreement. One such area is provided by the moral-centered viewpoint, favored by nearly 89% participants. Creating a discourse around these views can help organize conservation professionals into a more coherent and united body, crucial for effective participation in policy advocacy, design and implementation.

**Ratnayake, Chaminda,** *Field Ornithology Group of Sri Lanka,Department of Zoology,University of Colombo;* **Sarath Kotagama**, *Field Ornithology Group of Sri Lanka,Department of Zoology,University of Colombo*

**Does forest dieback in monatne cloud forests impact the endangered Sri LankaWhistling Thrush Myophonus blighi?**

Cloud forests in Sri Lanka are being rapidly degraded due to forest dieback (FDB). A climate-driven factor such as accumulation of toxic heavy metals in soils on wind slopes has been identified as the major reason for the observed FDB. Yet, very limited knowledge exists on how FDB affects endemic forest-dwelling birds in Sri Lanka. This study aimed to monitor habitat occupancy of the endangered Sri Lanka Whistling-Thrush (SLWT) in Horton Plains National Park (HPNP) where severe FDB has been observed. We used three different FDB levels - low, moderate and heavy dieback and estimated the probability of occupancy of SLWT. A total of 48 line transects (100m) stratified according to the FDB level were used in four 1km2 plots. Call play back was used to detect the elusive SLWT to maximize detection probability. Single-season occupancy modelling in PRESENCE software was used to estimate the probability of occupancy in different FDB gradients and the habitat occupancy of SLWT in HPNP was predicted by using the maximum entropy method (MAXENT software) and a habitat suitability map constructed. We found no difference in probability of occupancy of SLWT between FDB gradients. The constructed habitat suitability map for HPNP will contribute to developing a conservation management plan for SLWT in protected areas of Sri Lanka.

**Ratsirarson, Joelisoa,** *University of Antananarivo;* **Jeannin Ranaivonasy**, *University of Antananarivo;***Alison Richard,** *Yale University*

**Biodiversity risk assessment and conservation challenges in southern Madagascar**

In addition to its intrinsic value, biodiversity provides many important goods and services that are essential for human well-being. Madagascar's biodiversity faces immediate threats from human activities, as well as other underlying threats. Biodiversity risk assessment is an important tool to enhance understanding of these challenges. It requires long term information in order to detect, describe and respond to environmental changes. Our paper illustrates the interconnectedness of social and natural sciences in risk assessment and shows the importance of ecological and socioeconomic monitoring at spatial and temporal scales. Our example comes from the monitoring program established 25 years ago at Beza Mahafaly, southwest Madagascar, in collaboration with the local community. We show how information collected at Beza Mahafaly is used as a warning system, and helps developing effective strategies to slow or reverse continued threats and loss of biodiversity in the areas.

**Ray, Justina,** *Wildlife Conservation Soc. Canada*

**Defining Recovery Under Canada's Species At Risk Act: De-listing Or More?**

The interplay of scientific information and value-based information and decision-making under Canada's Species at Risk Act (SARA) requires careful, transparent distinctions between scientific and non-scientific considerations. Intended to guide the recovery — not simply the survival — of listed Threatened or Endangered species, a recovery strategy must be a scientific document and include recovery targets for that species across its entire Canadian distribution. These are meant to provide a scientifically defensible baseline to enable informed and transparent political decisions that follow about when, whether, and how to attain it. The absence of a statutory definition of “recovery” under SARA, however, requires reliance on interpretations of the legislation for guidance as to intent, as well as on scientific understanding of what is necessary to secure the long-term conservation of species. In this context, it is important to consider: 1) the legal and policy context for the definition of recovery objectives under SARA; 2) the scientific foundation for defining the necessary attributes for recovery; and 3) examples of how these concepts apply to various species. Although it might appear logical to declare a species recovered once it qualifies for down-listing or de-listing (an already ambitious target), this would shift the aim from providing for long-term persistence across a species’ geographic range towards minimizing extinction risk.

**Raymond, Christopher,** *Charles Sturt University*

**A conceptual framework for assessing conservation opportunity.**

Multiple frameworks of conservation opportunity have recently been presented in the conservation planning literature. This presentation will provide a synthesis of existing frameworks and a new multi-disciplinary understanding, as developed by a team of researchers and practitioners who attended a workshop in Australia on The Development of New Tools and Processes for Assessing Conservation Opportunity (April 23-26 2013). The framework defines and quantifies conservation priority and feasibility dimensions of opportunity assessments. The presentation will conclude with a discussion of the strengths and weaknesses of this framework in regards to the translation of conservation priorities into effective conservation actions.

**Read, John,** *Ecological Horizons;* **Katherine Moseby**, *Tetepare Descendants' Assoication;***Chris Filardi,** *American Museum of Natural History;* **Richard Rice**, *Conservation Agreement Fund*

**The last wild island: Vital partnerships for sustainable conservation outcomes in Melanesia.**

An innovative, decade-long partnership between landowners, NGO's and scientists has successfully mitigated pressure to log Tetepare Island, the largest uninhabited island in the South Pacific and one of the last remaining unlogged islands in the Solomon Islands. Three key factors underpin this partnership's success: 1) a well organized local landowner association that supports protection; 2) a conservation agreement that buttresses this support by providing tangible benefits in exchange for continued conservation performance, and 3) the high conservation value of the area protected compelling long-term international funding. Project rangers, staffed by the local community association, manage the largest marine and terrestrial protected area in the Solomon Islands, and have measured significant recovery of key resources (e.g., fish, trochus and coconut crabs). Hunting at nest-sites of critically endangered leatherback turtles has ceased and secondary threats (e.g., sea level rise, monitor predation) are being adaptively managed. In exchange for their support, community members receive employment, scholarships and sustainable livelihoods in lieu of short-term benefits from logging. The Tetepare model has been successfully duplicated at other biologically significant Melanesian locations. With continued enthusiasm of their support network, the project has left Tetepare's owners well-equipped to navigate an uncertain future with ever-increasing social and economic pressures.

**Redford, Kent,** *Archipelago Consulting*

**It's tough to learn in the dark**

**Reed, J. Michael,** *Tufts University;* **Robert McCarthy**, *Cummings School of Veterinary Medicine, Tufts University;***Stephen levine,** *Tufts University*

**Feral cat population control: more effective when reproductive hormones remain intact**

Feral cats are a significant factor in the mortality of birds and other small animals, they can be a public nuisance, and can spread disease. The American Veterinary Medical Association strongly encourages and supports actions to eliminate the problem of feral cats. Management of feral cat populations by trap, neuter, and release (TNR) has gained popularity in recent years. TNR as presently employed, however, is insignificant to the overall problem and is largely viewed as ineffective. In fact, TNR increases survival of neutered animals, and kitten survival increases as adults are neutered. As a collaborative effort (ecologist, veterinarian, systems modeler) we created an individual-based simulation model to predict the effectiveness of TNR, lethal control (LC), and trap-vasectomy/hysterectomy-release (TVHR) in decreasing feral cat population size. TVHR outperformed TNR and LC at all annual capture probabilities from 10% and 90%. TNR was counterproductive, generating population size increases compared to no intervention at all. Unless over 57% of cats are trapped and sterilized annually by TNR or removed by LC there is minimal effect on population size. In contrast, with an annual capture rate of ≤35%, TVHR causes population size to decline. An annual capture rate of 57% eliminated the modeled population in 4000 days using TVHR, whereas >82% was required for TNR and LC. TVHR should be preferred over TNR for management of feral cats if decline in population size is the goal.

**Reed, Sarah,** *Wildlife Conservation Society;* **Matthew Dietz**, *The Wilderness Society*

**Effects of Traffic Levels and Motor Vehicle Noise on Bird and Mammal Communities in a National Forest**

Many protected areas around the world are managed under multiple-use mandates that combine goals of preserving biodiversity, permitting resource extraction, and providing nature-based recreation for people. We investigated the compatibility of these goals in a study of the effects of motor vehicle routes, traffic levels, and noise propagation on wildlife communities in a U.S. national forest. We used point counts, track plates, and bioacoustic monitors to survey for birds, mammals, and motor vehicle traffic along paved, gravel, and natural-surface roads and motor vehicle trails over two years in Sierra National Forest, California. Motor vehicle noise exceeded ambient natural sound levels up to 625 m from the nearest road. Detections of mammalian carnivores increased with distance to road, and the greatest numbers of native species were detected at the most isolated sites with lowest levels of human activity; sites with one-third fewer motor vehicle events produced detections of 3.2 times more native carnivores. We found no effect of distance to road or traffic level on detections or species richness of birds. Participation in motorized recreation activities has more than doubled in the past 20 years. By integrating information about traffic levels and noise propagation into transportation and recreation planning decisions, scientists and land managers can balance human use with species protection in protected area management.

**Reid, Frederic,** *Ducks Unlimited*

**Wetland linkages-surprising connections across continents and the globe**

The importance of wetlands for water filtration, flood control, carbon storage, and as drivers of ecosystem productivity are well known and at the forefront of reasons why conservation of wetlands is given a priority in much of the world. Less well known are some of the global and continental linkages that showcase the need for an expansive view of the shared responsibilities among nations for stewardship of wetland habitats. For example, the vast freshwater flow of boreal rivers into northern seas drives northern marine ecosystem productivity from which much of the human population of the world derives its protein. The same freshwater flow also powers global ocean currents that determine continental weather patterns and in turn agricultural outputs of nations. Another interesting global linkage has recently become better understood—that of the millions of birds that move annually from boreal wetlands where they breed to wetlands across the globe where they spend the winter. Bar-tailed Godwits breed in western Alaska and Siberia and winter in Australia and New Zealand. They have historically been hunted by the Yupiks In the north and the Moari in the south. Sea ducks that breed in the Northwest Territories make their way to coastal wetland complexes in the U.S. like San Francisco Bay and Chesapeake Bay for the winter. Billions of birds that nest in North America’s boreal region in winter become integrated into wetland natural communities across the Americas, some as far south as southern South America.

**Renjifo, Luis Miguel,** *Pontificia Universidad Javeriana;* **Angela María Amaya**, *Pontificia Universidad Javeriana;***Jaime Burbano,** *Pontificia Universidad Javeriana;* **María Fernanda Gómez**, *Instituto Alexander von Humboldt;* **Jorge Iván Velázquez**, *Instituto Alexander von Humboldt*

**Assessment of Extinction Risk of the Colombian Birds Eleven Years Later**

Assessment of extinction risk is fundamental for conservation planning and practice. Risk assessment is heavily dependent on available information. We evaluated extinction risk for the birds of Colombia following the IUCN criteria through a highly collaborative process to compile information. We invited ornithologists and highly qualified birdwatchers to provide information ranging from records to writing species accounts. 142 people compiled species accounts on 212 bird species. Several institutions and a number of scientist provided information that was used in the assessment process. We found significant changes on species status between 2002 and 2013. Some of these changes were due to genuine status changes involving declines or improvements on bird populations and habitats. Also, a number of changes were due to improvements on knowledge, description of new species and taxonomic changes.

**Ressurreição, Adriana,** *Centre of IMAR of the University of the Azores;* **Alexandra Simas**, *Azores Sea Observatory (OMA);***Ricardo Santos,** *Centre of IMAR of the University of the Azores;* **Filipe Porteiro**, *Centre of IMAR of the University of the Azores*

**Resident and expert opinions on marine related issues: implications for the ecosystem approach**

Marine management is never an exclusively science-based endeavour. Putting the concept of ecosystem-based management (EBM) into practice requires building up a collective vision for Europe's regional seas where the values and views of different groups of stakeholders are indentified and integrated. To date, such integration is lacking and Europe's marine policy is mostly driven by scientific and technical advice with little input from citizens and stakeholders. Here we report an overview of people's perceptions and views regarding marine environmental issues, where the opinions of the general population and a group of marine experts were analysed and compared. Results based on 735 face-to-face interviews conducted in the Azores archipelago (north-eastern mid-Atlantic) showed significant differences among experts and public opinion regarding drivers of change, marine pressures and management priorities. The survey also showed that the public was poorly informed about marine protected areas and eco-labelling schemes. Taken together these results build upon the widely held perception that there is a gap between what is known among the scientific community and what the public know and understand about the marine environment, and emphasise the importance of involving the public, scientists and other stakeholders in all stages of the marine management process.

**Rhodes, Jonathan,** *The University of Queensland*

**When do Social Networks Matter for Dynamic Conservation Planning Problems?**

In the past two decades substantial progress has been made in developing theory and tools for solving systematic conservation planning problems. However, there has been much less progress in understanding how human social systems influence conservation priorities. Here we address this issue for dynamic conservation planning problems. We start with a well-known formulation of the dynamic reserve selection problem, where we have a series of sites, each containing a number of species, and the objective is to find the optimal sequence of sites to reserve through time. We then overlay a social network on these sites to represent social connections between site land-owners. Each land-owner has a certain probability of developing their site in a way that results in the loss of species at that site and makes the site unavailable for future reservation. The links between land-owners in the social network introduce social dependencies between land-holders’ decisions to develop their sites based on the assumption that connected land-holders are more likely to behave similarly. We show that optimal strategies depend on both the structure of the social network and the distribution of species relative to that network. Importantly, the benefit of explicitly using information about the social network also depends on the strength of the links between land-holders and how species are distributed among sites. This provides important insights for conservation planning in coupled human-ecological systems.

**Richards, Agnes,** *Environment Canda;* **Cheryl-Ann Johnson**, *Environment Canda;***Kathy Lindsay,** *Environment Canda;* **Cathy Nielsen**, *Environment Canda;* **Marlene Doyle**, *Environment Canda;* **George Arhonditsis,** *University of Toronto*

**Using Spatially-Explicit Modelling to Examine the Effects of Threats and Mitigation Measures for Peary Caribou Populations in the Canadian High Arctic**

Peary caribou, a species at risk listed as both threatened and endangered, is distributed throughout the Canadian Arctic Archipelago. Overall, populations have declined by approximately 72% since the 1980s and by 85% since the 1960s. The exception is the Boothia Peninsula population, which has increased by about 10%. Peary caribou optimize habitat use by moving around and between islands and these inter- and intra-island movements play a critical role in their survival. Our goal is to examine the feasibility of using a spatially-explicit population model to examine the effects of potential threats and mitigation measures. We will also incorporate Aboriginal Traditional Knowledge into these models by applying Bayesian methods. Threats, such as availability of winter forage, effects of climate change (e.g., sea-ice dynamics), human disturbance, and wolf predation will be examined. Mitigation measures, such as captive rearing will also be examined. Preliminary results of population growth rates under various scenarios that include both threats and mitigation measures will be discussed.

**Richardson, Jonathan,** *Yale School of Forestry & Environmental Studies;* **Robin Waples**, *Northwest Fisheries Science Center;***David Skelly,** *Yale School of Forestry & Environmental Studies*

**Finding efficiency in amphibian conservation: How well do rapid assessments of genetic viability predict long-term population trends?**

Persistence of populations depends on both population size and genetic viability. However, few studies are able to integrate data on long-term population trends and genetic viability in order to predict population persistence. In this study, we combined more than 10 years of demographic census data with genetic estimates of effective population size in eleven populations of the wood frog (Rana sylvatica), the most broadly distributed amphibian in North America. The wood frog life history and breeding phenology present an ideal system to explore the predictive utility of genetic estimates of population size. Specifically, we tested how well estimates of effective population size obtained from genetic data predict long-term demographic trends within a habitat. We found a strong correlation between genetic and census estimates of population size, suggesting that genetic estimates obtained in only a single sampling effort can provide an accurate picture of demographic dynamics. While there is no replacement for long-term monitoring of populations, our data suggest that genetic estimates offer a rapid and robust assessment of both trends in populations size and genetic viability. Considering that conservation management often requires timely information on imperiled populations, efficiencies gained during the assessment phase can provide an important advantage for the conservation of amphibians and other taxa.

**Richardson, Kate,** *Massey University;* **John Ewen**, *Zoological Society of London;***Isabel Castro,** *Massey University;* **Doug Armstrong**, *Massey University*

**Addressing the challenges of monitoring at community reintroduction projects: the case of hihi at Maungatautari Ecological Island**

Reintroductions of endangered species are increasingly being led by community groups as part of local conservation projects. Although these initiatives have many potential benefits, they present new challenges for obtaining the post-release monitoring data needed for ongoing conservation management. We review the post-release monitoring techniques developed for the reintroduction of an endangered New Zealand forest bird, the hihi (stitchbird, Notiomystis cincta), to New Zealand's largest community conservation project, Maungatautari Ecological Island. This large (3400 ha) predator-fenced reserve presented new monitoring challenges due to its size, terrain and dense forest. 135 hihi were released at the reserve in four translocations between 2009 and 2011, and subsequent information on the fate of the population has been gathered through a combination of field and genetic research, and trialling of survey techniques using contractors, researchers, field staff and volunteers. The combination of these methodologies has enabled comprehensive information to be gathered to provide estimates of population size and growth, information on the occurrence of disease, and data on dispersal patterns in an establishing reintroduced population. We aim to establish long-term monitoring programmes at the site that continue to integrate science and communities, and provide conservation benefits for this endangered species.

**Rico, Yessica,** *University of Toronto;* **Helene Wagner**, *University of Toronto;***Hans Juergen Boehmer,** *Interdisciplinary Latin America Center (ILZ), University of Bonn;* **Rolf Holderegger**, *WSL Swiss Federal Research Institute*

**The role of directed dispersal by shepherding on population genetic connectivity across the landscape**

Understanding the link between spatial patterns of genetic structure and dispersal mechanisms is fundamental for the conservation of plant populations in fragmented landscapes. Plants exhibit a variety of vectors influencing the distance, direction, and destination at which seeds are deposited. Directed dispersal by animals has an influence spatial dynamics of plant populations, but empirical data are lacking on the potential of directed dispersal by grazing of domestic animals on gene flow across the landscape. We investigated the effect of large-flock shepherding on landscape genetic structure in the calcareous grassland plant Dianthus carthusianorum. Based on eleven nuclear microsatellites, we found a significant pattern of genetic structure differentiating calcareous grassland patches of three non-overlapping herding systems and ungrazed patches. Among ungrazed patches, we found a significant and strong effect of isolation by distance (rM = 0.55, p = 0.001). In contrast, genetic distance between grazed patches within the same herding system was unrelated to geographic distance but significantly related to distance along shepherding routes (rM = 0.45, p = 0.001). The distance-dependent effect of shepherding suggests that gene flow occurs mostly between adjacent populations. The differences in genetic structure between ungrazed patches and patches connected by shepherding indicate the potential of dispersal by grazing on seed-mediated gene flow across the landscape.

**Ries, Leslie,** *National Socio-environmental Synthesis Center;* **Karen Oberhauser**, *University of Minnesota*

**A citizen army for conservation: quantifying participatory research on monarch butterflies and its impacts on science, conservation, and behavior**

Public participation in scientific research has been going on for decades and even centuries in some places. Recently there has been an explosion of interest as increasingly engaged citizens are eager to document their interactions with nature at the same time that conservation scientists are demanding real-time biological data at massive scales. While most programs focus on adult sightings, monarch scientists have pioneered engaging "super-volunteers" to collect more process-based data, such as tracking migration, juvenile development, and disease. We surveyed all monarch volunteer programs that collected data in 2011, quantified the amount of time volunteers invested in collecting data for each project, and integrated these values, stratified by spatial location (at a 1 degree resolution) and stage of the monarch's annual cycle. Volunteers spent an estimated 86,000 hours in the field collecting data on monarchs in 2011; this is the equivalent of 40 full-time, year-round field workers. The majority of this time (70%) was spent on monitoring the fall migration, especially in the north central and eastern regions of North America. We also present a monitoring "gap analysis" that can be used to target future volunteer recruitment. Finally, we show that monitoring is leading to a more engaged citizenry, through volunteers who are participating in conservation and education activities and even presenting scientific results of their own research at national meetings.

**Riley-Gilbert, Marybeth,** *ICF International;* **Franz Ingelfinger**, *Massachusetts Division of Ecological Restoration;***Nick Wildman,** *Massachusetts Division of Ecological Restoration;* **Erin Healy**, *ICF International*

**Determining the Carbon Benefit of Ecosystems Restoration Projects and the Associated Reductions in the Social Cost of Carbon**

Several methodologies are available to determine the climate change mitigation potential and monetization of the carbon benefits. In a system for pricing and trading carbon "credits", the value of carbon is based on regulatory penalties for emissions, as well as incentives for reducing or offsetting emissions. The second method for valuing carbon is a model to determine the Social Cost of Carbon (SCC), which is based on the projected social damages of climate change due to carbon dioxide (CO2) emissions. This model, developed by the Interagency Working Group on the Social Cost of Carbon (IAWGSCC) to determine national-scale impacts of federal policy, estimates a dollar value for the societal impact of CO2 emissions, as well as the reduction or offset of such emissions. Examples of factors considered and monetized in the model are projected financial losses due to property damage from coastal storms and sea level rise, increases in human health problems due to heat waves or increasing risk of infectious disease, and reductions in agricultural productivity. Downscaling this model to consider project-scale CO2 impacts is an option for improving the evaluation of benefits of investing in ecosystem restoration projects. This paper describes a recent project for Massachusetts Division of Ecological Restoration (DER) to evaluate the carbon benefits and reductions in SCC as a result of two wetland restoration projects in Massachusetts.

**Rioja-Nieto, Rodolfo,** *UA-Sisal, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico;* **Erick Barrera-Falcon**, *UA-Sisal, Facultad de Ciencias, Universidad Nacional Autonoma de Mexico;***Gustavo Hinojosa-Arango,** *Centro para la Biodiversidad Marina y la Conservacion, A.C.;* **Rafael Riosmena-Rodriguez**, *Universidad Autonoma de Baja California Sur*

**Benthic Habitat β-diversity Modelling and Landscape Metrics for the Selection of Priority Conservation Areas Using a Systematic Approach**

Social, political and economic needs, particularly in developing countries, make the establishment, design and management of Marine Protected Areas (MPAs) difficult. In this study, we aim to assist the management of three coastal regions in Mexico, by proposing priority conservation areas (PCAs), based on β-diversity modelling and landscape metrics. Quantitative estimates on the percentage of cover of benthic substrates from ground truthed sites were used to perform a cluster analysis with the Bray-Curtis similarity index to identify main habitat types. In general, habitats were characterized by an inter-mix of sand, seagrass, macroalgae, rhodolith, and rock substrates. Thematic maps of benthic habitats were produced utilizing a supervised classification with the maximum likelihood rule on natural color mosaics of high resolution satellite scenes (overall accuracy >80 %, Kappa > 0.69). Scripts written in Matlab were then used to calculate β-diversity values based on the nature and distribution of habitats. A weighted overlay analysis considering habitat type, patch compactness (area/perimeter2) and β-diversity was performed to identify PCAs. About 20 % of the shallow benthic landscape of each region is proposed to be considered within a MPA scheme. By selecting sites with these landscape characteristics we are using a systematic approach to protect the natural processes responsible for maintaining diversity and the livelihoods of the local communities.

**Rising, James,** *Columbia University*

**Coupling Natural and Human Systems for Resource Conflict**

Scarcity of natural resources can be a significant source of conflict, but recent work has questioned the predictive capacity of this connection. While many existing models of conflict use natural resources as external inputs, many renewable resources are linked to human behaviors within complex social-ecological systems. Direct attempts to extend existing models with additional feedback loops can result in runaway feedback or unrealistic fitted parameter values. This study presents a new method of coupling natural and human systems, through a Bayesian framework. This method allows models to be combined and to overlap without re-estimating parameters. It also provides stochastic predictions under chaotic dynamics, while enforcing a degree of stability. The paper also presents an extension that enables models defined at different scales to be combined, forming multi-level models. The method is analyzed on both theoretical and practical grounds, and applied to a model of conflict driven by renewable natural resources. Conflict is modeled using an economic framework developed in Olsson 2008, while renewable resources are modeled using simple growth functions. Finally, spatially distributed conflict is simulated on a grid, and coupled across scales with aggregate natural resources.

**Robalino, Juan A. ,** *Universidad de Costa Rica*

**Explaining variation in forest spillovers and welfare effects of protected areas**

Land conservation policies can significantly affect deforestation rates and economic well-being in surrounding areas. We try to explain the sign and the magnitude of these effects in Costa Rica. First, we empirically examine how parks affect deforestation rates in nearby areas. We find, without distinguishing roads and tourism presence, insignificant net effects on deforestation. However, these results are averages of treatment effects across space. When we explore in greater spatial detail, we find large increases in deforestation rates (around 9%) near roads in areas less affected by tourism (far from park’s entrances). Second, we explore parks’ effects on wages as a measure of well-being. The effects on wages in nearby areas also vary according to the presence of tourism. Wages close to parks are higher only for people living near tourist entrances. Workers close to entrances are not only employed in better paid activities but also receive higher wages for these activities.

**Roberts, James,** *Department of Fish and Wildlife Conservation, Virginia Tech;* **Paul Angermeier**, *U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit;***Eric Hallerman,** *Department of Fish and Wildlife Conservation, Virginia Tech*

**A New Framework to Evaluate and Avert Risks to Fragmented Populations of Stream Fish**

Many populations of stream fish persist in remnant patches that are isolated by anthropogenic barriers. Risk-averse management of such populations could involve either of two contrasting strategies: (1) restoration of connectivity, which averts risks associated with small population size, or (2) maintenance of isolation, which averts risks associated with the mixing of divergent gene pools. The optimal strategy depends on the relative magnitudes of these "small-population" (SP) versus "outbreeding-depression" (OD) risks, which depend on the demographic and genetic characteristics of populations and evolutionary relationships between populations. We developed a framework to facilitate comparison of SP and OD risks based on published risk criteria and commonly available data. To illustrate how the framework could guide conservation choices, we applied it to seven isolated populations of Roanoke logperch (Percina rex), an endangered stream fish. Both risk types varied considerably among populations, suggesting that a uniform management strategy would be ineffective. Only one population exhibited low risk for both types, whereas four exhibited high SP (but not OD) risk and two exhibited moderate OD (but not SP) risk. Based on this analysis, four P. rex populations could benefit from restored connectivity, whereas two should remain isolated. Our approach could be used to develop transparent, science-based management strategies for P. rex, as well as other rare or imperiled taxa.

**Roberts, Callum,** *University of York, England*

**Large Fully Protected Marine Reserves: The Best Tool for Sustaining Ocean Ecosystems?**

Fully protected marine reserves are areas completely off limits to fishing and other extractive uses. In the last half century, hundreds of reserves have been established in coastal settings where they have proven to be powerful tools for rebuilding depleted populations, restoring biodiversity and recovering habitats. Previously exploited populations frequently increase by 2-5 times following 5-10 years of protection, while habitats typically take decades to rebuild. The great majority of fully protected marine reserves established to date have been small, usually less than a few square kilometres. While a few very large reserves have been created, such as that in the British Indian Ocean Territory (Chagos), their effects remain virtually untested at very large scales and in oceanic rather than coastal habitats. This talk will explore the implications of these differences for the likely future conservation performance of large marine reserves.

**Robinson, Natasha,** *La Trobe University;* **Michael Clarke**, *La Trobe University;***Andrew Bennett,** *Deakin University;* **Steve Leonard**, *La Trobe University*

**Faunal refuges in fire-prone landscapes: does planned fire moderate the impact of mega-fire on bird assemblages?**

Unburnt patches within fire boundaries are considered to act as refuges for fauna, facilitating survival and persistence within fire-prone landscapes. Accordingly, the retention of unburnt patches is often an aim of ecological fire planning. Moreover, when challenged by wildfire, recent planned burns are thought to resist burning or to burn at lower severity than surrounding long unburnt vegetation, thereby creating future refuges. However, the value of unburnt patches has rarely been examined. This study aimed to determine the relative importance of unburnt patches of long and short time-since-fire periods in predicting the persistence of birds in burnt landscapes, within the context of a 'mega-fire'. Surveys were conducted in eucalypt forest of south-east Australia that had experienced a 'mega-fire' in 2009. Sites (n=91) ranged in fire severity from unburnt to crown burnt. Fire history prior to 2009 was defined as recently burnt (20 years). Our results revealed declining species richness and abundance with increasing fire severity. However, the magnitude of this effect was greater for long time-since-fire sites. Unburnt patches created due to recent fire were important avian refuges, harbouring more species than more severely burnt habitat; but exhibited lower bird abundance than unburnt patches of older vegetation. Such insights can inform decision-making in the use of planned fire to achieve ecologically positive outcomes for birds.

**Rodriguez, Claudia,** *Dartmouth College*

**When the policy tool fails: Explaining Land Use Change in Protected Areas**

Land use change is one of the major threats faced by protected areas. Based on in depth interviews with 55 protected area managers from 17 countries in the Americas this paper systematically analyzes the influence of demographic, economic, institutional, governance and policy factors on land use change. The findings indicate that land use change in protected areas is critically driven by the lack of policy integration between environmental, development and social agencies. Protected areas often swim against the current as other governmental agencies invest resources and provide incentives to the neighboring communities that increase land use change. The findings also indicate that land use change can be reduced through the development of sustainable livelihood projects by protected areas. Surprisingly, economic welfare of neighboring communities does not play a significant role explaining land use change.

**Rodriguez, Jon Paul,** *Instituto Venezolano de Investigaciones Cientificas;* **David Keith**, *University of New South Wales;***Edmund Barrow,** *International Union for Conservation of Nature;* **Kathryn Rodriguez-Clark**, *Instituto Venezolano de Investigacines Cientificas;* **Maria Oliveira-Miranda**, *Provita;* **Patrick Comer,** *NatureServe;***Emily Nicholson**, *The University of Melbourne*

**IUCN Red List of Ecosystems: tests of this new global standard for applying conservation science to environment and development policies**

The 2008 World Conservation Congress of the International Union for Conservation of Nature (IUCN), launched the IUCN Red List of Ecosystems (RLE). After an initial stage of designing and testing draft categories and criteria for assessing ecosystem risk of collapse, the revised version became available in 2013. Applicable to terrestrial, freshwater, marine and subterranean ecosystems at multiple spatial and temporal scales, the criteria focus on reductions in geographical distribution, restricted extent, degradation of the abiotic environment and disruption of biotic processes. We present initial results of the first continental test of the RLE, applied to the Americas (Alaska to Patagonia). The analysis was undertaken both as a top-down and a bottom-up exercise. The top-down approach, mainly science-driven, began with development of a map of ecosystem units of the Americas, whose status was assessed by the proportion of extant natural vegetation and recent changes in their distribution. The bottom-up approach began with a meeting of national-level policy-makers from Bolivia, Chile, Colombia, Costa Rica, Ecuador and Peru, asked to consider what they would use an ecosystem red list for. Their input informed national-level risk assessments, anchored on local data sources, needs and expertise. Integration of the regional analysis with national perspectives provides a broader context to the local risk assessment, enhancing the role of RLE on environment and development policies.

**Rodriguez-Clark, Kathryn,** *Instituto Venezolano de Investigaciones Cientificas;* **Ada Sanchez-Mercado**, *Instituto Venezolano de Investigaciones Cientificas;***Jose Ferrer-Paris,** *Instituto Venezolano de Investigaciones Cientificas;* **Shaenandhoa Garcia-Rangel**, *Universidad Simón Bolívar;* **Edgard Yerena**, *Universidad Simon Bolivar;* **Bruce Robertson,** *Bard College*

**A novel combination of habitat and threat models can reveal potential ecological traps**

Ecological traps can threaten the persistence of affected populations, so techniques to predict and map potential traps are needed. However, existing methods provide no estimate of spatial uncertainty. Here we present a novel method for visualizing potential ecological traps and their uncertainty at large scales in a natural landscape, and demonstrate its application using presence data for Andean bears (Tremarctos ornatus, Ursidae) in the Cordillera de Mérida, Venezuela. We applied a partitioning procedure to generate partially independent datasets, and used them to fit maximum likelihood models of the probability of occupancy. These were combined with an existing model of hunting risk to predict potential trap location and uncertainty. The best habitat suitability model predicted high suitability in the center and in northern parts of Cordillera de Mérida, as expected from expert opinion. However, more than a third of suitable area had a high potential trap index, and was next to or within the largest national parks. Conservation actions for Andean bears may be planned more effectively following field confirmation of trap predictions. Managers should avoid increasing connectivity between trap and safe habitat, and focus targeted education and law enforcement in confirmed trap habitat. Our approach will be useful in other species for identifying possible ecological traps created by hunting and other human activities at the landscape level

**Rodríguez-Estrella, Ricardo,** *Centro de Investigaciones Biológicas del Noroeste;* **Lucía Campos**, *Centro de Investigaciones Biológicas del Noroeste;***Laura Rivera,** *Universidad Autónoma de Sinaloa*

**Fishing scallops, oysters and associated epifauna in Baja California Peninsula: Loss of non-officially recorded biodiversity**

Scallops, oysters and other mollusks are annually collected by local fisheries of Baja California Peninsula. Fisheries extractions of scallops and clams have officially reached ca. 6000 tons/year. Although evaluations have been made in order to determine the potential impact of fisheries in scallops and mollusk populations, it has not been evaluated the "parallel" impacts of fishing on epibionts or associated biological diversity to shells. In 2005, we randomly collected 1500 shells of scallops and oysters from shell dumps scattered located in Bahia Magdalena and identified and quantified the numbers of epifaunal groups (e.g. polychaetes, barnacles). More than 60% of epifaunal species were counted in scallop shells and 36% in oyster shells. However, more than 50% of scallop shells contained epifaunal groups while only 5% of oyster shells contained them. We estimated the impact of the total extraction of scallops during every year and found that deep impacts on this biological diversity are occurring. We stress the need to better evaluate the neglected impacts on structure and function of communities given by fisheries when the loss of epifauna occurs.

**Rohlf, Dan,** *Lewis and Clark University*

**The Evolution Of US Policy On Endangered Species Recovery Since Passage Of The ESA**

When enacting the Endangered Species Act in 1973, Congress emphasized recovery of species facing extinction as the statute’s primary purpose. In the statute’s early years, lawmakers emphasized this goal by amending the statute to require preparation of recovery plans, allow for public participation in plan development, and require that recovery plans set forth both site-specific recovery measures and “objective, measureable criteria” to define when a species has recovered. Implementing recovery plans has faced many obstacles, however, including delays in plan preparation, funding shortfalls for recovery actions, and determinations that the measures set forth in recovery plans are merely discretionary even for federal agencies. Other challenging questions about recovery arise as the ESA enters its fifth decade, such as whether species dependent on human intervention in some facet of their life cycle can be termed recovered, and how to deal with uncertainties caused by climate change. Finally, a 2012 court decision giving federal agencies broad discretion to delist species as recovered regardless of whether the species has attained the criteria set forth in its recovery plan raises anew the fundamental question of when it means to “recover” imperiled species.

**Rolhf, Dan,** *Lewis and Clark Law School*

*Prospects for Progress*

**The Endangered Species Act -- Still Vigorous at 40?--The State of the ESA on its 40th Anniversary and**

**Roman, Joe,** *Gund Institute Ecological Economics*

**Applying ecosystem service valuation tools to environmental policy and decision-making**

There is a critical need to link our understanding of ecosystem-service flows to policies that ensure their sustainable delivery. Ecosystem accounting provides one method for organizing and integrating information about how humans and nature interact. Such a framework can detail the interactions of a specific ecosystem, characterizing ecosystem-service flows, evaluating tradeoffs, and comparing projected outcomes of alterative management strategies. Ecosystem accounting models, such as the Multiscale Integrated Model of Ecosystem Services (MIMES) and InVEST, can be made spatially explicit and dynamic to account for variations in time, space, and decision-making. Although these models tend to be limited in their ability to directly inform stakeholders--since running them requires a high level of technical know-how and software requirements--new user interfaces have been designed to overcome this hurdle and allow stakeholders to explore various scenarios. Several case studies will be discussed, including the evaluation of tradeoffs for the Massachusetts Ocean Plan and efforts to revise economic analyses of critical habitat under the U.S. Endangered Species Act and other assessments required for most agency regulations by the White House Office of Management and Budget. Although these tools are still in development, their analyses are vastly preferable to overlooking ecosystem-service information when making policy decisions, which risks assigning a zero value to all services.

**Romanach, Stephanie,** *U.S. Geological Survey;* **Craig Conzelmann**, *U.S. Geological Survey;***Kevin Suir,** *U.S. Geological Survey;* **Christina Hunnicutt**, *U.S. Geological Survey;* **Mark McKelvy**, *U.S. Geological Survey;* **Sumani Chimmula,** *University of Louisana*

**EverVIEW data visualization software designed for Everglades restoration decision-making, used internationally**

Methods developed in the Greater Everglades are influencing restoration programs worldwide. Joint Ecosystem Modeling (JEM) has facilitated collaboration among federal and state agencies, universities, and NGOs, resulting in a suite of software tools to help with restoration decision making. EverVIEW Data Viewer provides side-by-side map panels to compare model output and simultaneously examine species or habitat impacts from alternative restoration plans. Other uses include multiple geographic or temporal displays. Animations highlight general trends in model output over time, e.g., changes from wet to dry seasons. An extensible framework to EverVIEW allows for customized tools to analyze model outputs in a spatial context. By introducing metadata standards and producing standards-compliant model output, national programs have leveraged models, tools, and source code within the EverVIEW platform. JEM products are being used in: 1) USDA's Natural Resources Conservation Service's Conservation Effects Assessment Project, 2) State of Louisiana's Coastal Protection and Restoration Authority Coastal Master Plan, and 3) United States Army Corps of Engineers and South Florida Water Management District's Central Everglades Planning Project. Informally, EverVIEW has been adopted by researchers in several parts of the world. JEM remains committed to its standards-driven philosophy to allow products to be relevant well beyond the Everglades.

**Romero, Jorge Alvarez,** *ARC COE for Coral Reef Studies*

**Marine conservation planning in practice: lessons learned from the Gulf of California**

Overfishing, pollution, coastal development and climate change threaten marine biodiversity globally and compromise the services that marine ecosystems provide. Systematic conservation planning (SCP) provides a framework to identify areas where actions can be effective in addressing these threats, while minimizing the costs of interventions. We investigated the application of SCP in the Gulf of California, a marine hotspot where seven spatial prioritization exercises have been undertaken. We found that the use of SCP methods has progressed slowly (gaps include planning for land-sea connections and ecosystem services) and highlighted benefits and difficulties of undertaking SCP. According to experts, the implementation of new marine protected areas (MPAs) in the region has been influenced by some of the planning exercises. However, uptake of planning outputs has progressed slowly due to multiple factors (e.g., conflicting mandates and interests between organizations, limited technical capacities and resources, insufficient political commitment). Apart from MPAs, other benefits included: developing institutional skills and knowledge; improving collaboration and coordination between organizations; converging on the need to assess priorities for marine conservation in regional context; and building trust among organizations. The existence of multiple marine conservation plans in the region highlighted some of the complexities and benefits of having multiple sets of priorities.

**Romulo, Chelsie**, *Virginia Tech;* **Miriam Westervelt**, *Virginia Tech****;* Amanda Miner**, *Virginia Tech;* **Dennis Sonkoi**, *Virginia Tech*

**Community Based Forest Conservation in Kenya**

This project is a case study in natural resource conservation planning with the Loita Maasai tribe of southwestern Kenya. Due to the traditional nomadic lifestyle and small population of the Maasai in this region, most of the forest and surrounding rangelands are undeveloped. Some of the forest is experiencing increasing threats from resource extraction and development. As Maasai continue to transition from a predominantly pastoral nomadic lifestyle to a mixed farming economy there is an urgent need for a conservation and land use management plan to conserve Loita's ecological integrity. Attempts to provide the community with forest management plans have been rejected in the past on the basis of lack of community involvement. During the spring semester of 2011 a team of 3 students created a preliminary plan using the Open Standards for the Practice of Conservation. This plan provided the basis for a 3-day workshop with the Loita Maasai Council of Elders to assist the community in developing their own plan for resource conservation. With guidance from the authors, the Council employed Participatory Rural Appraisal methods to share their local knowledge of resource use and to plan for the future. The final plan identified biodiversity targets (lion, elephant, olive tree), threats (energy demand, drought, agriculture), and adaptive management strategies (education, compensation). The authors plan to continue the project by engaging the community in a second planning workshop.

**Root-Bernstein, Meredith,** *Oxford University*

**Interactions between qualitative methods and complexity modelling: a case study of conservation in the Espinal**

Complexity modelling has lent concepts and analytical tools to conservationists interested in systems approaches. While feedback, lags, scaling, emergence or historicity describe some macro aspects of socio-ecological systems, they lead to few actionable predictions. We need to focus on core properties unique to socio-ecological systems, such as context-dependence, hierarchical control of behavior, and constructed niches. These properties problematize the idea of the unit as integral and invariant, and complicate modelling multiple interacting units. Qualitative social sciences methods are better equiped to consider these "complicated" interactions, and may already use complex systems thinking. I show how three qualitative concepts, practice, foreshadowing, and emergent properties of objects, can inform a complex-systems approach to modelling complicated conservation conflicts. I provide concrete examples of their application from my research on conservation in a silvopastoral system, the espinal of Chile. Practice means behaviors enter the repertoire in context-dependent groups, preventing tree lovers from supporting conservation of espinals. Foreshadowing means the future has "already happened" in the past, and results in conservationists focusing effort on areas of lower conservation priority. Finally, the emergent properties of objects such as rodent burrows and runways increase biodiversity, while those of cars reduce perceptions of it.

**Rose, Eli,** *North Carolina Cooperative Fish and Wildlife Research Unit, NCSU;* **Theodore Simons**, *US Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit*

**Using remotely sensed fire severity indices to predict bird distributions in southern Appalachian forests; an occupancy modeling approach**

Prescribed fire is increasingly used to reduce fuel loads and improve conditions for wildlife. Nevertheless, landscape scale fire effects are often highly variable and difficult to quantify. Recent advances in the application of remotely sensed information are providing new tools for assessing habitat changes associated with fire. We illustrate the application of several fire severity metrics to models of avian distribution and abundance. We develop occupancy models for six avian species using habitat and burn severity co-variates and avian point count data collected in Great Smoky Mountains National Park during May and June 2012. Three species are associated with early succession habitats and three associated with late succession habitats. Overstory cover, difference Normalized Burn Ratios, and field derived fire severity metrics were consistently found among top models. Our results suggest that remotely sensed fire severity metrics can be a useful predictor of occupancy probability for five of the six species modeled.

**Rose, Robert,** *Wildlife Conservation Society;* **Allison Leidner**, *NASA Earth Science division;***David Wilkie,** *Wildlife Conservation Society*

**Identifying the Top 10 Conservation Challenges that Can Be Answered Through Remote Sensing Technologies**

Remote sensing plays a vital role in helping the conservation community monitor threats to the planet's ecological systems. With rapid advancements in remote sensing technology and increasing rates of ecosystem degradation, there is a need to both help the conservation community best use remote sensing to address the most critical environmental challenges and help the remote sensing community better understand what imagery and tools would most contribute to conservation activities. With support from NASA, the Wildlife Conservation Society organized a workshop that brought together 32 leaders from the conservation and remote sensing communities, representing the academic, government and NGO sectors, in order to address these needs. The goals of the workshop were to: identify the 10 highest priority conservation challenges that could be resolved using remote sensing technologies; renew relationships within the community to address these challenges; and outline a process to re-energize a conservation remote sensing working group. During the workshop, the 300+ challenges were narrowed down to the top ten. In addition, workshop participants outlined a plan to develop a conservation remote sensing working group. This session will review the process used to conjure the initial questions and distill the list to 10, present the results, and discuss the implications of making the list broadly available to the conservation, remote sensing and donor communities.

**Rose, Naomi,** *Humane Society of the US*

**Human Dimensions in Marine Mammal Science**

It should be a truth universally acknowledged that many problems in conservation have little to do with science but rather with human perceptions, opinions and values. In the case of marine mammals, some communities may value them as food, whereas in others they are valued as cultural icons. Public sentiment can run very high, whether marine mammals are considered competitors for fish, or species that must be protected at all costs, regardless of what science might show. In many, but not all, developed countries, marine mammals (especially cetaceans) occupy a special place in the public psyche and numerous studies have shown an elevated concern for marine mammal conservation, regardless of their actual conservation status. For example, one U.K. study found that 40% of the public would view more favorably, and more likely vote for, a politician who proposed a law specifically for the protection of cetaceans. In the past, such public opinion led to the passage of laws such as the 1972 US Marine Mammal Protection Act. Conservation interventions involving marine mammals that approach situations from a purely scientific standpoint, without considering the human dimension, are almost certainly doomed to failure; for example, the current stalemate at the International Whaling Commission and the failure of conservation attempts related to endangered marine mammals such as the Yangtze River dolphin.

**Rosenthal, Amy,** *Natural Capital Project at the World Wildlife Fund;* **Emily McKenzie**, *Natural Capital Project at WWF*

**Why Every Conservation Scientist Should Have a SPI, or Making Conservation Science Matter in the Anthropocene**

"SPI" is the science-policy interface, the mechanisms and routes through which conservation science results have the potential to be applied in management and policy decisions. Despite the potential, many conservation science studies remain locked away in journal articles and fail to be taken up by decision makers. This failure is the result of a variety of challenges, e.g. low salience to decisions, perceived illegitimacy, unclear or mis-communication, inappropriate endpoints, or poor framing or visualization of study and results. Fortunately, there are strategic ways to overcome these challenges, as long as conservation scientists are willing to take a systemic approach. The Natural Capital Project and the World Wildlife Fund have done just this, pioneering a transdisciplinary SPI program that focuses on emerging ecosystem service science. In this talk, we explore the world of SPIES, identifying how this work can ensure better science and uptake of results, with a focus on the key areas of framing, scenario development, stakeholder engagement, selecting appropriate endpoints, and lessons learned.

**Rosson, James,** *USDA Forest Service; Southern Research Station;* **Anita Rose**, *USDA Forest Service; Southern Research Station*

**Mortality Impact of the Hemlock Woolly Adelgid in the Great Smoky Mountains National Park**

The hemlock woolly adelgid (Adelges tsugae Annand) (HWA) is native to Japan and China and was first discovered in North America in British Columbia in the 1920's. The Park Service discovered HWA near Fontana Dam in 2002 and since then it has spread throughout the Great Smoky Mountains National Park (GSMNP), killing many hemlocks and leaving a devastating visual impact to park visitors. We used landscape-level data from the USDA Forest Service, Forest Inventory and Analysis (FIA) program to statistically assess the impact of the HWA and describe the current status of Tsuga canadensis (L.) Carr. in the GSMNP. Individual T. canadensis trees ≥ 12.7 cm in dbh were tracked on sample units systematically located across the GSMNP and measured between 1998 and 2011. For all species, there were 2,892 dead and live trees ≥ 12.7 cm dbh measured on 83, 0.674 ha sample units; 304 of these were T. canadensis spread across 50 of the sample units. The mortality rate of T. canadensis for the period, between 1998 and 2011, was 26 percent, the highest of any tree in the park. Of all dead trees in the park, 16.9 percent were T. canadensis followed by Picea rubens Sarg. at 11.6 percent. For live trees, as of 2011, T. canadensis ranked second behind Acer rubrum L. in the total tree population but ranked eighth in trees ≥ 20.0 cm dbh. The continued loss of this keystone species in the GSMNP will provide an open niche for other species and dramatically alter forest structure and communities.

**Rostal, Melinda,** *EcoHealth Alliance*

**USAID PREDICT Wildlife Surveillance in Mexico and Brazil**

PREDICT is a USAID funded global zoonotic disease surveillance of wildlife program designed to detect new viruses and predict viruses of zoonotic potential. Wildlife disease surveillance is important to human and domestic animal health; 70% of emerging infectious diseases are reported to be of animal origin, and of that, 75% have wildlife origins. PREDICT uses ecological modeling to target surveillance for emerging infectious diseases based on global “hotspots for emergence” and targeting high-risk wildlife species at human- wildlife interfaces. Standard protocols for field and laboratory techniques have been developed to generate comparable data across 20 countries on three continents. This presentation focuses on the progress of PREDICT in Mexico and Brazil after three years, including the development of a surveillance program that is scalable to country level, discovery of new viruses, interactions with the universities and national governments and characterizing human-wildlife contact.

**Roth, Robin,** *York University;* **Brian Thom**, *University of Victoria*

**Idle No More: Best Practices and Lessons Learned from Indigenous Conservation Partnerships in Canada**

It is necessary to build successful conservation partnerships with indigenous communities and yet concrete examples of how to do so from the perspective of indigenous peoples are difficult to encounter. This paper recounts the findings from a research project that focused on the best practices and lessons learned from indigenous conservation partnerships in Canada. We present the key findings from our detailed conversations with community leaders and practitioners who have built and worked within successful partnerships. Our findings point to essential elements, from the legal context of partnership arrangements, to strategies for incorporating indigenous knowledge and cultural practice, to the values embodied within interpersonal relationships while navigating these complex matters. The results are hopeful and demonstrate that meaningful conservation partnerships with indigenous communities are possible. And they are timely, as indigenous movements around the world, such as Idle No More in Canada, have renewed a debate about the recognition of aboriginal and treaty rights, the role of indigenous peoples environmental decision-making and governance, and the importance of partnerships between indigenous and settler communities. These questions have been central to the on-going collaborations between indigenous peoples and their conservation partners. The paper contributes to a renewed practice that can respond to the demands of indigenous peoples that we be idle no more.

**Ruch, Jeff,** *Public Employees for Env'l Respons*

**Federal Scientific Integrity Policies: On Paper and In Practice**

Reacting to the perceived abuses under his predecessor, in March 2009, less than two months into his tenure, President Obama issued a directive banning political manipulation of governmental science. This directive also required all science-based agencies to adopt policies for ensuring that the integrity of scientific and technical data, analysis and conclusions produced are safeguarded from suppression or inappropriate alteration. The resultant policies, for the first time, conferred a legal status on both the content and treatment of technical documents, as well as legal protections for scientists and other specialists who create them. They also purported to limit the ability of political appointees and senior managers to “create their own set of facts.” This presentation provides a broad comparison of the scientific integrity polices ultimately adopted by federal agencies, including how they differ in scope and application. This will be followed by a description of how these policies have actually operated in a handful of high-profile cases involving complaints of scientific misconduct, in violation of the policies adopted by the U.S. Department of Interior and the National Oceanic & Atmospheric Administration. The presentation will conclude with recommendations for strengthening these policies and closing glaring gaps.

**Russell, Gareth,** *New Jersey Institute of Technology;* **Joseph Wilder**, *Rutgers University*

**An underwater, camera-based, automatic identification system for coral reef fish: a prototype of a continuous monitoring network for reef populations**

Coral reefs around the world are in decline, but monitoring reef communities is costly and time-consuming. We developed an underwater camera system that can identify coral reef fish to species as they swim past. The system was deployed in a large aquarium with a simulated Caribbean reef environment, and captured image sequences that, over a two-month period, included 16 species. A tracking algorithm located individual swimming fish, which were segmented from the frame. Basic shape statistics were used to select the 'best' (most side-on) images from an individual sequence, and a number of shape, color and texture features were extracted. These were then classified via trained neural nets organized in a hierarchical manner to progressively eliminate errors. Using independent testing sets, each of the eight 'common' species (accounting for 93% of the observations) were correctly identified at least 95% of the time. (The rarer species were lumped as 'unknown,' with their images being stored for later identification by hand.) A system like this could provide a network of reef census stations operating many hours a day. The output would have high statistical power for detecting changes in reef fish populations, providing an early warning system for reef impacts. It would also improve in accuracy and scope as the database of images grew. While our prototype system proved the principle, it was not fully ocean-worthy. The remaining challenges are largely those of marine engineering.

**Russell, Kimberly,** *New Jersey Institute of Technology;* **Sarah Kornbluth**, *Rutgers University*

**Integrated Vegetation Management in Powerline Rights-of-way Provides Quality Habitat for Native Bees**

Evidence from Europe and the U.S. suggests a recent decline in the abundance and diversity of native bees (Potts et al. 2010). Increasing habitat that provides forage and nesting sites could boost struggling populations in the U.S., particularly in urban, suburban and agricultural landscapes. The millions of acres beneath US powerlines are kept free of tall-growing vegetation to meet Federal Energy Regulatory Commission standards, and hence have the potential to provide suitable habitat for most native species. Prior work (Russell et al. 2005) demonstrated that bee communities in easements managed using Integrated Vegetation Management (IVM) were more diverse than in nearby annually mowed areas. To further evaluate the impact of vegetation management, we conducted a two-year study in cooperation with three power companies across the U.S. (BGE in Maryland, BPA in Oregon, ATC in Wisconsin). Bee communities within rights-of-way managed by periodic mowing on a 1, 2 or 4 year rotation were compared to sites managed using either IVM, seeding, or planting, and also to other open habitats near the ROW. Regional differences were profound, but bee richness was higher in the IVM sites than either open or mowed sites. Bee diversity tracked estimated nest site diversity measured using a combination of quadrat sampling and nest box colonization. We conclude that IVM creates quality habitat for native bees, especially in a powerline context that includes connectivity and relative stability.

**Russell, Diane,** *USAID*

**Evidence and evaluation in conservation program design: USAID's experience**

The US Agency for International Development is a major investor in international conservation with over two decades of programming experience. This paper describes how USAID has employed evaluation findings and other data to inform design of new programs. Examples include evaluations of the Global Conservation Program, the Central African Regional Program on the Environment and the Liberia Land Rights and Community Forestry Program as well as evidence from applied research and “stocktaking,” international fora, and partner consultations. Evaluation and evidence-based programming has growing prominence within the Agency. As such, the Forestry and Biodiversity Office launched a new program “Measuring Impact” (MI) that links improvements in and insights from evaluation, monitoring, and adaptive management to program design. MI is working with USAID/Washington and several USAID Missions on specific evaluations, including an innovative two-stage impact evaluation of its flagship program Sustainable Conservation Approaches in Priority Landscapes (SCAPES). This work bolsters the evidence base for USAID’s emerging Biodiversity Policy, which emphasizes the role of biodiversity conservation in development outcomes. Challenges include making evidence from biodiversity sector meaningful to other sectors and the complexity of institutional learning in a complex, decentralized information-overloaded agency.

**Ryan, Maureen,** *University of Washington & Simon Fraser University;* **Alan Hamlet**, *University of Notre Dame;***Wendy Palen,** *Simon Fraser University;* **Se-Yeun Lee**, *University of Washington, Climate Impacts Group;* **Meghan Halabisky**, *University of Washington;* **Michael Adams,** *US Geological Survey;***Joshua Lawler**, *University of Washington;* **Lara Hansen,**

*EcoAdapt*

**Amphibians squeezed between introduced fish and climate change in montane wetlands**

Amphibians in the mountains of western North America are squeezed between two synergistic threats: rapidly changing climate and introduced predatory fish. Exotic trout exclude amphibians from many deep, permanent ponds and lakes. Yet climate-induced hydrologic changes may eliminate shallow fishless habitats on which amphibian populations now rely. Fish removals from mountain lakes have been successful in restoring aquatic habitat for amphibians, and thus represent a viable option for restoring resilience to climate change. However, the intensity of synergistic effects, and hence the effectiveness of fish removals for preventing declines, will vary among landscapes and species based on the amount and quality of fishless habitat and the proportion of habitats that are likely to become unsuitable in future climates. We present results from a study in Mount Rainier National Park. We developed projections of climate impacts to montane wetlands using the Variable Infiltration Capacity hydrologic model and new remote sensing approaches to classify existing wetland habitats. We show how these tools, in combination with amphibian life history and occupancy data, can be used to identify hot spots of synergistic effects of climate change and fish, where fish removal efforts can be targeted to restore resilience. These approaches can be applied to vulnerability assessment more broadly to support wetlands conservation and climate adaptation planning.

**Ryder, Ollie,** *San Diego Zoo Institute*

**Preserving the last individuals of a species: Advances in methods to culture amphibian tissues for cryobanking**

The IUCN Amphibian Conservation Action Plan calls for bioresource banking efforts for viable gametes and somatic cells of amphibian taxa, ideally as a distributed network of centers. Such a resource would facilitate research in systematics, disease risk factors and their management, as well as development and application of advanced reproductive technologies. With support from the U.S. Institute of Museum and Library Services, we have undertaken efforts to initiate, culture and freeze somatic cells from amphibians, with an emphasis on endangered taxa. Although amphibian tissues have historically proven more challenging to culture than other vertebrates, cell lines from six species have been successfully established and frozen, and methodological improvements in establishing amphibian cell cultures identified. Initial cell growth was achieved for >300 samples; 29 cell lines were successfully frozen, including the critically endangered Rana sevosa. These efforts more than tripled the prior number of reported amphibian cell lines. It is especially critical to establish and cryopreserve cell lines from amphibian species that might not be available in the future. The cell cultures can be expanded to generate large quantities of DNA/RNA, and could potentially be used for future somatic cell nuclear transfer or generating induced pluripotent embryonic stem cells. For species at the brink of extinction, access to banked viable cells may afford options for genetic rescue of critically small populations.

**Saba, Vincent,** *NOAA NMFS NEFSC, Princeton, NJ*

**Projected response of an endangered marine turtle population to climate change**

Assessing the potential impacts of climate change on individual species and populations is essential for the stewardship of ecosystems and biodiversity. Critically endangered leatherback turtles (Dermochelys coriacea) in the eastern Pacific Ocean are excellent candidates for such an assessment because their sensitivity to contemporary climate variability has been substantially studied. If incidental fisheries mortality is eliminated, this population still faces the challenge of recovery in a rapidly changing climate. Here we combined an Earth system model, climate model projections assessed by the Intergovernmental Panel on Climate Change, and a population dynamics model to estimate a 7% per decade decline in the Costa Rica nesting population over the twenty-first century. Whereas changes in ocean conditions had a small effect on the population, the ~2.5 ◦ C warming of the nesting beach was the primary driver of the decline through reduced hatching success and hatchling emergence rate. Hatchling sex ratio did not substantially change. Adjusting nesting phenology or changing nesting sites may not entirely prevent the decline, but could offset the decline rate. However, if future observations show a long-term decline in hatching success and emergence rate, anthropogenic climate mitigation of nests (for example, shading, irrigation) may be able to preserve the nesting population.

**Saif, Samia,** *Durrell Institute of Conservation & Ecology, University of Kent;* **Christina Barlow***, WildTeam;* **Douglas MacMillan***, Durrell Institute of Conservation & Ecology, University of Kent*

**Local consumption of tiger parts in the Bangladesh Sundarbans**  
Sundarbans is the largest mangrove forest in the world and the Bangladesh Sundarbans comprises an area of about 6017 sqkm. The tiger population of 300-500 individuals which inhabits it is one of the largest remaining populations of wild tigers on earth. About 4 million people live in villages adjacent to the Sundarbans and depend on the forest directly or indirectly for their livelihoods. Over the time many medicinal, traditional and economic values of tiger parts have emerged among these people. This study was conducted in Bangladesh Sundarbans to investigate the existing values in the area. Semi-structured interviews were carried out to gain an in depth understanding of the innately clandestine topic. The study found that tiger parts have medicinal, traditional and economic values for the local people. These values are not same as those in traditional Chinese medicine which is thought to be the main demand for the tiger parts. Most of the local values of tiger parts were unique in terms of the ways they are used and purposes they are used for. A total of 139 people were interviewed across the 4 ranges and 43 were found to use tiger parts, 46 owned tiger parts at their home and 79 believed in the traditional and medicinal values of it. Tiger parts used by the villagers were tooth, bone, meat, tongue, genital organs, claw, whisker, stool and even the pugmark. It is important to understand the local demand of tiger parts as it might be an unexplored reason of tiger poaching.

**Salafsky, Nick,** *Foundations of Success;* **Matt Deniston**, *Sitka Technology Group;***Brian Knowles,** *Sitka Technology Group;* **Dan Salzer**, *The Nature Conservancy*

**Scaling-Up Adaptive Management from Individual Projects to Aggregate Programs**

Conservation practitioners have a long history of using adaptive management principles and tools, such as those contained in the Open Standards for the Practice of Conservation, to design, manage, monitor, and learn from specific site-based and thematic projects. There is now growing interest in scaling these principles and tools to apply to "parent programs" composed of multiple "sibling projects" - for example, a network of sites managed by an organization, or a portfolio of grants funded by an agency or foundation. In this talk, we share recent experiences in program-level adaptive management, drawing on examples of developing a donor's funding strategy for the Galapagos Archipelago, performance measures for US State and Federal Fish and Wildlife Agencies, and a new cloud-based information system to manage and share conservation actions and projects. As with most scaling efforts, taking adaptive management from projects to programs is not a simple linear transformation. Key lessons include the need to 1) adjust planning, monitoring, and analysis units to a larger scale, 2) invest in developing standard lexicons, templates and information technology tools that ensure that projects are designed and monitored in a comparable fashion, and 3) ensure that adaptive management takes place in the context of regular program business practices. If done appropriately, program level adaptive management can improve cross-project learning and ultimately, the practice of conservation.

**Sanderson, Eric,** *Wildlife Conservation Society*

**The Human Footprint: A Retrospective**

The human footprint map helps us see, understand, and plan for human influence on Earth. The human footprint map shows the physical mark of humanity on Earth. The human footprint is created by compiling global datasets on population, land use, transportation networks, and power infrastructure at approximately 1 km2 resolution to show the global gradient of human influence on the land’s surface at a particular point in time. Such a map allows one to map cities, suburbs, rural areas, and wilderness; it represents a spatially explicit measure of threat; and it helps conservationists better frame the tradeoffs between economic development and nature conservation. In the decade since it was published, the map dataset has been used in over 360 different peer-reviewed studies to test propositions regarding protected area effectiveness, susceptibility to biological invasion, species range changes and diversity, ecosystem services, environmental sustainability, and conservation planning. It has encouraged researchers to pursue higher resolution versions for the western US, the Northern Appalachian mountain range in the US and Canada, Guatemala, and Israel, and a global effort for the world’s oceans. The most important use of the human footprint, however, has been for communication, showing people outside of conservation biology how and why the distribution, magnitude, and extent of humanity’s mark on Earth is critical to what it means to be human in the twenty-first century眠牯摬࠮慆牢

**Sandin,, Stuart,** *Scripps Institute of Oceanography;* **Les Kauffman**, *Boston University*

**Can the Coral Health Index (CHI) support Pacific Ocean reef conservation and management?**

**Sandström, Annica,** *Stockholm Resilience Centre*

**Treating networks seriously' in conservation management: How a network approach enhances our understanding of collective action and adaptive capacity**

The challenges of conservation management originate in ecological as well as social complexities. Social factors like institutional uncertainties, multi-actor settings, competing goals, and conflicts of interest often impede the evolution of legitimate and adaptive management systems. The argument proposed here is that these challenges should be approached through social networks. Based on social science theories and by means of empirical illustrations from fishery and carnivore management, three arguments for a social network approach are suggested. The first emphasizes the descriptive value of a network perspective; it contributes greatly to the process of defining the boundaries of the social system and to the generation of important information regarding the actors and their interactions. The second argument stresses the theoretical contribution of a network approach and rests on findings from previous research on the interplay between different network characteristics and management outcome. The main message is that the structure of a network affects the way it functions. The third argument is based on a managerial perspective and discusses implications for institutional design. The issue of how to design new, or influence existing, management systems to improve their capacity to deal with social challenges is elaborated. To conclude, research on conservation management has much to gain by ‘treating networks seriously.’

**Sawaya, Michael,** *Sinopah Wildlife Research Associates;* **Steven Kalinowski**, *Montana State University;***Anthony Clevenger,** *Western Transportation Institute*

**Genetic Connectivity at Wildlife Crossing Structures in Banff National Park.**

Roads fragment and isolate wildlife populations which will eventually decrease genetic diversity within populations. Wildlife crossing structures may counteract these impacts by maintaining or restoring gene flow, but most crossings are relatively new, and there is little evidence that they facilitate gene flow. We conducted a three-year research project in Banff National Park, Alberta, to evaluate genetic connectivity at wildlife crossings. Our main objective was to determine how the Trans-Canada Highway and the crossing structures along it affect gene flow and population structure in grizzly (Ursus arctos) and black bears (Ursus americanus). We compared genetic data generated from wildlife crossings with data collected from greater populations using noninvasive genetic sampling. We detected a genetic discontinuity across the highway in grizzly bears but not in black bears. Grizzly bears detected at crossings assigned to populations north and south of the highway, providing evidence of bidirectional gene flow and genetic admixture at wildlife crossings. Genetic parentage tests showed that 47% of black bears and 27% of grizzly bears that used crossings were successful breeders. Differentiating between dispersal and gene flow is difficult, but we documented gene flow at wildlife crossings by showing a migration event followed by successful reproduction and genetic admixture. We conclude wildlife crossing structures allow sufficient gene flow to prevent genetic isolation.

**Saxena, Anuj,** *Government of Rajathan*

**Biotechnology and Biodiversity conservation: Attaining synergy through policy making.**

India is one of the 12 mega diversity "hotspot" regions of the world with an inventory of over 47,000 species of plant and 89,000 species of animals. Biotechnology has already assisted in the conservation of plant and animal genetic resources and offers vast potential for improving the productivity of agriculture, forestry and fisheries. In recent past, emerging biotechnologies have simultaneously added to the inequities by displacing traditional agricultural products, introducing new environmental and health hazards along with serious hardship for rural communities. Therefore the technology use for the benefit of farmers and conservation of traditional knowledge and biodiversity needs a revaluation in the context of Biotechnology. A scope for synergy can be achieved through policy document, a comprehensive note of the same must include some key elements like- Building and strengthening Knowledge ecosystem by setting up centres of excellence with development of gene bank to capture unique biodiversity of the region, catalyse industrial development through growth centre, Promoting investment and above all ensuring regulatory and compliance mechanism through task force to address the issues of bio-safety, bio-ethics and intellectual property rights in the field of biotechnology. Policy document thus enables and facilitates a need based support for the convergence of the interests of the industry, government and other stakeholders.

**Saxon, Earl,** *Forest Inform Partners*

**Participatory Land Use Planning for Conservation, Livelihoods, Infrastructure and Agro-industrial Development in Southeastern Myanmar**

Land use conflicts in southeastern Myanmar threaten Asia's largest block of contiguous lowland Dipterocarp forest. Some are due to a disconnect between legal and customary land tenure, others to decades-long conflict and still others to ad hoc and informal allocation of land. However, Myanmar does not have decades to resolve these issues if it is to protect biodiversity, modernize agriculture, provide for resettlement and anticipate impacts of climate change. The 1997 conservation plan proposed a system of protected areas spanning a tropical forest belt that runs for 600 km along the Myanmar-Thailand border. In the north, the Tanintharyi Nature Reserve, declared in 2002, has funding, staff and a management plan. In the south, the Tanintharyi National Park, declared in 2005, is a "paper park" and the proposed site of a major hydro-electric dam. The unprotected central sector is the proposed location for road, rail, powerline and pipeline corridors connecting Southeast Asia with the Andaman Sea at Dawei. In 2013 Tanintharyi Division's government convened a stakeholder workshop. Participants reviewed lessons learned from previous infrastructure and agro-industrial development. They used maps and satellite change imagery to identify plausible land use scenarios for the areas at risk. Their scenarios range from high-risk strategies that could ignite social conflict to strategies that buffer natural areas and protect forests and rivers on which community livelihoods depend.

**Scanga, Sara,** *Utica College;* **Andrea Blowers**, *Utica College;***Charles Schirmer,** *SUNY College of Environmental Science and Forestry*

**Feasibility of out-planting small populations to conserve a rare fen plant**

Restoration and translocation increasingly are used to bolster declining populations of rare species. Because declining species often have limited reproductive success, it can be difficult to acquire sufficient propagules for out-planting large populations. At the same time, certain rare species sometimes persist as small populations without apparent negative effects, indicating that out-planting small populations may be effective for some species. We investigated the feasibility of out-planting small populations of the rare and declining fen plant Trollius laxus. Seedlings were planted at 12 plots (n = 10 plants per plot) located within a protected area where a well-studied metapopoulation of T. laxus already occurs. Suitable plots were identified using a GIS-based, macroscale habitat model. We monitored the subpopulations 1, 2, 3, and 8 years after out-planting. We used population modeling to evaluate the vigor of the transplanted populations, and compared microscale habitat conditions between successfully and unsuccessfully established plots. Of the original 120 transplants, 64 survived at least 1 year, and 10 survived to year 8. These survivors occurred at 6 out of the 12 original plots, and showed increases in size and flowering during the study. Microhabitat conditions appear to influence successful establishment. Therefore, if microscale conditions are considered, out-planting small populations may be a feasible approach to conserving naturally rare plants.

**Schaefer, Jame,** *Marquette University*

**Advancing the Collaboration of Religious and Conservation Biology Communities**

Alarm over the accelerated rate of species extinction, degradation of ecological systems, and threats to the biosphere has prompted scholars and leaders of the world religions to dig deeply into their traditions and practices for ways of responding. They have discovered both treasures to retrieve and apply from their own faith perspectives and expressions of their faiths that may have lost their original meaning and/or need updating informed by contemporary scientific findings. Among the treasures found are compassion for living beings and the merits of relieving their suffering. Among the expressions of faith that need updating is the release of animals for the merit accrued by the individual who engages in this practice. Conservation biologists and religious communities should collaborate on this and other mutual issues to advance biological diversity, the sustainability of Earth, and more responsible and authentic expression of religious faith.

**Schindlinger, Michael,** *University of California, Santa Barbara;* **David Morimoto***,* *Lesley University;* **Gajendra Narine***, Guyana Amazon Tropical Birds Society;* **Asaph Wilson***, Village of Shulinab*

**A baseline avian survey of the Rupununi River, Guyana, by dugout canoe: a 'healing journey' for conservation**  
We surveyed birds by dugout canoe along ~147 km of the Rupununi River (RBS) in Guyana from Yupukari village to Rewa Ecolodge from 5-11 Jan. 2011. This remote largely pristine region is now subject to climate change, agricultural development, oil and gold prospecting, local organization, ecotourism, and Facebook. We did the survey in the spirit of the YRITWC indigenous healing journey in which canoeists survey and share stories with residents to link watershed stakeholders in mutual education and common experience. We recorded 4243 individuals, 292 species, and 58 families. Species accumulation revealed high β diversity as we traversed savanna to forest and across creek systems. More than 60% of the species were recorded on 1-2 days and 61% of species were represented by 1-5 individuals. Daily pairwise community similarity analyses reveal that the bird communities changed steadily. Comparisons with 4 published surveys in this otherwise poorly studied region reveal that 15 species were unique to the RBS, which recorded 51% of the 567 total species (643 spp. known in the region). On the journey we shared our love for birds and a vision of conservation, education, ecotourism and oneness with indigenous leaders, villagers, NGOs, and ecotourists looking to invest. We recommend that the Rupununi River corridor habitat be conserved and that the RBS survey, designed to be 'green', traditional, and easily replicated by expert indigenous stakeholders, be repeated at least every 5 years.

**Schloss, Carrie,** *University of Washington*

**Are we already conserving the stage? A land facet gap analysis for 14 ecoregions in the western USA**

As species shift their ranges in response to climate change, communities will be reshuffled to form new associations. Such changes provide a challenge to the process of conservation planning, which has typically focused on protecting current patterns of biodiversity. One strategy for protecting biodiversity in a changing climate is based on the idea of protecting the diversity of abiotic conditions that influence patterns of biodiversity. Abiotic features, such as soil, topography, and geology, largely determine the distribution of biodiversity, but will remain stable in a changing climate. By protecting unique combinations of abiotic diversity, or land facets, it may be possible to protect areas that will foster a diversity of biota currently and in the future —although these will likely be different sets of species. It is not clear to what extent land facets are already represented in current protected areas or in biodiversity-based conservation plans. Here, we designate land facets across 14 ecoregions in the western United States. We assess the extent to which land facets are already protected and identify the types of land facets that are underrepresented in current protected areas. We found that land facet representation varied across ecoregions and was proportional to the land area designated for protection. Individual land facet representation also varied. Some facet types were always adequately represented and others were largely absent from protected area networks.

**Schmiegelow, Fiona,** *University of Alberta;* **Justina Ray**, *Wildlife Conservation Soc. Canada*

**A Risk-Based Approach To Recovery Planning Under SARA: A Case Study Of The Wide-Ranging And Elusive Woodland Caribou**

The conservation of wide-ranging species for which population censuses are impractical presents particular challenges to status assessment and recovery planning. Uncertainties inherent to endangered species recovery efforts are compounded by both scientific and societal reluctance to address associated risks in a transparent framework. Proponents at either end of the conservation spectrum may feel threatened by the requirement to explicitly state a tolerance for risk, rather than using the shroud of science (certain or not) to support a position. The recovery plan for woodland caribou in Canada (boreal population) applies a threshold approach to conservation of critical habitat that relies on indicators of population and habitat condition to establish recovery targets. The identified management threshold does not reflect a discrete ecological transition point, but rather represents a distinct policy choice relative to the likelihood of achieving the recovery objective of self-sustaining populations. In the absence of a comprehensive monitoring program, embedded in a flexible and responsive management framework, this approach risks achieving the recovery criteria (the target or threshold), but failing to conserve caribou. If effectively implemented, however, it provides a foundation for reducing uncertainty, and improving conservation success, through the refinement of recovery criteria.

**Schroeder, Lori,** *University of Alberta;* **Fiona Schmiegelow**, *University of Alberta;***Edward Bork,** *University of Alberta;* **Tom Jung**, *Environment Yukon*

**Rare Species in Relict Grasslands: Plant diversity responses to a reintroduced Wood Bison herd in Yukon, Canada**

Wood Bison were reintroduced into the southwest Yukon in the late 1980s as part of national recovery efforts. The Yukon population has subsequently increased from 34 to more than 1,100 animals, prompting concerns that bison may compete with other ungulates in the area, and alter pocket grasslands within the boreal forest (relicts of ice age steppe) that contain rare, endemic plant species. The Yukon Wood Bison Technical Team, which is composed of government, First Nations and co-management body representatives, has identified grasslands as focal points for vegetation monitoring in the Wood Bison Management Plan (2012). In order to quantify the impact of bison on grassland composition and diversity, bison location (GPS) data, fecal samples, orthophotos, existing plant inventory data and consultation with Champagne and Aishihik First Nations were used. After surveying vegetation cover at 70 sites representing different levels of bison usage, preliminary results indicate that both richness and Shannon's Diversity Index increase with the level of bison use, and that forbs are the driver of that change. Two new populations of the endangered Yukon Draba (Draba yukonensis) were also discovered. These results will inform ongoing management decisions and land use planning processes within the herd range and provide important information on an understudied and rare plant community believed to be analogous to Beringian Steppe communities.

**Schulfer, Nathan,** *University of Wisconsin - Madison Nelson Institute for Environmental Studies;* **Janet Silbernagel**, *University of Wisconsin - Madison Nelson Institute for Environmental Studies;***Adrian Treves,** *University of Wisconsin - Madison Nelson Institute for Environmental Studies;* **Ming Hua**, *University of Wisconsin - Madison Nelson Institute for Environmental Studies*

**Rethinking the integration of conservation science, stakeholder engagement and biodiversity protection in China**

This poster presentation describes academic and professional exchanges taking place between the University of Wisconsin - Madison's China Conservation Network, and Chinese academic partners and international NGO's working in China. Multiple political, social, and environmental challenges threaten the long-term maintenance of biodiversity in China. To address this range of challenges our conservation network focuses on programs that are adaptive to site level constraints and area contexts to best account for diverse stakeholder perspectives. Our work in China to integrate diverse stakeholders and academic disciplines is built on the interdisciplinary research and service based learning traditions of the UW-Madison's Nelson Institute for Environmental Studies. This conceptual model frames our presentation. We will briefly describe two current examples of our work in China - one being policy analysis for Conservation International - China on Payments for Ecosystem Services programs in the giant panda corridor of Daxiangling Nature Reserve in Sichuan Province, and the second being the complex dynamics of hydrology, people and cranes with the International Crane Foundation at Poyang Lake in Jiangxi Province. Finally, our poster will comment on the relevance of service based learning models for conservation, and how our Network will continue to use service-based models to adapt to Chinese understandings of biodiversity conservation.

**Schultz, Courtney,** *Colorado State University;* **Thomas Sisk**, *Northern Arizona University;***Barry Noon,** *Colorado State University;* **Martin Nie**, *University of Montana*

**Wildlife Conservation Planning Under the United States Forest Service's 2012 Planning Rule**

In 2012, the U.S. Forest Service promulgated new planning regulations under the National Forest Management Act. These regulations represent the most significant change in federal forest policy in decades and have sweeping implications for wildlife. This presentation provides a history of wildlife provisions in the planning rules and then discusses the 2012 rule. The new rule is of concern because of its discretionary nature and the inconsistency between its intent and operational requirements. We recommend that the USFS make commitments to directly monitor populations of species of conservation concern and focal species and to maintain the viability of both categories of species. If the USFS determines that the planning unit is not inherently capable of maintaining viable populations of a species, this finding should be made available for scientific review and public comment, and the USFS should commit to doing nothing that would further impair the viability of such species. Where extrinsic factors decrease species viability, the USFS has an increased responsibility to protect those species. Monitoring plans must include trigger points, and plans must include provisions to ensure monitoring takes place. Enforceable provisions will help to prevent additional listings under the Endangered Species Act. Although the 2012 rule gives cause for concern, forward-thinking USFS officials have the opportunity to create a robust and effective framework for wildlife conservation planning.

**Schultz, Jennifer,** *NOAA National Marine Fisheries Services****;* Alexandros Karamanlidis,** *MOm/Hellenic Society for the Study and Protection of the Monk Seal****;* Marianna Psaradellis, *MOm/Hellenic Society for the Study and*** *Protection of the Monk Seal;***Rebecca Hersch,** *American Museum of Natural History;***Stephen Gaughran,** *American Museum of Natural History;* **George Amato**, *American Museum of Natural History;***Panagiotis Dendrinos,** *MOm/Hellenic Society for the Study and Protection of the Monk Seal*

**Molecular tools reveal the secrets of the critically endangered Mediterranean monk seal**

The Mediterranean monk seal (Monachus monachus) is the most endangered Pinniped in the world. Less than 600 individuals comprise three geographically isolated populations in Greece, Madeira, and Western Sahara. Greece hosts the largest population of 300-350 seals. Over the past twenty years, MOm, the Hellenic Society for the Study and Protection of the Monk Seal, has opportunistically collected over one hundred tissue samples from dead, injured or orphaned individuals. We used these samples to evaluate population structure using microsatellite and mitochondrial genetic markers. We found moderate (microsatellite) to high (mitochondrial DNA) levels of genetic differentiation between Ionian and Aegean subpopulations, which are separated by relatively short geographic distances and no obvious physical barriers to gene flow. This information will help to improve monk seal conservation measures, such as Marine Protected Areas and population monitoring systems.

**Schumaker, Nathan,** *US EPA;* **Allen Brookes**, *US EPA*

**A Novel Simulation Methodology Merging Source-Sink Dynamics and Landscape Connectivity.**

Source-sink dynamics are an emergent property of complex species-landscape interactions. This study explores the patterns of source and sink behavior that become established across a large landscape, using a simulation model for the northern spotted owl (Strix occidentalis caurina) that was developed as part of the US Fish and Wildlife Service's most recent recovery planning effort for the species. Our spotted owl model was constructed with the HexSim life history simulator, and we take advantage of features in HexSim to develop maps of source and sink strength at multiple spatial scales across the range of the species. We also use HexSim to produce relatively simple matrix model representations of the full mechanistic simulation, and extract information about the fluxes of owls across the landscape from those simple models. We describe a quantity "net flux" that turns out to be well correlated with the importance of movement pathways, based on an analysis of dominant eigenvalues.

**Schuttler, Stephanie,** *University of Missouri;* **Jessica Philbrick**, *University of Missouri;***Alden Whittaker,** *Wildlife Conservation Society;* **Kathryn Jeffery**, *Agence Nationale des Parcs Nationaux;* **Lori Eggert**, *University of Missouri*

**Social networking in African forest elephants: Hidden associations, but disconnected population**

African forest elephants (Loxodonta cyclotis) are of immediate conservation concern because poaching for ivory has decimated populations. This species is the least understood of the extant elephants as they are cryptic in forest habitats. Fission-fusion sociality has been detected in Asian and African savanna elephants, and for the latter species, has importance for fitness. We investigated if forest elephants have kin-based fission-fusion sociality. Individuals were observed in savanna clearings within forests of Lopé National Park, Gabon in 2006, 2008, and 2010. We recorded associations between identified individuals and where possible, collected dung for genetic analyses. Using adult female associations, we created network models for years, seasons, re-sighted females, and for all adult females. We identified 118 adult females and collected dung samples from 40 individuals. Networks were characterized by low densities, disconnected components, short average path lengths, and high clustering coefficients. The average relatedness of adult females within a component was 0.093 ± 0.071 and components typically consisted of the same mitochondrial haplotype. One very large component consisted of 22 adult females, although there were few preferred associations (12.3%). There was no indication of differences between seasons or years. Our results offer some support for fission-fusion sociality in forest elephants, however it appears to differ in structure from the other species.

**Scofield, Anne,** *Sea Education Association;* **Amy Siuda**, *Sea Education Association*

**Biogeography of eel larvae in surface and subsurface waters of the Sargasso Sea**

The Sargasso Sea is a spawning and nursery ground for a number of commercially- and ecologically-important eel species; however, documentation of leptocephali biogeography in the region is incomplete. Pelagic Sargassum species support a diverse community of associated organisms; given that prior studies focused sampling effort on the subsurface, a connection between leptocephali and Sargassum has not been investigated. We identified and measured more than 3000 leptocephali collected in approximately 200 surface and 75 subsurface net tows during 40 Sea Education Association research cruises in the western Sargasso Sea from 1988 to 2012. Over 95% of individuals collected at the surface were identified as the congrid eel Ariosoma balearicum. A positive correlation observed between total leptocephali abundance and Sargassum spp. density suggests that A. balearicum uses pelagic algae as nursery habitat. Seasonal differences were also observed in size and abundance of A. balearicum, with greater quantities of small individuals present from October to November and fewer but larger individuals present in April to June. Diversity was greater subsurface, where multiple species were often collected in the same tow. Results from follow-up population genetics work with A. balearicum planned for spring 2013 will also be presented. These efforts can inform research on adult eel population dynamics and also represent an important step toward better assessing the region's conservation value.

**Segan, Daniel,** *Wildlife Conservation Society*

**Aligning local management with national conservation priorities in the assessment of high conservation value forest areas**

The concept of a High Conversation Value (HCV) forest emerged over 15 years ago within forestry management and has been used as a tool for individual land owners/concessionaires to identify and protect attributes of outstanding conservation value. The delineation of HCV areas gained momentum within the industry and nineteen countries have produced guidance documents on the process for identifying HCV areas. This has typically been a bottom-up process, where companies have used their own data to define conservation priorities in the absence of agreed national conservation priorities or planning frameworks. With increasing progress at the national level in systematically identifying conservation objectives and priority areas to achieve those objectives, there is now a critical need to integrate this work with industry led initiatives like HCV. Concession level HCV analysis must compliment national conservation priorities and the areas identified and values managed for at the concession level must collectively achieve the national conservation objectives. WCS is currently working with an operator at a forestry concession near Mayumba in Southern Gabon to trial a framework for integrating national level priorities into the identification of concession level HCV areas. This talk will explore WCS' experience working with industry to integrate information and priorities identified from national level conservation assessment into site scale HCV assessments and management recommendations.

**Selier, Sarah-Anne,** *School of Life Sciences, University of Kwa-Zulu Natal;* **Rob Slotow**, *School of Life Sciences, University of Kwa-Zulu Natal;***Bruce Page,** *School of Life Sciences, University of Kwa-Zulu Natal;* **Enrico Di Minin**, *Finnish Centre of Excellence in Metapopulation Biology, University of Helsinki*

**Understanding elephant distribution in a human-dominated transfrontier landscape**

Understanding factors that affect the persistence of charismatic megafauna in human-dominated landscapes is strategic to inform conservation decision-making and reduce conflict. In this study, we assessed the effect of environmental and anthropogenic factors on the distribution of elephants (Loxodonta africana) in the Greater Mapungubwe Trans Frontier Conservation Area in Southern Africa. We combined aerial counts over a 12 year period with 10 variables on food availability and landscape and anthropogenic variables in a logistic regression. Models were run for the entire landscape, as well as smaller management units with different land-use practices, such as ecotourism, trophy hunting, and a combination of hunting and photographic tourism. The results of all models showed that human activities, such as human population density, the use of electric fences, and hunting, negatively affected the distribution of elephants. The provisioning of water was also found to be an important variable affecting elephant distribution. When planning transboundary conservation areas and corridors in human-dominated landscapes it is important to take anthropogenic factors and their effect on the movements and distribution of megafauna into consideration. Particularly where countries with diverging management strategies are involved.

**Selva, Nuria,** *Policy Academy of Sciences*

**Roadless and low-traffic areas as conservation targets and wilderness surrogates- the European perspective**

With more than 100 million km of roads worldwide, the road network plays a main role in shaping the environment. Road impacts on the environment are numerous, very complex, time-lagged and extend far beyond the edge of the road itself. Probably the most important road effect is what we have termed “contagious development”: roads provide access to previously remote areas, thus opening them up for more roads and developments, and triggering land-use changes, resource extraction and human disturbance. In this context, keeping road-free the remaining large unfragmented patches of natural habitats is of crucial importance for their conservation. Roadless and low-traffic areas represent relatively undisturbed natural habitats and functioning ecosystems. They increase landscape connectivity, act as barrier against pests and invasions, and render many ecosystem services. Roadless areas largely contribute to the preservation of native biodiversity and contain more species and individuals, species with large spatial requirements (e.g. top carnivores) and species sensitive to human disturbance. They get special relevance in the context of climate change because their higher resilience and buffering capacity. Roadless areas have become a rare element of the landscape, particularly in Europe, where roads are among the biggest land consumers in the European Union. An analysis of conservation legislation in Europe illustrates that although most laws aimed at protecting targets which are inherent to fragmentation, like connectivity, ecosystem processes, or integrity, roadless areas are widely neglected. For example, in Germany, although the Natura 2000 network covers an important proportion of the country (16%), most low-traffic and roadless areas (75%) lie outside this network. Additionally, Natura 2000 sites are highly fragmented. A similar study in Greece shows that less than 3% of the roadless areas in the country were protected under the Natura 2000 network, mostly in mountains tops. We propose that the few still existing roadless and low-traffic areas in Europe shall be an important focus of conservation efforts and that “roadlessness” must be an essential component of wilderness. Recent initiatives include the Report on Wilderness in Europe by the European Parliament, the European Union Strategy on Green Infrastructure or the Federal Defragmentation Programme in Germany.

**Sentman, Wayne,** *Harvard University Extension School;* **A. E. Vo**, *University of California - Berkeley;***Myra Finkelstein,** *University of California - Santa Cruz;* **Scott Edwards**, *Harvard University;* **Heidi Auman**, *University of Tasmania, Hobart, Tasmania, Australia;* **Michael Bank,** *University of Massachusetts - Amherst*

**Pollution Canary - Albatross as Sentinels of Marine Pollution**

Mercury and plastic pollution levels in the Pacific Ocean are considered to be increasing with high levels of mercury, lead, and plastic documented in North Pacific albatross species. Our group has shown that changes in methylmercury levels, in Black-Footed Albatross (BFAL) have increased as predicted from anthropogenic mercury emissions using museum specimens spanning the past 130 years. At the local scale, lead paint exposure from buildings on their breeding ground affected the population viability of Laysan albatross (LAAL), suggesting albatross are threatened by heavy metal exposure at both local (lead) and global scales (mercury). Plastic pollution in the oceans accumulates in zones of high density or "gyres". Our pilot study indicates that plastic can leach potentially toxic concentrations of metals (e.g., lead, zinc). Since the BFAL and LAAL feed at the top of the marine food chain, range across the Pacific, and feed along the gyres of plastic pollution, they are ideal sentinel species for marine pollution. Therefore, we propose that North Pacific albatross are an effective marine flagship species and understanding their exposure risks will support broader biodiversity conservation across the North Pacific.

**Sevin, Jennifer,** *Smithsonian Institution;* **Evan Grant**, *U.S. Geological Survey*

**Occupancy Study Investigates Historic Hypothesis Related to Distribution of Endangered Shenandoah Salamander**

The federally endangered Shenandoah salamander (Plethodon shenandoah) is an endemic, high elevation, terrestrial salamander found exclusively on three mountaintops in Shenandoah National Park. In the face of climate change and other potential stressors on the species, management agencies need the ability to make informed decisions. Few studies have been conducted on the Shenandoah salamander since the early 1970s and historic hypotheses related to distribution and habitat use are conflicting. As part of a broader collaboration among state and federal agencies, this study uses multi-season occupancy data, coupled with macro and micro habitat data, to explore multiple hypotheses relating to distribution and habitat preference. Results do not support historic hypotheses and have led to the formation of new hypotheses. This research provides useful information for the development of a long-term monitoring plan for the Shenandoah salamander and will assist managers as they evaluate management options to reduce extinction risk for this salamander, given expectations of future climate change.

**Sexton, Joseph,** *Global Land Cover Facility;* **Xiao-Peng Song**, *Global Land Cover Facility;***Praveen Noojipady,** *Global Land Cover Facility;* **Anupam Anand**, *Global Land Cover Facility;* **Chengquan Huang**, *Global Land Cover Facility;* **Min Feng,** *Global Land Cover Facility;***Saurabh Channan**, *Global Land Cover Facility;* **Do-Hyung Kim,**

*Global Land Cover Facility;* **Danxia Song,** *Global Land Cover Facility*

**A global, 30-m resolution tree cover dataset: consistency with the MODIS Vegetation Continuous Fields and accuracy relative to lidar measurements**

Geospatial datasets representing Earth's tree cover are crucial for detecting forest gains, losses, and degradation. We generated a global, 30-m percent tree cover dataset using circa-2000 and -2005 Landsat images and the MOderate-resolution Imaging Spectroradiometer (MODIS) Cropland Probability and Vegetation Continuous Fields (VCF) Tree Cover layers. Our estimates maintain fidelity to the MODIS VCF (RMSE = 9% in 2000 and 12% in 2005) but improve accuracy in agricultural areas and discrimination of small clearings. Compared against lidar measurements in multiple biomes, the Landsat-based estimates exhibit accuracy equivalent to that of the MODIS VCF (RMSE = 17% for both MODIS- and Landsat-based estimates), but RMSE of Landsat estimates relative to lidar measurements is 3% percentage points lower than that of the MODIS data in a mixed forest-agricultural region. Saturation of the MODIS VCF at ≥80% tree cover is retained in the Landsat estimates, but the Landsat data show greater potential for removal of errors through calibration to lidar, with post-calibration RMSE of 9% compared to 14% in MODIS estimates. With 30-m spatial resolution and improved accuracy in agricultural regions, the 2000 and 2005 Landsat-based tree cover dataset is the highest-resolution multi-temporal depiction of Earth's tree cover available to the conservation community. The data and associated quality layers are provided for free download at the Global Land Cover Facility website (www.landcover.org).

**Shafer, Craig,** *George Mason University*

**Potential Land Use Impediments To Grizzly Bear Emigration In The Greater Yellowstone Ecosystem**

The Greater Yellowstone Ecosystem (GYE) is the largest tract of wild land remaining in the lower 48 states; however its habitat is being fragmented by various human activities. The flagship species in the GYE is the grizzly bear (Ursus arctos horribilis) which persists here at its southernmost North American latitude. This GYE subpopulation is perceived to have been isolated from other grizzly bear subpopulations in the United States for around a century. In fact, some scientists have measured a loss of genetic diversity in the GYE population compared to the one in the Northern Continental Divide Ecosystem (NCDE). Retaining or reestablishing usable habitat connectivity between the GYE, the NCDE and the Selway-Bitterroot Ecosystem would help mitigate this genetic loss. Using GIS analysis, I examine the relationship between GYE grizzly bear emigration distance various influences on the land. Roads may be the primary barrier. Additional GIS insight is that roads and mining/oil and gas leases occur within the grizzly bear Primary Conservation Area and within GYE Roadless Areas. The opportunity to create a usable landscape matrix allowing the GYE grizzly bear to emigrate to other sub-populations will not last indefinitely.

**Shanas, Uri,** *University of Haifa-Oranim;***Elad Peled,** *University of Haifa;***Rachel Ben-Shlomo,** *University of Haifa-Oranim*

**Specialists can have high genetic diversity in small patches**

It is postulated that specialist species, having narrow ecological niches are highly vulnerable, and in patchy habitats they may fail to form a metapopulation. We examined this hypothesis by comparing two closely related species, the generalist Lichtenstein's short-fingered gecko (Stenodactylus sthenodactylus), and the specialist endangered Middle Eastern short-fingered gecko (Stenodactylus doriae), both living in the Arava valley shared by Israel and Jordan. Using AFLP analysis and comparing sub populations we found that among populations, as expected, the specialist S. doriae had an interrupted gene flow, while the generalist S. sthenodactylus showed an undisturbed connectivity. However, we were surprised to find that the most isolated population of the specialist S. doriae, located in the smallest sand dune (Samar), exhibited the highest gene diversity of all the populations studied (He = 0.4286). This population was also found to be genetically unique when compared to its neighboring populations, and gene flow between two populations located to the north and to the south bypassed it. The generalist S. sthenodactylus, in contrast, did not exhibit exceptional heterozygosity. Based on the results we suggest that high quality habitats may provide adaptive advantage to specialists that can hold exceptional diversity even in small, secluded patches and thus we need to pay special conservation attention for such unique habitats.

**Sharma, Ghanashyam,** *The Mountain Institute India*

**Impact of Climate Change on Conservation of Globally Significant Biodiversity Elements of Sikkim Trans-Himalaya in the Eastern Himalayas, India**

A study of impact of climate change on the critical wildlife habitats was carried out through extensive biodiversity surveys, participatory community consultation and socio-economic assessments covering 2000 sq km in the Alpine/Trans-Himalaya (2500−6000 m) of Sikkim in the Eastern Himalayas. Rotational pastoralism of nomadic Dokpas, stocking density, and indigenous resources management pattern were assessed. Of the total 85 locations assessed, 80% had high stocking density of domestic yak and sheep resulting into overgrazing competition with wild ungulates. With the impact of globalization, ecological resilience and socio-cultural systems of the region suffer from unbalanced economic exploitation such as hydropower projects, unregulated tourism, and illegal collection/trade of species. Pronounced impact of climate change resulted into species migration, emergence of new diseases in domestic/wild ungulates, resource degradation and reduction of grazing regime due to low productivity. Further, habitat fragmentation, lowering of habitat ranges, population decline and vulnerability were also recorded. Thus, habitats of the last surviving species of the region such as Snow Leopard, Blue Sheep, Himalayan Tahr, Tibetan Argali, Southern Kiang, Tibetan Gazelle, Eurasian Lynx, Red/Tibetan Fox, Tibetan Wolf etc. are rapidly degrading. This globally significant biodiversity hotspot in the Khangchendzonga complex needs sustainable transboundary cooperation and conservation strategies.

***Sharma, Sandeep,*** *Smithsonian Conservation Biology Institute and George Mason University;* ***Trishna Dutta,*** *Smithsonian Conservation Biology Institute;**and George Mason University****; Jesús E. Maldonado,*** *National Museum of Natural History, Smithsonian Institution;* ***Thomas C. Wood****, George Mason University;* ***Hemendra Singh Panwar****, Peace Institute Charitable Trust;* ***John Seidensticker****, Smithsonian Conservation Biology Institute*

**Forest corridors maintain historical gene flow in a tiger meta-population in central India**

We used multiallelic genotypic information from 273 individually identified tigers and used Bayesian and coalescent-based analyses to answer questions about spatial genetic structure and gene flow in the tiger meta-population of the Satpura-Maikal landscape. We found that the tiger meta-population in central India has high rates of historical and contemporary gene flow. Their population sub-division began about 1000 years ago and accelerated about 200 years ago due to habitat fragmentation, leading to four spatially separated populations that have been in immigration-drift equilibrium maintained by high gene flow. We also found the highest rates of contemporary gene flow in populations that are connected by forest corridors.

**Shattuck, Elizabeth,** *Armed Forces DNA Identification Lab;* **David Foran**,

**Determining the Geographic Origin of Illegally Harvested Hawksbill Sea Turtle Products**

**Shaw, Justine,** *Environmental Decision Group,University of Queensland;* **Aleks Terauds**, *Terrestrial Nearshore Ecosystems, Australian Antarctic Division;***Steven Chown,** *School of Biological Sciences, Monash University;* **Hugh Possingham**, *Environmental Decision Group,University of Queensland*

**Antarctic Protected Areas at risk: conservation planning, human activity and non-native species in Antarctica**

Human activities in Antarctica are greater than ever before and are predicted to increase. Here we evaluate the protection of Antarctic biodiversity provided by the Protocol on Environmental Protection to the Antarctic Treaty System. We examined the Antarctic Specially Protected Area (ASPAs) network, identifying that 54 specifically protect Antarctic biodiversity. The spatial aspects of the ASPA network in relation to human activity were examined and, using a recent continent wide risk-assessment, the likelihood of non-native species establishment was quantified. We also looked at protection in a global context by incorporating recent research on the bioregionalisation of terrestrial Antarctica. Spatial analysis highlighted that ASPA were significantly closer to sites of human activity than would be expected by chance. Seven APSAs are at high risk of non-native species establishment and all are located on the Antarctic Peninsula. We show that in a global context the overall level of protection of Antarctic biodiversity is low, with only 1.5% of ice free land protected for biodiversity conservation. Five of the 15 bioregions have no protected areas suggesting that the ASPA network is not representative. Given the increasing levels of human activity and that non-native species establishment is one of the greatest threats to terrestrial biodiversity, the ASPA network requires revision to be more systematic, representative and comprehensive in a changing environment.

**Shen, Xiaoli,** *Smithsonian Conservation Biology Institute;* **Norman Bourg**, *Smithsonian Conservation Biology Institute;***William McShea,** *Smithsonian Conservation Biology Institute;* **Benjamin Turner**, *Smithsonian Tropical Research Institute*

**Effects of white-tailed deer on the invasion of exotic plants in a mid-Atlantic temperate forest**

The forest ecosystem in eastern North America has experienced duel impacts from exotic plant invasion and chronic high herbivore density, yet the interaction between these factors is not well understood. We examined the impact of white-tailed deer (Odocoileus virginianus) on the abundance of four exotic (Rosa multiflora, Berberis thunbergii, Rubus phoenicolasius and Microstegium vimineum) and a native (Cynoglossum virginianum, known to be deer-dispersed) plant species, within a 25.6-ha mature temperate forest plot in Virginia, USA. A 4-ha 30-year-old fenced subplot was paired with a 4-ha control subplot within the plot. In each 400-m2 quadrat, we measured each species' abundance and determined 11 environmental and stand variables. For each species, we constructed a conditional inference tree using the quadrats outside the two subplots to identify significant predictors for their abundance, and then constructed a second tree using the relevant significant variables from the two subplots and presence/absence of deer to examine the role of deer on their abundance. We found lower abundance of C. virginianum, B. thunbergii, R. phoenicolasius and M. vimineum but higher abundance of R. multiflora in the fenced subplot. Our results indicate chronic high densities of deer increased plant abundance for several exotic species with notable exceptions to R. multiflora possibly because lower diversity and abundance of avian community indirectly induced by deer limited its seed dispersal.

**Shepheard-Walwyn, Emma,** *University of Kent*

**Sacred Site Conservation: Changes in Culutre, Changes in Management: Preserving the Mijikenda Kayas of Kenya**

This research focuses on the sacred forests of the Mijikenda in coastal Kenya. It aims to investigate how changes in local cultures, attitudes, values alters the use of sacred natural sites, and how this impacts the management of such sites. Existing management plans are framed around the traditional animistic belief systems of the Mijikenda, and assumes that the majority of local people adhere to these beliefs and associated practices. However, to date continued degradation of these forests have cast doubt over the efficacy of the existing management plans. I used an interdisciplinary approach to investigate the value of the forests to the local biodiversity, the extent of existing sacred forests in the area, as well as how attitudes and values of local people have changed, how these changes affect the use of the forests and what impacts they may have for the management and preservation of these sites. This research has found that the sacred sites are important for biodiversity, culture and ecosystem services. However, the attitude, values and behaviours towards the sacred sites have changed. Many people no longer subscribe to the traditional belief systems, do not take part in traditional practices, and do not use the sites in accordance with traditional laws. The management to date has not adapted to meet the changes in local culture and associated behaviours (including more extractive activities) and therefore is not a practical approach to the conservation of these sites. In order to effectively manage the Mijieknda sacred Kaya forests, for biodiversity and cultural heritage, management must take into account the attitudes and values of the local people as they are today.

**Sheridan, Michael,** *Middlebury College*

**Sacred groves and conservation in African farming societies: A Tanzanian case study**

**Shi, Benkong,** *Grace Gratitude Temple, USA*

**The Chinese Buddhist Practice of Release Life: Past, Present, and Future**

The traditional Chinese Buddhist practice of releasing animals slated for slaughter or suffering is considered an act of kindness through which the individual can gain merit. Originally the animal was locally caught or raised, purchased in a local market, and released with minimal negative impact on the environment. Today Release Life is very popular in China, other Asian countries, and many in South East Asia where the practice has become a “big business.” Millions of animals are released annually into rivers, lakes, farmland, suburbs, cities, and animal reserves. The devastating environmental impact and the cruelty to the animals released have been documented. As more Buddhist learn about the harm that is caused through Release Life practices, members of the Chinese Buddhist communities are endeavoring to educate Buddhist congregations with the help of conservation biologists, environmentalists, rehabbers, and rescue groups.

**Shiffman, David,** *University of Miami*

**Using Twitter as a Tool for Conservation Education and Outreach from Scientific Conferences**

If more conservation-minded citizens were aware of certain environmental threats and how to resolve them, these issues could be resolved more effectively. Scientific conferences focusing on conservation (like the ICCB) bring together countless experts on environmental problems and solutions, but are not an effective means of reaching the interested public on a large scale. If used properly, social media technology such as twitter can be a powerful tool for science and conservation outreach from conferences. This presentation will discuss using twitter to share important information from scientific conferences with the interested public around the world in real time. It will explain general principles of twitter for science and conservation outreach, and will include a case study from the 2011 ICCB in Auckland, New Zealand.

**Shirk, Jennifer,** *Cornell Lab of Ornithology*

**Reimagining research for conservation: PPSR scientists reveal new research strategies and opportunities**

Much has been made of citizen science as a new approach to scientific research, one that can provide scientists and communities access to otherwise unavailable knowledge. By engaging members of the public in the scientific process, citizen science also has the opportunity to bring social considerations into conversation with technical aspects of research, a necessity when approaching problem-focused work in complex social-ecological contexts such as conservation. As scientists are significant partners in research design and project management, their considerations of relevant social and scientific concerns related to conservation problems may influence research questions, protocols, and opportunities afforded to the public in the process of knowledge production and use. Some scientists working with citizen science projects speak of their commitments to conservation purposes, and demonstrate willingness to think creatively about their roles as experts in bringing their knowledge to bear on problems. But not much is known about the choices scientists make towards generating knowledge via citizen science, or about their considerations of the use or usefulness of different knowledges for conservation purposes. Stories of practice, from professional scientists committed to citizen science, reveal ways in which scientists’ work at the intersection of research and the public can offer new ways of understanding and pursuing knowledge for conservation purposes.

**Shoemaker, Kevin,** *Stony Brook University;* **Resit Akcakaya**, *Stony Brook University;***Michelle Verant,** *USGS National Wildlife Health Center;* **Philip Miller**, *IUCN-SSC Conservation Breeding Specialist Group;* **Damien Fordham**, *University of Adelaide;* **Robert Lacy,** *Chicago Zoological Society;***Travis Livieri**, *Prairie Wildlife Research;* **Barry Brook,** *University of Adelaide*

**Modeling the recovery of the endangered black-footed ferret in a linked predator-prey-disease system**

Since the black-footed ferret (Mustela nigripes) was declared extinct in the wild in 1987, several populations have been reestablished from captive stock. In recent decades, outbreaks of sylvatic plague have threatened to undermine ferret recovery efforts by depleting the ferret's obligate prey base (i.e., prairie dogs). In a novel "meta-modeling" approach to population viability analysis, we linked a plague epidemiological model, a prairie dog metapopulation model, and a ferret population model to investigate ferret extinction risk in plague-affected landscapes. Based on results from 500 simulated landscapes with variable metapopulation size, growth rates, and connectivity, we found that ferret populations were most likely to persist within large prairie dog metapopulations (>150 distinct colonies) with low connectivity or permeability to plague. In addition, we detected an emergent cyclic pattern of plague outbreaks that resulted in oscillatory dynamics in prairie dog populations and thereby affected the stability of ferret populations. Using the Conata basin in South Dakota as a real-world case study (the site of a successful and rigorously monitored ferret reintroduction program), we found that black-footed ferrets were unlikely to persist unless either (1) ferrets could access a network of prairie dog colonies beyond the spatial scope of the current population or (2) permeability to plague was reduced via management.

**Shrestha, Samridhi,** *Arizona State University;* **Andrew Smith**, *Arizona State University*

**Environmental education and attitudes toward biodiversity conservation: A case study in protected areas of Nepal.**

Despite a relatively successful conservation program in the protected areas of the Terai region, poaching remains a major threat to biodiversity in Nepal. Conserving biodiversity in developing countries is a challenge because a large proportion of the rural poor are dependent on forest resources for sustenance. Protected areas restrict use of and access to forests in order to protect wildlife.These restrictions may alienate local communities and create conflict between conservation and human development goals.We hypothesized that increased levels of environmental education (EE) will have a positive impact on the attitudes of local people toward biodiversity conservation. We surveyed 600 randomly selected local people in buffer-zone communities surrounding three different neighboring protected areas in southern Nepal using a questionnaire to asses socio-demographic status and attitude of local communities toward biodiversity conservation. We also interviewed personnel in governmental and non-governmental organizations to determine current status of conservation of commonly poached species such as rhinos, tigers and elephants.We found that locals who participated in environmental education programs had a positive attitude compared to the ones who did not. Socio-demographic factors such as age and gender did not show a significant relationship with conservation attitude.Our findings indicate that EE is a valuable investment for protected areas to achieve long-term success.

**Shriver, Greg,** *University of Delaware;* **Chris Elphick**, *University of Connecticut;***Brian Olsen,** *University of Maine;* **Tom Hodgman**, *Maine Department of Inland Fish and Wildlife*

**The Conservation of Tidal Marsh Birds: Guiding action at the intersection of our changing land and seascapes**

The total area of tidal marsh is estimated to be

**Shuster, Gabriela,** *Antioch University New England*

**Levelling The Playing Field: New Strategies For Stakeholder Integration and Reframing Conflict In The Management Of Socio-Ecological Systems**

One of the greatest challenges to the successful implementation of conservation management practice is managing the role of multiple stakeholder groups. This presentation describes new strategies for improving stakeholder relationships and participation in management practice based on an example of intractable conflict in the management of the feral pig (Sus scrofa) in the Wet Tropics of Australia. I used a participatory research design that included group meetings, oral histories, and sociograms to investigate the socio-political relevance of pigs to hunters, growers, managers, and traditional landowners. I found all stakeholders considered pig control to be an acceptable management goal however, multiple barriers impeded successful application of management strategies including poor communication, competing social structures, and conflict between equilibrium and ecological resilience oriented practices. Illusory barriers tied to negative stereotypes compounded the conflict. This presentation describes tools to assist in overcoming such challenges. Frame analysis clarifies the values and positions of stakeholders and suggests strategies for reframing conflict. The evaluation of specific criteria for understanding stakeholder social structures provides information about the social context of management issues. The definition of particular guidelines for participation in adaptive management assists managers in determining the amount of participation desired by stakeholders.

**Shwartz, Assaf,** *Natural History Museum*

**Virtual Garden: a novel tool exploring which elements of biodiversity people want in cities**

Urban ecology is emerging as an integrative science that explores cities, biodiversity and people. Stimulating interdisciplinary research requires the creation of new tools that allows the investigation of people-biodiversity relation. While it has been established that access to green spaces or nature could benefit city-dwellers, the role of species diversity per se remains poorly studied. I developed a user-friendly 3D freeware (Virtual Garden www2.mnhn.fr/cersp/spip.php?rubrique173) that allows people to design their own public/private greenspaces and enables researchers to explore which elements of biodiversity people want, while accounting for other functions that people value in urban greenspaces. In 2011, 732 participants designed their ideal small public garden using Virtual Garden. An average garden contained 5 animals, 8 flowers and 5 woody species. While the distribution of flower and woody species richness appears to be similar to what would be expected by random choice, 30% of people did not place any animal species in their garden and people preferred charismatic animals avoiding non-native species. My result further highlight that the diversity of species placed in the garden was related to the nature people experience in their daily lives. Virtual Garden offers a standardized tool that allows exploring people-biodiversity relation in different environments, cultures and countries, but also an applied tool to consider people's opinions in urban planning.

**SIbanda, Mxolisi,** *Independent Researcher*

**Lessons from the Conservation Sector's response to the crisis in Zimbabwe**

This paper examines the responses of conservation organisations to a crisis environment in Zimbabwe. Since about 2000, Zimbabwe has gone through a political, social and economic crisis that has led to reduced support, and in some cases disengagement, by international and regional conservation organisations. Five response types on a continuum of disengagement, are explored and lessons for wider conservation practice proposed. The lessons include the need to recognise that political discourses often exclude biodiversity conservation and so any conservation decisions based on political expediency runs the risk of shortchanging conservation progress. Further, solid progress in conserving biodiversity requires sustained investment for gains despite changing political circumstances in the biodiversity rich countries. Such investment should include support for institutional development, local engagement and accountability that engenders ownership of local conservation initiatives. The study concludes that conservation organisations must take a long term view of conservation and commitment in order to enhance conservation impact. This kind of engagement must be adaptive in order to generate better results instead of a 'wait and see' attitude or other forms of disengagement as has been seen in Zimbabwe. Conservation organisations have the choice to wait to re-learn this at the risk of continuing biodiversity loss in some of the world's most beautiful but yet unstable spaces.

**Siders, Zachary,** *Grand Manan Whale and Seabird Research Station;* **Heather Koopman**, *University of North Carolina Wilmington;***Andrew Westgate,** *University of North Carolina Wilmington;* **David Johnston**, *Duke University;* **Laurie Murison**, *Grand Manan Whale and Seabird Research Station*

**Seasonal variation in the spatial distribution of basking sharks (Cetorhinus maximus) in the Bay of Fundy, Canada: implications for vessel collisions**

Basking sharks in Atlantic Canada are listed as a species of Special Concern because little is known about their true conservation status. The Bay of Fundy (BOF) attracts basking sharks between May and December due to high densities of diapausing copepod prey, but concurrently exposes sharks to high levels of vessel traffic. We developed a maximum entropy distribution model using 10 years of boat-based basking shark sightings, collected in the BOF to describe seasonal spatial variation in habitat use and habitat-vessel traffic overlap. Distance to the 200 m contour, sea surface temperature, and chlorophyll a concentration were the most determinant variables in our model. From June to September, suitable habitat was confined to waters >100 m and from October to December a shift to waters >200 m occurred. Predicted habitat and the International Maritime Organization BOF vessel traffic pattern overlapped, ranging from 9.93 % in August to 20 % in October-December. With >1000 vessels using these traffic lanes during shark residency, a significant potential for vessel collisions with basking sharks exists. Over 800 hours of time-depth recorder data revealed that basking sharks in the BoF spent on average 24 % of their time between 0-15 m. Given the spatial overlap with ship traffic, diving patterns and low reproductive capacity of the species, collisions likely pose a significant detriment to basking shark recovery.

**Sieges, Mason,** *University of Delaware;* **Jaclyn Smolinsky**, *University of Delaware;***Jeffrey Buler,** *University of Delaware*

**Use of NEXRAD radar to assess bird response to temporary wetland creation after the Deep Water Horizon oil spill along the Gulf of Mexico**

The Natural Resources Conservation Service implemented the Migratory Bird Habitat Initiative (MBHI) in 2010 after the Deep Water Horizon oil spill to provide temporary wetland habitat for migrating and wintering waterfowl and other waterbirds along the Gulf of Mexico. MBHI activities included flooding existing farmed wetlands and prior converted croplands. We used weather surveillance radar (NEXRAD) to conduct a region-wide assessment of bird response to MBHI activities. We mapped the spatial and temporal patterns of bird densities with NEXRAD measures taken at the onset of nocturnal flights of wintering waterfowl and migrating shorebirds. In general, birds responded positively to MBHI management; exhibiting greater bird density at sites relative to the previous two years before management was implemented and in comparison to concurrent bird densities at unmanaged agricultural lands during 2010. Temporal fluctuations in radar-based bird densities corresponded with the passage of shorebird migrants and presence of wintering waterfowl. The magnitude of bird density among sites varied according to landscape placement such as amount of flooded hardwood in the vicinity, landscape context such as distance to refuge, and the type and intensity of management (i.e. flooding). Our results provide evidence that MBHI lands provided wetland habitat used by birds along the Gulf of Mexico immediately after the Deep Water Horizon oil spill.

**Sifleet, Samantha,** *Environmental Consultant and Contractor to the US EPA;* **Anne Neale**, *US EPA;***Lisa Wainger,** *University of Maryland Center for Environmental Science;* **Megan Mehaffey**, *US EPA*

**Measuring ecosystem rarity to target conservation efforts**

Conservation of biodiversity remains a high priority for maintaining many ecosystem functions, and conservation efforts often focus on protecting vulnerable species. Species population measurements may not be suitable for evaluating the collective benefits and services that emerge from entire ecosystems, particularly those that do not contain rare or charismatic species. Here we combine currently available land cover data with ecosystem taxonomy and landscape ecology principles to evaluate the relative rarity of natural ecosystems in the continental US. Our goal was to develop a measure of ecosystem rarity that can distinguish ecosystems with intrinsically limited extents consistent with historic conditions (i.e. riparian or bog systems) from those that have limited area due to land conversion. We present a relative rarity metric that ranks ecosystems based on current extent, spatial pattern type, and relative uniqueness. This metric shows promise when compared to more complex and expensive methods. The majority (57%) of the area covered by 'rare' ecosystems we identify in the continental US fall within the boundaries of the Nature Conservancy's Conservation Priority Areas, whereas only 28% of our 'rare' ecosystems are currently held in protected status. The ecosystem rarity index we developed captures both fine scale species diversity as well as regional ecosystem services. This type of metric can support efforts such as creating an ecosystem Red List.

**Silva, Catarina,** *Victoria University of Wellington;* **Jonathan Gardner**, *Victoria University of Wellington*

**Developing microsatellite markers for management and conservation of the New Zealand scallop Pecten novaezelandiae**

The New Zealand scallop (Pecten novaezelandiae Reeve, 1852) is a highly valued endemic species that has been exploited for over 40 years, supporting important commercial, recreational and customary fisheries. Sustainable scallop exploitation faces several problems mainly because recruitment is highly variable and the processes that result in large periodic population fluctuations are not understood. Thus, knowledge of population genetic structure and connectivity is needed to achieve suitable management and conservation plans. As a result of being informative (highly polymorphic) and easy and cheap to develop, microsatellites are currently the most popular and versatile DNA markers for stock assessment and connectivity applications. To better understand the population genetics of P. novaezelandiae, 14 polymorphic microsatellite markers were developed de novo using next-generation sequencing techniques and tested on tissue samples. A total of 315,404 reads were obtained from an eighth-plate run on a 454 GS-FLX instrument and from these reads 448 di-, tri-, tetra- and pentanucleotide short tandem repeats (STRs) with primers were identified. Of the 49 loci screened, 32 (65%) STRs were successfully amplified. The success of management and conservation of marine resources relies on accurate stock identification. These 14 microsatellite markers are currently being used to study genetic connectivity among P. novaezelandiae populations around New Zealand.

**Silver, Sue,** *Frontiers in Ecology and the Enviro*

**Journal expectations and peer review: an editor's perspective**

Citizen science (CS) has been around for a long time, but the validity and reliability of CS data has been questioned by some scientists. To be fully accepted as a valid method for the collection of large-scale datasets, research papers based on CS projects need to appear regularly in mainstream scientific journals. This means finding suitable journals to publish CS-based work and then running the gauntlet of Editors and peer reviewers, some of whom may still cling to outdated visions of questionable data, collected by enthusiastic amateurs with no understanding of scientific processes. New techniques and technologies have long since taken CS out of that realm, but the question remains: where to publish CS papers and what extra challenges might they face?

**Singh, Gerald,** *University of British Columbia****;* Kai Chan,** *University of British Columbia****;* Ian Eddy,** *University of British Columbia*

**Mapping Human Impacts to Ecosystem Services in British Columbia**

A key challenge for the science of ecosystem-based management is to account for the myriad ways that humans impact their environment with repercussions for the provision of ecosystem services (ES). In this project we investigated what ES are at greatest risk from which human activities. To do so we combined i), modeled output of ecosystem service extent and provision using Marine InVEST (Integrated Valuation of ES and Trade-offs), and ii), spatial data of human activities. Using these data we generated hotspot maps of the overlap of ES and human activities on the BC coast. Using InVEST, we have mapped the spatial extent of the following ES in British Columbia: fisheries, aquaculture, water quality, landscape aesthetics, coastal protection, habitat quality, marine recreation and renewable energy potential. We also acquired spatial data on over 30 human activities that occur on the BC coast. Using these two data sources, we overlayed human impact maps over ES maps to generate hotspot maps of human impacts to ES. Global stressors affect greater areas of ES than regional stressors, and regional stressors often overlap with areas where ES provision is high. Mapping human activities and modeled ES can provide a way to assess key places and stressor-ES combinations for ecosystem-based managers to target and provides a repeatable method for adaptive decision-making.

**Sitters, Holly,** *University of Melbourne;* **Fiona Christie**, *University of Melbourne;***Julian Di Stefano,** *University of Melbourne;* **Paul Sunnucks**, *Monash University;* **Alan York**, *University of Melbourne*

**The influence of topography on responses of understory birds to planned fire in south-east Australia**

Planned fire is used extensively in south-east Australia to mitigate wildfire risk. Recently it has also been applied to achieve ecological outcomes, and it is widely agreed that patchy fires of low severity are more conducive to biodiversity conservation. Low severity fire is associated with the presence of faunal refugia, the spatial arrangement of which is often a function of topographic complexity. For example, wet gullies are unlikely to be affected by low severity fire, and it is plausible that they provide refugia for birds. We tested this prediction using a before-after control-impact experiment in a topographically variable area. Generalized linear mixed models were used to examine the influences of fire and topography on two understory insectivorous birds (Superb Fairy-wren (Malurus cyaneus) and White-browed Scrubwren (Sericornis frontalis)). Both species were present in gullies at the impact area after fire. S. frontalis avoided burnt ridges and became largely confined to gully refugia, reflecting its preference for dense habitat. In contrast, M. cyaneus remained on ridges, but expanded its distribution to gullies. Our data suggest that spatial variation in fire severity associated with topographic complexity enabled both species to persist after planned fire, and demonstrate contrasting responses to disturbance by similar species. Strategic use of topographic features in planned burning operations might help to facilitate ecologically sensitive fire management.

**Skandrani, Zina,** *Museum National d'Histoire Naturelle;* **Anne-Caroline Prévot-Julliard**, *Museum National d'Histoire Naturelle*

**Insights on Human-animal Relationships Through the Lens of Problem Animals: The Pigeon Case**

In this paper we consider rethinking human-animal relationships essential for conservation issues. We penetrated these relationships through an analysis and deconstruction of animal social representations and categorizations/statute attribution. We relied for this on the cultural history of cohabitation between humans and pigeons, from domestic to feral forms, tracing and contextualizing the evolution of values attributed to the birds. As a result of our procedure and leaning on social representations theory, which conceptualizes identity as a location within representations, we highlight issues of human identity construction at stake in human-animal relations. We invite to rethink the impact of such human self-definition on environmental stances, as it could constrain further developments or improvements of conservation perspectives.

**Skorka, Piotr,** *Poznan University of Life Sciences;* **Magdalena Lenda**, *Institute of Nature Conservation, Polish Academy of Sciences*

**Road mortality hot-spots: what do they tell us?**

Collisions with cars are important mortality factor in many species. There are several measures to mitigate road mortality, however they are costly and can not be implemented for the entire road network in a target area. Thus, the knowledge on the sites where road mortality is the highest is required. We used data on butterfly roadkills in three large landscape plots in Poland to identify the road mortality hot spots. Identification of the hot spots was based on spatial proximity of road mortality incident data. The nearest neighbor hierarchical spatial clustering was performed for data from each landscape plot. We mapped habitats within a 500-radius from the centre of each hot spot and in the equal number of random points located in the areas that were not identified as the mortality hot spots. Butterflies at road verges and in surrounding landscape in the hot spots and control areas were counted. We found that road mortality hot spots had higher species richness and abundance of butterflies at road verges and in the surrounding landscape than in control areas. This can be explained by the higher cover of grasslands around the hot spots than in the control areas. Therefore, the hot spot analysis identified not only areas with the largest number of roadkills but also species rich areas of conservation concern that were intersected by roads. Thus, conservation practitioners maythese enable to direct the mitigation measures in a cost-efficient way in these sites.

**Smith, Jordan,** *NC State University*

**The Effects of Affiliation-Based Influence and Shared Information Sources on Rare and Little Known Species Conservation Behaviors**

Little is known about how social network structure influences individual-level outcomes such as attitudes and behaviors; even less is known about the functions of network ties across scales of social organization. This research addresses the question of how cross-scale interactions within social systems lead to human behaviors that have direct ramifications for natural systems. Specifically, we examine the effects of affiliation-based influence and shared information sources (cross-scale ties), as well as species-specific attitudes, on individuals' behavioral intentions toward a threatened salamander located in the Midwestern United States. The analysis suggests the influence of species-specific attitudes on behavioral intentions is not dependent upon information and ideas that are exchanged in formalized membership organizations. However, the analysis also reveals that for some behaviors the influence of species-specific attitudes is dependent upon the types of information sources that individuals utilize. The presence of multiple cross-scale information source linkages appears to be related to more 'socially-acceptable' behaviors such as putting the animal back in the river if it were encountered. The investigation illustrates that social and information networks function and interact at multiple scales; it also highlights how the structural characteristics of social and information networks affect human behavior and conservation outcomes.

**Smith, Justine,** *University of California, Santa Cruz;* **Chris Wilmers**, *University of California, Santa Cruz*

**A Hierarchical Approach Investigating Puma Kill Behavior Along an Urban-Rural Gradient**

Biotic communities are increasingly exposed to habitat modification due to exurban development, yet our understanding of behavioral ramifications within animal populations is fragmented. We explored patterns of puma (Puma concolor) kill behavior along an urban-rural gradient in the Santa Cruz Mountains of California regarding prey size and time allocation at kills. We investigated 579 GPS clusters from 26 pumas. Using GPS cluster characteristics, we used individual lions as a random variable in a hierarchical logistic binomial model to predict prey size with respect to housing density. We found that individual variation and housing density improved model fit to differentiate prey size class. Small kills (e.g. raccoons and house cats) were found in locations with higher housing density than large kills (e.g. deer and wild pigs). Pumas had a higher fidelity at kills in areas of high housing density, indicating that they may avoid spending extended periods of time in disturbed areas. Our results support that pumas respond differentially to development, but are more likely to consume small prey in modified habitats and may temporally avoid human activity when feeding. This study provides insight on impacts of exurban development on puma feeding behavior and suggests potential ramifications on puma energetics in a modified landscape.

**Smith, Sarah,** *Environmental Defense Fund;* **Jake Kritzer**, *Environmental Defense Fund*

**Integrating ecological and social objectives in fisheries management: Fishermen's perceptions of closed area costs and benefits in New England**

Closed areas are a spatial management tool used to accomplish a variety of biological and ecological objectives for fisheries, including protecting benthic habitat, reducing fishing mortality, protecting spawning activity, and rebuilding fish stocks. The use of closed areas as a fisheries management tool can have a number of intended or unintended social outcomes as well, including either creating or mitigating gear conflicts and changing where and how fishermen fish. The New England Fishery Management Council is evaluating the region's existing closed areas and designating new closures. We use interviews with industry members along with press coverage and public testimony to analyze fishermen's perceptions of the costs and benefits of groundfish closed areas in New England, including both ecological and socio-economic outcomes. Results highlight a diversity of perspectives within the industry on the objectives and outcomes of closed areas, and we examine how these perceptions differ among different fishing ports, gear types, and vessel sizes. We also describe area-specific proposals originated by the fishing industry, and how these have been included in the process of redesigning the closed area network. We argue that developing an understanding of these costs and benefits and how they are differentially experienced by fishermen is essential for integrating social and ecological objectives of closed areas and for optimizing management outcomes.

**Smith, Gordon,** *Wildlife Works*

**Carbon trading: Land-based credits and future market trends**

The presentation will give an overview of carbon markets, contrasting compliance versus voluntary markets, and offsets versus allowances. Terrestrial carbon sequestration can be reversed, thus requires ongoing monitoring. Reducing emissions from deforestation and forest degradation (REDD) has been touted as a potential major global source of emission reductions. "Jurisdictional" REDD, where national or provincial governments do relatively comprehensive monitoring within their boundaries, offer the possibility of reducing problems of "additionality" (emission reductions are "additional" if they would not have occurred in the absence of the project) and "leakage" ("leakage" is displacement of emissions from within a project boundary to outside of the project boundary, to a location where the displaced emissions are not counted). Determination of baseline, or "reference level" emissions remains uncertain, even when scaling up from projects to jurisdictions. Examination of trends in supply and demand for REDD credits suggest that, unless governments create large new demand, the market will soon be oversupplied and collapse.

**Soanes, Kylie,** *University of Melbourne;* **Melissa Carmody Lobo**, *University of Melbourne;***Peter Vesk,** *University of Melbourne;* **Michael McCarthy**, *University of Melbourne;* **Rodney van der Ree**, *Australian Reserach Centre for Urban Ecology*

**From use to effectiveness: how well do crossing structures mitigate the impacts of roads on wildlife?**

Millions of dollars are spent on wildlife crossing structures to mitigate the negative impacts of roads on animal populations. However their success is largely unknown due to a lack of research on population impacts. We use before-after-control-impact (BACI) population monitoring to evaluate the effectiveness of crossing structures for the squirrel glider (Petaurus norfolcensis), a threatened arboreal mammal, along a highway in south-east Australia. Remote-sensing cameras, personal integrated transponder (PIT) scanners and BACI radio-tracking were used to determine the impacts of mitigation on squirrel glider movement. Mark-recapture surveys were conducted BACI to determine how survival rates changed as a result of mitigation. Crossing structures re-established squirrel glider movement across the freeway. Multiple individuals crossed regularly, suggesting resident animals use the structures for home range access. However, movement was only partially mitigated relative to control (non-freeway) sites. Previous research found the survival rate of squirrel glider populations at freeway sites was 60% lower than at control sites. Analysis of post-mitigation data is currently underway, and will reveal if survival rates have improved as a result of mitigation. This research will be used to determine if these structures are successful, or if additional management actions are required to preserve squirrel glider populations.

**Solomon, Jennifer,** *Colorado State University*

**Crimes Against Conservation: Methods and Trends for the Future**

This talk establishes the context for the symposium, Detecting, Understanding and Deterring Conservation Crime. Conservation criminology is an emerging field that cuts across multiple disciplines and has wide-ranging conservation implications. Conservation criminology is "the study of environmental risks at the nexus between humans and natural resources that involve issues of crime, compliance and/or social control" (Gibbs et al. 2010). Illicit or non-compliant human behaviors may occur in all ecosystems and range from subsistence illegal resource collection to poaching by organized criminal syndicates. Such acts have an enormous impact on ecosystems and yet monitoring them is challenging, primarily because the topic is extremely sensitive and the victims are voiceless. The future of many of the world’s conservation areas depends upon compliance with conservation regulations. However, the demand, be it local or international, fuels the crises we find ourselves in today. With a growing human population, consumptive societies, and rapid expansion of business opportunities fueled by new technology, there is little doubt that demand will remain steady or increase for many of our natural resources. I outline major conservation crimes, review models and methods used to monitor and respond to the problem for both subsistence and commercial trade and finally pose the question: where should we focus our limited efforts?

**Soltanoff, Carrie,** *NOAA, NMFS Office of International Affairs, former WWF;* **Helen Fox**, *WWF*

**Global marine conservation priorities: Patterns in marine protected area development across nations**

Similar to terrestrial protected areas, marine protected area (MPA) number and spatial extent varies among countries, habitats, and over time. Despite the Convention on Biological Diversity’s commitment to the target of ‘‘at least 10% of each of the world’s marine and coastal ecological regions effectively conserved by 2020,” MPA coverage lags behind that of terrestrial areas. The relative paucity and heterogeneous distribution of MPAs indicates the need for better understanding of factors that foster MPA establishment at local, sub-national, and national levels. Assessment of the relationship between national-level MPA establishment and geographic, ecological, social, and political factors revealed that a country’s coastline length, the Human Development Index (HDI), and spatial overlap with designated conservation priority areas are positively correlated with MPA establishment. These national dynamics explain a relatively small proportion of variation, however, indicating that other biological or social factors, as well as sub-national processes, also influence MPA establishment. One local-level social factor may be the existence of shifting environmental baselines among populations of fishermen. Understanding the particulars that catalyzed MPA establishment for ‘‘leaders’’ can highlight policies and practices that may merit replication elsewhere. Ensuring a supportive enabling environment at the national or even multi-national level can enhance success at the local level.

**Songer, Melissa,** *Smithsonian Conservation Biology Institute;* **Myint Aung**, *Friends of Wildlife, Myanmar;***Peter Leimgruber,** *Smithsonian Conservation Biology Institute*

**Drivers of change in Myanmar's wild elephant distribution**

Myanmar is considered a stronghold for wild elephants, though estimates vary widely, from 3,000-10,000. Lack of infrastructure and technical capacity make extensive ground surveys challenging. In partnership with Myanmar's Nature and Wildlife Conservation Division we brought together elephant experts from around the country to delineate an updated range map and produce the best available wild population estimates. The resulting estimate was between 1,430-2,065 individuals- about half of the lower estimates reported in the literature. We followed up with expert interviews in townships throughout the known 1990s range with questions on numbers of elephants living in townships and threats to and from elephants. We used general linear models to analyze characteristics of townships with and without elephants to understand possible drivers of change in distribution. Our results show a major decrease in the geographic distribution of elephants in Myanmar between 1992 and 2006. Increases in forest cover resulted in higher probabilities for elephant presence, while increases in edge area and human population density reduced probabilities of elephant presence. Understanding the current status and drivers of change are critical for planning to conserve Myanmar's wild elephants, particularly as more than 50 years of political isolation are rapidly ending and giving way to exponential increases not only in research and conservation but also in exploitation of their vast natural resources.

**Souto, Tamia,** *Smithsonian Conservation Biology Institute;* **Cecilia Núñez**, *Smithsonian Conservation Biology Institute;***Jessica Deichmann,** *Smithsonian Conservation Biology Institute;* **Alfonso Alonso**, *Smithsonian Conservation Biology Institute*

**Indigenous territories, industry, and science: finding common grounds to establish conservation projects**

There is high overlap of oil and gas concessions with indigenous territories of great biodiversity in the Peruvian rainforest. It is therefore a goal to find common interests among indigenous peoples, biologists and corporations to develop sound conservation projects that improve peoples' livelihoods. We attest that conservation projects will have a higher chance of success if communities are empowered through active participation and are involved in the decision making process from the start. Equally important is that projects have a solid design, where assumptions can be systematically tested to achieve the desired goals. We present our work with two indigenous communities in the Lower Urubamba River, Peru where we applied a series of steps that embraced different types of knowledge to select and develop conservation projects that answered people's needs and considered all stakeholders accordingly. We conducted participatory workshops and surveys, and used the results to develop seven project ideas that incorporated local solutions to environmental problems. These were then prioritized by all stakeholders using a viability ranking system based on 11 criteria. Two projects were selected for full development in an Adaptive Management workshop where indigenous peoples, corporate partners and local scientists participated to develop the full proposals. This process demonstrates that even in highly contested situations, common ground can be achieved under the right conditions.

**Sowards, Stacey,** *University of Texas El Paso*

**The role of communication and social marketing in community-based conservation campaigns**

This presentation focuses on how environmental advocacy campaigns in Indonesia employ techniques to measure the effectiveness of campaigns through development of theory of change, barrier removal operation plan, and social marketing strategies in local contexts. This presentation also addresses how social change and activism function in the context of environmental advocacy campaigns in Indonesia. Specifically, case studies were examined, from forest conservation campaigns that were implemented from 2008 – 2010 in villages near Ujung Kulon National Park (Banten), Gunung Halimun-Salak National Park (Banten-West Java), Sungai Putri Peat Swamp Forest Complex (West Kalimantan), Sungai Lamandau Wildlife Reserve (Central Kalimantan), Ulu Masen Forest Complex (Aceh), Gunung Leuser National Park (North Sumatra), and Dolok Surungan Wildlife Reserve (North Sumatra). Marine ecosystem campaigns that were implemented from 2010 – 2012 in Kepulauan Seribu National Park (near Jakarta), Bunaken National Park (North Sulawesi), and Karimunjawa National Park (Java) were also included in this study. These campaigns were studied over a two year period as they were being implemented, in collaboration with the a special master’s program offered through the University of Texas at El Paso in collaboration with Rare. This program focuses on building campaign managers’ leadership capacity, research (both quantitative and qualitative) and community organizing skills, campaign development through social marketing techniques, and conservation biology knowledge for effective barrier removal.

**Spear, Stephen,** *Project Orianne*

**Using environmental DNA methods to improve detectability and assess reproduction in Eastern hellbender (Cryptobranchus alleganiensis alleganiensis) monitoring programs**

Eastern hellbenders (Cryptobranchus alleganiensis alleganiensis) are among the most threatened of North American salamanders, and thus monitoring populations is a priority for managers. Hellbenders are completely aquatic, and surveys require both intensive effort and can disturb important microhabitats. Many populations do not appear to be reproducing successfully despite continued presence of long-lived older adults. We developed a quantitative PCR protocol to amplify hellbender environmental DNA (eDNA) from river samples to 1) test for presence of hellbenders, 2) evaluate if eDNA quantification can test relative abundance, and 3) determine if eDNA amounts increase during the breeding season. We filtered water samples at over 100 sites across Tennessee and North Carolina from May to October 2011-12. We successfully detected hellbender eDNA at all sites with current survey observations and also identified hellbenders at sites where survey efforts were not successful. Total estimates of eDNA in a 1L sample ranged from 0.012 ng to 8.19 ng, with an average of 0.5 ng. Estimates were not uniform across season, as we saw a consistent increase in the amount of eDNA in the fall breeding season relative to spring and summer samples, with increases as great as a hundredfold. This suggests that not only is the fall an optimal time for hellbender eDNA monitoring, but also highlights the promise of this tool to identify reproductive populations.

**Sponarski, Carly,** *Memorial University of Newfoundland*

**Mapping human-wildlife conflict using the potential for conflict index: A case study of coyotes in Nova Scotia, Canada.**

Attitudes toward human-wildlife interaction are important for wildlife managers. Different interest groups often differ in their perceived fear, control, and likelihood of encounters with wildlife. Using the Potential for Conflict Index (PCI2), we explored differences and similarities among local residents, park staff, and visitors in their (a) attitudes toward, (b) fear of, (c) control over, and (d) likelihood of coming into contact with coyotes. The research was conducted near Cape Breton Highlands National Park (CBHNP), where a coyote caused a human fatality in 2008. Local residents were mailed a questionnaire (n=578; 72% return rate) in 2011. Park staff were given the questionnaire (n=124; 85% return rate) in 2011 and visitors were interviewed on trails and given a mail-back questionnaire in 2011 and 2012 (n=375; 51% return rate). The Potential Conflict Index (PCI2) was used to examine differences among the three groups. Residents held more negative attitudes, reported more fear, felt less control in coming into contact with coyotes, and reported a higher likelihood of seeing a coyote while in CBHNP than park staff and visitors. Understanding different interest group attitudes toward coyotes facilitates the design of specialized messages for different populations to ensure each is receiving the appropriate information.

**Springer, Jenny,** *World Wildlife Fund*

**Scaling Up Community Conservation and Natural Resource Management**

Globally, significant areas for conservation are the traditional lands of indigenous peoples and local communities who depend upon forests, fisheries, wildlife and farming for their livelihoods and cultures. These local women and men are key actors in conservation and natural resource management, for the stewardship roles they have often played historically, and as the people on whom future sustainability depends. Community-based conservation and resource management have been part of conservation strategies for many years but are gaining increased attention. Reasons include increasing formal recognition by governments of community rights to significant lands and resources, a growing body of scientific research documenting the efficacy of community-based management of natural resources, and growing awareness of significant threats to the environment of indigenous and community lands. While experience from some countries demonstrates that community-based management can contribute significantly to large-scale conservation and rural development goals, too often the geographical scale of community conservation and natural resource management remain limited. This paper will present results from recent field experience and analysis on integrated approaches to scaling up community conservation and natural resource management, including key elements of effective CBC/NRM, strategies for scaling up and holistic approaches to community conservation across mosaics of land uses.

**Sritongchuay, Tuanjit,** *Prince of Songkla University;* **Jane Memmott**, *School of Biological Science,;***Sara Bumrungsri,** *Prince of Songkla University*

**The pollination network structure and reproductive success in mixed fruit orchards near and far from forest edge in Thailand**

This study was conducted to determine whether pollination network structure and reproductive success in mixed fruit orchards depend on distance from the forest edge. Mixed fruit orchards are common in southern Thailand. The reproductive success of some plant species is dependent on distance to the forest edge, because forest remnants can be important sources of pollinators. The reproductive biology and pollination ecology of single plants have been studied, however, we need to understand pollination interactions at the community level. We observed plant and animal interactions at three pairs of study sites. Network structures, including interaction density, nestedness, number of compartments, and evenness were calculated. Fruit and seed set were observed two weeks after pollination, and compared within pairs. We found more animal species at orchards near forests than at orchards far from forests. The connectance, nestedness, and evenness of pollination networks from study sites near to the forest tend to be higher than study sites far from the forest. In addition, the number of Rambutan fruit set declines with the distance from the forest (Nested T-test: p < 0.001). This study shows that pollinators are critical for the reproduction of many economically-important crops. Distance from the forest edge is an important influence on plant reproductive success, particularly for plant species that are serviced by forest-dependent pollinators.

**St. John, Freya,** *University of Kent*

**Public motivations for compliance with wildlife legislation: carnivore killing in rural Taiwan**

Many approaches to managing and conserving natural resources depend upon rules that restrict human use. Activities aimed at encouraging compliance with wildlife legislation frequently adopt conventional enforcement tactics aimed at generating deterrence. Economic theories of compliance hold that rule breaking occurs when anticipated benefits outweigh the costs. Knowledge of rules, personal values, and social motivations are also thought to play a role in fostering this compliance. However, there has been little attempt to test the relative importance of these factors in shaping compliance with environmental legislation. We use the randomised response technique, designed specifically for investigating sensitive behaviours, to investigate the relative contributions of knowledge of rules, personal values, economic, and social factors in stimulating compliance with wildlife regulations. We estimate the proportion of the rural population of north-western Taiwan killing four mammal species, and explore motivations for compliance using a modified logistic regression model. Nearly 10% of respondents admitted to requesting a hunter to kill leopard cats, protected in Taiwan, in the three years preceding the study. Preliminary analysis reveals the importance of exploring the role of personal values, economic, and social motivations in fostering compliance with rules. This study contributes to the understanding of factors shaping compliance with wildlife legislation.

**Sterling, Eleanor**, *Center for Biodiversity and Conservation, American Museum of Natural History;* **Ana Porzecanski**, *Center for Biodiversity and Conservation, American Museum of Natural History;* **Adriana Bravo**, *Center for Biodiversity and Conservation, American Museum of Natural History;* **Nora Bynum**, *Duke University*

**Assessing and Developing Key Skills in Conservation Students through Classroom Exercises**

Understanding and conserving the biosphere requires professionals and academics proficient in process and professional skills such as critical thinking, data analysis, information synthesis, oral and written communication, and ability to work with diverse teams of people. There is evidence that undergraduate science students in the United States are not sufficiently developing these important skills. How do we teach and evaluate these skills in our students? The Network for Conservation Educators and Practitioners is leading a study to create and validate instructional materials that develop critical thinking, data analysis, and oral communication skills for conservation biology topics. We pilot materials at 17 institutions under two different instruction modalities: individual reflection on the skill, and intensive classroom discussion. Results to date show that students improve in skill performance for all three skills. However, the degree of improvement varied among skills and skill dimensions, suggesting that some dimensions may require interventions of different durations or intensities. In addition, there are changes in students' confidence in their skills, but these do not consistently mirror skill changes: students may over- or underestimate their confidence depending on the skill. Finally, students gained content knowledge while using the materials designed to develop skills, suggesting that investment in skill development in a class does not affect content learning.

**Stewart, Alyssa,** *University of Maryland;* **Michele Dudash**, *University of Maryland*

**Foraging habitats and diets of pollinating bat species in southern Thailand**

We examined the foraging habitat preferences and diets of Old World nectarivorous bat species to assess how these important pollinators are responding to southern Thailand's changing landscape. From mist net captures at bat-pollinated plants, we compared nectar bat foraging activity in natural versus agricultural habitats. Additionally, pollen samples were collected from the fur of each netted individual to compare the diets of different species. Overall, nectar bat foraging activity in natural and agricultural habitats was not significantly different (P > 0.05, permutation t-test). However, analysis at a finer scale revealed that some bat species do exhibit significant preferences for certain habitats (P < 0.05, permutation ANOVA). Furthermore, bat species differed significantly in the amounts of each pollen species that they carried (P < 0.05, permutation ANOVA). Our results reveal that nectar bats are foraging in both natural and agricultural habitats, and are pollinating both native and cultivated plants. However, nectarivorous bat species exhibit distinct preferences for both habitat type and flower species, indicating that these pollinators have complementary roles in ecosystem functioning. The mixed agricultural farms used in southern Thailand appear to be suitable foraging habitat for nectar bats, and may serve as corridors connecting separate forest fragments and promoting the genetic diversity of bat-pollinated plants.

**Stiles, Margot,** *Oceana;* **Michael F. Hirshfield**, *Oceana*

**Country-level comparisons using conservation, livelihoods, governance and market indicators to estimate fisheries recovery potential**

If we can recover marine fisheries and prevent future declines, we estimate wild fish can contribute at least 20% more to the global food supply. Much of this goal can be accomplished by focusing conservation efforts on the 30 countries with the largest marine fish catches, as a proxy for potential marine food production. These top 30 countries are divided nearly equally among emerging and developed nations. In this study we compared the potential to recover fisheries to feed people in 16 emerging economies, using 22 indicators of conservation, livelihoods, governance and markets. Our goal was to identify easily measurable indicators of the necessary pre-conditions to advance policy change which ensures the long-term sustainability of marine ecosystems and food fish production.

**Stock, Charles,** *NOAA GFDL*

**On the use of IPCC class climate models to assess the impact of climate on Living Marine Resources**

Understanding of the climate system and its representation within climate models has progressed such that many climate model outputs can now be used effectively to project the impact of climate on Living Marine Resources (LMRs). Limitations of present physical climate projections include coarse resolution, model biases, and inter-model spread. Manifestations of these issues can be particularly significant at regional scales and in coastal areas. Bias-corrections, ensemble approaches, and downscaling techniques provide ways forward, but the assumptions underlying these approaches must be carefully assessed for each application. Priority climate model developments include improved model resolution and accuracy, inter-annual to decadal scale predictions, and continued development of Earth System Models capable of simulating both the physical climate system and the biosphere. For LMRs, improved understanding of the multi-scale mechanisms that link LMRs and climate is needed to develop holistic models grounded in robust physiological and ecological principles that will hold in a changing climate. Achieving these objectives requires an extensive observational baseline with both detailed process studies to elucidate climate-LMR links, and long time series for detecting climate impacts and validating models. Efforts toward priority developments should occur in parallel and be informed by the continued application of existing tools and knowledge.

**Stortz, Sasha,** *Northern Arizona University;* **Thomas Sisk**, *Northern Arizona University;***Erik Nielsen,** *Northern Arizona University;* **Jill Rundall**, *Northern Arizona University;* **Todd Chaudhry**, *Grand Canyon National Park*

**Prioritizing areas for conservation and management across the greater Grand Canyon region using a participatory spatial analytical framework**

The challenge of integrating ecological information and stakeholder interests into large scale planning is increasingly addressed through collaborative efforts complemented by use of decision support tools and geographic information systems. Here, we demonstrate a novel approach to addressing stakeholder values, scientific data and cultural resource information in a trans-boundary conservation effort at the landscape scale. The Greater Grand Canyon Landscape Assessment is a Grand Canyon National Park-led effort to assess the condition of select natural and cultural resources and prioritize areas for management across 2 million hectares spanning beyond the park's borders to adjacent lands. Our work involves a) developing spatial data layers, models and tools for decision support, b) convening a series of workshops with diverse stakeholders to explore options and scenarios for prioritization and c) developing an evaluative process to test hypotheses about the qualities necessary for stakeholders to effectively participate in deliberation and spatial analysis. This study illustrates the opportunity to move beyond general metrics of collaborative process evaluation to assess the quality of stakeholder interaction with the data that is often at the core of science-based planning processes. Greater understanding of the influences of science on the deliberative process will help to empower stakeholders and improve outcomes of collaborative planning and conservation.

**Strickler, Katherine,** *University of Idaho*

**Quantifying effects of UV, temperature, and pH on degradation rates of eDNA in a microcosm**

A crucial consideration for detecting aquatic species using eDNA is the potential for degradation of DNA caused by environmental factors. DNA breaks down in water due to hydrolysis and is also affected by environmental conditions such as water temperature, UV light, and pH. Factors influencing eDNA degradation have obvious implications for species detection, but the degree to which environmental factors influence degradation rates is unknown. To address uncertainty about the effects of these factors on the persistence of eDNA in aquatic systems, we conducted an experiment to quantify degradation rates of DNA in water through time. We held bullfrog (Lithobates catesbeianus) tadpoles in 3 L aquaria for 10 days at a density of 2 tadpoles per aquarium. Following removal of the tadpoles, we placed the aquaria in plant growth chambers with controlled temperature and UVB light conditions, manipulated pH, and inoculated each aquarium with representative freshwater bacteria. We used a full factorial experimental design with 3 levels each of UVB, pH, and temperature, and collected 250 mL water samples at 4 time steps. Levels of each environmental factor were selected to represent conditions at our concurrent eDNA sampling sites in Washington, Arizona, and Florida. The microcosm experiment allows us to quantify eDNA degradation rates in controlled conditions and use those rates to make generalized conclusions about the expected effects of temperature, UV, and pH in different systems.

**Strombom, Evelyn,** *Smithsonian Conservation Biology Institute;* **Jonathan Thompson**, *Smithsonian Conservation Biology Institute*

**Modern conservation: private vs public efforts in Northeastern, US**

Federal efforts no longer represent a significant source of new land set aside for conservation. Today, private conservation easements and small, state-level acquisitions are the only new lands added to the conservation land base. Using state conservation databases from MA, we compared rates of modern private and public conservation since the 1960s. We used Classification and Regression Trees (CARTs) to examine the spatial relationship between forest conservation; development, US census derived measures of population density and wealth; and biophysical factors such as proximity to water and topography. Public efforts continue to conserve larger total and average areas of land, even though private interests began to outpace the government in total number of conserved parcels in the 1980s. CARTs (p$32879/yr), but "low" house value (

**Stropp, Juliana,** *Joint Research Centre of the European Commission;* **Julien Gaffuri**, *Joint Research Centre of the European Commission;***Richard Ladle,** *Federal University of Alagoas;* **Ana Malhado**, *Federal University of Alagoas;* **William Temperley**, *Joint Research Centre of the European Commission;* **Philippe Mayaux,** *Joint Research Centre of the European Commission*

**Mapping ignorance: a method for assessing the completeness of datasets on flowering plants in Africa**

Recent initiatives, such as, the Digital Observatory of Protected Areas and the Map of Life are joining datasets on biodiversity, land cover and land use to deliver targeted information for the conservation community. By joining rich datasets, these initiates are creating sophisticated information systems (IS) to guide decision making. Biodiversity datasets (BD) are, however, often biased and incomplete. This shortcoming hampers their usefulness and cannot be easily resolved as we still lack tools to quantify the completeness of BD. Here, we propose a method to assess completeness of datasets on flowering plants. We use an asymptotic regression to model the relationship between the number of records and number of genus observed in 0.25 degree grid cells, thereby identifying data-deficient cells. Moreover we estimate the overlap between data-deficient cells and points of occurrence of data-deficient (DD) species, according to the IUCN. We apply our method to 1,527,584 records of plants collected in Africa. Around 80% of the cells can be classified as data-deficient and 60% of points of occurrence of DD species fall into data-deficient areas. This finding suggests that our knowledge on flowering plants is severely limited over vast areas of Africa. Integrating estimates of completeness of BD into IS could allow scientists and decision makers to be aware of knowledge shortfalls, offering them an opportunity to factor this into policy initiatives and conservation interventions.

**Stutzman, Hannah,** *Amazon Conservation Association;* **Amy Rosenthal**, *WWF - US;***Adrian Forsyth,** *blue moon fund*

**Creating Mosaic-Based Conservation Corridors to Respond to Major Threats in the Amazon Headwaters**

Peru's southeastern Andes-Amazon region is home to rich biological and cultural diversity and is an emerging frontier for development threats. Developing habitat corridors is considered one of the few effective methods for responding to the risk of large-scale land conversion yet relatively few examples exist in implementation. The presentation will describe Amazon Conservation Association's strategy of creating landscape-level corridors as a means to maintain landscape connectivity while allowing for human use. ACA designed 3 interlinking corridors in southeastern Peru based on a land-use mosaic, which includes an array of rights-holders and land tenures in addition to conservation areas. Supported by both science and community engagement, each corridor design considers social and political dynamics as well as ecosystem processes. Anchored by large protected areas, these conservation corridors consist of a patchwork of land uses, which permit economic development while allowing for gene flow and species migration. Implementation of the corridors has included sustainable livelihoods activities such as agroforestry, agriculture, aquaculture and ecotourism, along with creation of several types of protected areas, reforestation, capacity building and strengthening governance, communications, and support for development of conservation finance mechanisms. The presentation will discuss the current state of these initiatives as well as obstacles to success and lessons learned.

**Suckling, Kieran,** *Center for Biological Diversity*

**Species are recovering under the Endangered Species Act**

Critiques of the Endangered Species Act have focused on the fact that only one percent of listed species have recovered and been delisted. But given that 77 percent of species have been listed for 30 years or less, while the average time-to-recovery specified in federal recovery plans is 46 years, this is an inappropriate measure of effectiveness. We reviewed official recovery plan goals and timelines for several hundred species, obtained their history of listing, downlisting and delisting, and quantified their population trend from year-of-listing to the present in order to judge the Act’s effectiveness according to its stated goals: 1) preventing extinction, 2) moving species toward recovery, and 3) achieving recovery within a specified time. We found that the Endangered Species is working well to avert extinction, place species on a recovering trend, and attain recovery in a timely fashion.

**Sudan, Robinson,** *Pollinator Partnership;* **Victoria Wojcik**, *Pollinator Partnership;***Jennifer Blanchard,** *Honey Island Conservation Program*

**Honey bee/native bee competition and delivery of pollination services to non-timber forest products on production forests of the US Gulf South**

Forestry dominates land use in the US Gulf South. While timber products are essential to the region's economy, these lands are often alternatively managed to enhance wildlife habitat. They also provide forage for managed honey bee colonies between pollination contracts. With traditional forage lands becoming scarce and pollinators declining worldwide, maintaining sufficient habitat for wild and managed bees alike is imperative for successful conservation and agriculture. Despite a clear need, virtually nothing is known about the activities of pollinators on southern timberlands, and research on competition between wild and managed bees has proven contradictory. To examine this potential competition, flower visitors to titi (Cyrilla racemiflora) on timberlands were recorded over two years at sites with managed honey bee hives, sites without hives, and control sites. To examine pollination services among treatments and degree of pollinator dependence, eight plant species important as wildlife food resources were studied using a pollinator exclusion protocol. Flower visitation data suggest minimal bee competition, while control sites differed significantly from both treatments. Plant species showed pollinator dependence across sites, but small sample sizes may be an issue with the observed insignificant differences in fruit set. This ongoing project reveals important aspects of bee interactions and habitat use, and future analysis will benefit from forthcoming seasons of data.

**Sukumar, Raman,** *Centre for Ecological Sciences*

**The tiger and the elephant: can alternative conservation paradigms meet to conserve biodiversity in Asia?**

Policies for conserving the tiger and the elephant present contrasting approaches to saving not just these charismatic megavertebrates but the overall biodiversity in human-dominated landscapes in India. Conservation of the tiger, exemplified by "Project Tiger" launched in 1973, has focused on individual protected areas, ensuring strict protection and eliminating all human use of as large "inviolate" areas as possible; this is generally regarded as an exclusionary model of wildlife conservation. Conservation of the elephant, as outlined by "Project Elephant" in 1992, has advocated a landscape approach to management of the species, acknowledged the inevitable presence of people and agriculture, and emphasized the need to mitigate animal-human conflicts; this approach is thought to be a more inclusive model of conservation. Implementation of both these flagship conservation projects has, however, faced challenges and aberrations resulting in serious conflicts between people, parks, tourism and authority. In this talk I contrast these two approaches to wildlife conservation in India, review current legislation for habitat protection and indigenous peoples' rights, and argue for a convergence of conservation thinking and policy. This should take into consideration a metapopulation dynamics framework for larger mammals at the scale of landscapes and, at the same time, ensure social justice for local people who may be adversely impacted by conservation policy and implementation.

**Sullivan, Constance,** *Puget Sound Partnership;* **Scott Redman**, *Puget Sound Partnership;***Kari Styles,** *Puget Sound Institute;* **Sandra O'Neill**, *NOAA;* **Tracy Collier**, *Puget Sound Partnership*

**The use of conceptual frameworks and models to inform the selection of ecosystem indicators for Puget Sound recovery**

The Puget Sound Partnership (PSP) is tasked with coordinating the recovery of Puget Sound, a complex ecoregion in Washington State under intense development pressure. To track progress of recovery efforts, a set of high-level ecological and human health indicators was developed. Since then, the indicators have received external review by the WA State Academy of Sciences, decision-makers, and other stakeholders. In response to this input, PSP evaluated an expanded set of indicators to reflect a more comprehensive and cohesive assessment of key attributes and components of ecosystem conditions. To aid in the assessment, an overarching ecosystem framework describing key attributes and relationships among biophysical components of the ecosystem was created, along with more focused, topical conceptual models describing links between key drivers, pressures, and specific ecosystem components and attributes. The framework and models integrated existing findings from recent social science research supported by PSP. The process of creating the models involved stakeholder input from federal, state, and local jurisdictions, as well as tribes, academia, and non-profits. The indicators developed via this process will be used collaboratively and adaptively to track the overall health and of recovery of Puget Sound.

**Sushinsky, Jessica,** *University of Queensland;* **Jonathan Rhodes**, *University of Queensland;***Hugh Possingham,** *University of Queensland;* **Tony Gill**, *New South Wales Office of Environment and Heritage;* **Richard Fuller**, *University of Queensland*

**Maintaining people's access to nature in growing cities**

Connection to nature is a central component of human health and well being, and as urbanization continues to increase in scale and intensity around the world there is mounting concern that people are becoming increasingly isolated from nature. Despite this, almost nothing is known about how we should design our cities to maintain people's access to nature. Here, for the first time, we quantify the impact of future urban growth on people's access to nature using spatially explicit, statistical models to predict local extinctions of bird species around people's homes in the city of Brisbane, Australia. We discovered that changes in people's access to nature depend on the form of urban growth. Under a sprawling form of urban growth, with lower residential densities and fewer interstitial green spaces, we predict severe declines in bird species richness around the home. Additionally, there is a significant, positive correlation between these declines and socioeconomic status; less affluent areas of the city experience the greatest declines in bird species richness around homes. Our results suggest that cities built to minimize further isolation from nature are characterized by high residential density and large interstitial green spaces. However, without careful planning, increased residential density may diminish the size and quality of backyards which may limit people's opportunities to interact and connect with nature, negatively affecting health and well being.

**Sutcliffe, Trish,** *University of Queensland*

**Marine reserve systems constructed using environmental domains do not comprehensively represent seabed fauna**

In many instances around the world, knowledge of marine systems is limited and the cost of acquiring new data is high. Therefore, we need to know whether more readily available data is sufficient to design comprehensive and representative reserve systems. Here, we designed sixteen reserve systems based on the intersection of four kinds of domains (environmental domains; weighted environmental domains; pre-defined bioregions of the Great Barrier Reef; random) and four combinations of two constraints (cost to commercial fisheries, and clumping of reserves). To measure the efficacy of each reserve system, we evaluate how well 842 species collected at 1155 sites from the Great Barrier Reef seabed were represented. We found that 10-22% of species had less than 10% of their biomass conserved under any of the reserve combinations, and that the number of species reaching a 30% conservation target was similar to random. We conclude that the large number of species that fall well short of the conservation target is unacceptable for a representative reserve system. Random reserve design is equally as effective as any of the combinations tested here. In this shallow water tropical marine ecosystem, seabed biota is not adequately conserved using environmental domains, and biological data is needed to inform the design process. Our study highlights that caution should be taken when designing reserves without biological data.

**Suter, Ingrid,** *The University of Queensland;* **Gilles Maurer**, *ElefantAsia;***Greg Baxter,** *The University of Queensland*

**Population Viability Analysis of Captive Asian Elephants in the Lao PDR**

An endangered species, Asian elephants (Elephas maximus) are in global decline. Encompassing a third of all Asian elephants is the captive elephant population, with approximately 16,000 individuals. Within the Lao PDR only an estimated 600 wild and 480 captive elephants remain. Captive Lao elephants play an important role in the conservation of both elephant populations yet until now no robust conservation management has been applied to the Lao captive elephant population. Our objective is to determine population viability for Lao captive elephants and create conservation management strategies suitable for the local Lao context. We assessed demographic data from >80% of the captive Lao elephant population and applied VORTEX software to create seven conservation management scenarios. Results indicate that without improved management the current population is likely to be extinct in 107 years (r = -0.099). Population supplementation, increased reproductive rates and reduced mortality rates will give captive Lao elephants an additional 140 years of longevity. However to ensure long term persistence it is essential that management focuses also on in situ breeding programs and a cessation in calf exportation. With captive populations declining in other range nations and captive elephant management providing conservation benefits to wild populations, there is a case for managing all Asian elephants as a single management unit.

**Sutherland, Ron,** *Wildlands Network;* **Rob Baldwin**, *Clemson University;***Paul Leonard,** *Clemson University;* **Derek Fedak**, *Wildlands Network;* **Rachael Carnes**, *Wildlands Network*

**Modeling fine-scale habitat connectivity for terrestrial mammals, snakes, and turtles in the Southeast USA**

The rich biodiversity in the Southeast USA is under threat from both rapid urbanization and climate change. Re-connecting the existing natural areas in the region is perhaps the best hope of preventing extinction for many species. However, scientists have been thus far unable to provide fine-scale recommendations for conservation practitioners as to the best land parcels to protect or restore in order to efficiently enhance terrestrial habitat connectivity. In this project, we take advantage of recent advances in supercomputing and connectivity modeling software to identify high priority habitat connectivity zones for a range of vertebrate species across a 7-state study area. Target species include black bear, red wolf, Florida Panther, eastern diamondback rattlesnake, timber rattlesnake, pine snake, and box turtle. We used expert opinion to derive dispersal resistance surfaces for each species, and then Circuitscape and other connectivity analysis tools to model the potential flow of these animals across the landscape. Our general results highlight the importance of three parallel connectivity zones in the Atlantic Coast portion of the Southeast (Appalachians, Fall Line Sandhills, and Coastal Plain Wetlands), and also demonstrate considerable significance for the numerous large river corridors that stretch inland perpendicular to the main arteries of connectivity.

**Sutton, Stephen,** *James Cook University*

**Engaging the recreational fishing community in marine conservation in Australia**

Australia has the third largest marine estate of any nation in the world. With recent initiatives such as the rezoning of the Great Barrier Reef Marine Park and the addition of 2.3 million square kilometres to the national system of marine reserves, Australia has shown strong commitment to the principles of marine conservation. With approximately 20% of the Australian population spending approximately 20 million days fishing (80% of which are in salt water) each year, the recreational fishing community is a key stakeholder in marine conservation. Consequently, there is interest in developing appropriate methods for effectively engaging recreational fishers in conservation initiatives. The paper compares and contrasts three recent initiatives to enhance the engagement of recreational fishers. Results suggest that commonly used public consultation programs (public meetings and submission programs) provide little opportunity for meaningful engagement and are not viewed favourably by most recreational fishers. Alternative arrangements that engage fishers directly though community-based environmental monitoring or through partnerships in scientific study of the environment hold promise for enhancing recreational fishers’ engagement in marine conservation. However, such programs must overcome constraints related to recruitment and retention of volunteers, fishers’ lack of trust in science and management, on-going funding, and acceptance of such programs by scientists and managers.

**Suzan, Gerardo,** *UNAM School of Veterinary Medicine*

**Habitat fragmentation, metacommunity structure, and disease ecology.**

Habitat fragmentation results in decreased area and increased patch isolation, along with microclimatic and biogeographical changes, altering the richness and the relative abundance of species involved in disease transmission cycles, leading to changes in pathogen persistence, prevalence and distribution in the landscape.

**Tabor, Gary,** *Center for Large Landscape Conservation*

**A State perspective on a national conservation network**

Large landscape conservation initiatives are those efforts which are focused on large areas of recognized conservation value, sensitivity and/or threat and require a broad-based, multi-jurisdictional, multi-sectorial, multipurpose (economic, social and environmental) approach with specific, measurable conservation objectives. The North America Large Landscape Practitioners’ Network is an alliance of over 250 large landscape initiatives and includes professionals and citizens engaged in leading, managing, researching, advocating, funding, educating or setting policy to advance these initiatives. Specific objectives of the network include: 1) Building capacity and awareness for large landscape conservation at various scales and across sectors; 2) Linking existing and emerging large landscape conservation initiatives; 3) Promoting leadership; and 4) Advocating for resources and policies that support large landscape conservation initiatives. Large scale conservation efforts function as institutional isolates. Through networked coordination, these initiatives can elevate the trajectory of these efforts, especially in a time of climate change. North America is not alone in advancing this ambitious conservation agenda. There are efforts worldwide which can be supported and championed by a global network.

**Tabor, Gary,** *Center for Large Landscape Conservation*

**Planetary Thresholds and Conservation Medicine**

Perhaps we didn't aim high enough. Conservation Medicine was designed to bring together the ecological health, human health and animal health communities to address the health implications of environmental change. Tom Lovejoy termed those who practice conservation medicine as "Planetary Doctors". Today we stand at the brink of a real and impending conservation bottleneck. Within the next 100 years we will surpass several planetary thresholds relating to climate change, irreversible loss of global biodiversity, and the aspirations of 11 billion people. The next 100 years will test our collective resolve in finding a sustainable path for human livelihoods and nature conservation. Conservation Medicine needs to enlist the knowledge disciplines and institutions that can address this challenge. True planetary health will require more than combined collaborations between entrenched branches of the ecological, medical and veterinary science communities. We need to train planetary doctors and inspire citizens of our planet to be global health practitioners. As planetary doctors, we cannot simply treat the symptoms of this problem, whether it be emerging infectious diseases due to ecological change, or asthma within polluted cities. We must pursue a systemic and preventive health approach. Our ambitions are fueled by the planetary crisis at hand and thus we have no choice but to aim higher.

**Takahara, Teruhiko,** *Hiroshima University*

**Using environmental DNA to estimate the distributions and biomass of fish**

Knowledge of the biomass/distribution of a species is critical to manage and conserve the population. Environmental DNA (eDNA), DNA fragments released from aquatic vertebrates, has recently used to detect the presence of species. In order to develop how to estimate biomass/distribution of fish species, we used common carp (Cyprinus carpio) and invasive bluegill sunfish (Lepomis macrochirus) as the target species, and quantified the concentration of their DNA copies in 1-2 L water samples using quantitative real-time PCR (qPCR) with species-specific primer/probe set for cytochrome b. The concentration of eDNA from carp was positively correlated with carp biomass in the both laboratory and outdoor experiments. The biomass data estimated from eDNA concentration reflected the potential distribution of carp in the natural freshwater lagoon. In 70 ponds, we estimated the presence of invasive bluegill with the eDNA method. We detected bluegill DNA in the ponds where bluegills were observed visually and some where bluegills were not observed. Using our eDNA method, we can estimate the presence of fish species more precisely than using traditional methods, such as casting-nets or fishing, in the natural environments where species are difficult to detect. The eDNA method can be easily adapted to monitor the other species for which primers can be developed.

**Takem Mbi, Bienvenu Magloire,** *University of Yaounde I/INC*

**Protecting the Cross River gorilla (Gorilla gorilla diehli) in a multi-stake landscape of Cameroon: assessment of current and emerging challenges**

A sub-population of the Cross River gorilla (CRG) has been discovered in the Lebialem-Mone Forest landscape (LMFL) of Cameroon. According to the forestry law, the LMFL is a non-permanent forest estate implying that it can be converted into any form of land use. While FFI and ERuDeF are working with the administration towards designating a wildlife sanctuary for this CRG, the local populations are striving towards achieving their livelihood. Also, multi-national corporations and "power class" individuals are starting off large scale plantation agriculture. For FFI and partners to proceed with the plan, field information is mandatory. They need to know the changes that have occurred over time and become acquainted with the current and emerging challenges to conserving the LMFL. Landsat and SPOT satellite images for 1986 and 2011 respectively were employed to assess the changes. Questionnaires, interviews, observations and FGDs were used to identify current and emerging challenges. Results proved forest cover reduced from 80% in 1986 to 66% in 2011 and that 84% of the population were actually aware. The drivers of the current change were identified to be: farming 69%, house construction 12%, and timber exploitation 10%. These same activities plus large scale plantation were recognized as emerging threats to the CRG of the LMFL. To continue with the plan, FFI and partners should work with all actors involved in the zone if they wish that the LMFL should be used sustainably.

**Takemura, Takeshi,** *National Institute for Rural Engineering;* **Masakazu Mizutani**, *Utsunomiya University;***Noriyuki Koizumi,** *National Institute for Rural Engineering;* **Atsushi Mori**, *National Institute for Rural Engineering;* **Keiji Watabe**, *National Institute for Rural Engineering;* **Kazuya Nishida,** *National Institute for Rural Engineering*

**A simulation model to evaluate re-networking for fragmented fish habitats with consideration for population dynamics**

Fragmented fish habitats by passage blockages such as drops and dams have adversely affected up to down movement and breeding in agricultural canals around paddy fields in Japan. Although re-networking by installation of fish-ways into passage blockages has been often conducted, the effects of the improvement have not been sufficiently evaluated owing to shortages of consideration for population dynamics including movement and reproduction. We developed a simple population dynamics model specifically designed for small stream networks. The networks were depicted on a computer, using numerous mesh elements equaled to habitat units. The difficulty of movement over the boundary between adjacent mesh elements was given as an attribute value corresponded to the ascending rates for each element. Movement distance of each individual in no blockage was given based on our previous studies. Success or failure of movement over each boundary within the ideal movement distance was determined in order of closeness to the original position until the individual failed to move successfully or moved its ideal movement distance by comparing the attribute value with a generated uniform random number. In each mesh element, annual reproduction was calculated using the logistic growth model. We simulated population dynamics before and after re-networking habitats in a hypothetical network, and proposed methods to relatively evaluate the effect of re-networking habitats under each scenario.

**Tamura, Narumi,** *Meiji Univercity;* **Noboru KURAMOTO**, *Meiji Univercity*

**Perk User's Attitudes towards Turtles**

Abstract: In Japan, six species of aquatic turtles live in fresh water or semiaquatic habitats. Native turtles living on Honshu Island, Mauremys japonica, Chinemys reevesii, and Pelodiscus sinensis, are decreasing in number because of competition with alien turtles. The main species competing with native turtles in Japan, the red-eared slider Trachemys scripta elegans (young sliders are called "midorigame" in Japan), are distributed throughout Japan because these turtles are kept as pets. Many studies have investigated the manner in which T. scripta elegans colonizes ponds in Japan, but few reports describe popular perceptions. This study was conducted to support educational activities aimed at reducing the abandonment of alien species. Inhabitation of city parks by turtles was examined. Then a questionnaire survey was administered to park users to clarify their views of turtles and perceptions of T. scripta elegans. Alien turtles dominated native turtles in the two studied ponds. Furthermore, city park users like all turtles. However, alien turtles, including T. scripta elegans, are not as well liked. Reasons for abandoning T. scripta elegans include the idea that perceptions of young midorigame do not match perceptions of adult red-eared sliders. As one might expect, city park users do not know that breeding T. scripta elegans is difficult. City park users must be educated about the problem of alien turtles when exterminating alien species.

**Tarasova, Olena,** *Ukrainian Environmental Club;* **Natalia Gozak**, *Ukrainian Environmental Club "Green Wave";***Natalia Gudkova,** *Ukrainian Environmental Club "Green Wave";* **Olena Kovalenko**, *Ukrainian Environmental Club*

**First Course on Conservation Biology in Ukraine: Is There Any Effect on Students' Behavior and Environmental Competence?**

The first attempt to introduce conservation biology into the system of education as a separate discipline in Ukraine was made at the National University of Kyiv-Mohyla Academy (Tarasova, 2012), based on teaching materials developed by NCEP, AMNH (ncep.amnh.org). The aim of the study was to estimate the effectiveness of the new course in developing environmental competence of Ukrainian students. For evaluation of behavior towards environment in the open and behavioral component of environmental competence in our experiment the methods developed by Shebanova (1999) and Prutsakova (2005) was applied. Before and after the course students received the questionnaire with 10 situations which may occur in professional or domestic life. Analysis of open answers was carried out according to the criteria of the types of behavior (Prutsakova, 2002), and responses were interpreted as one of four behavioral types scaling from actively friendly to actively aggressive. Results showed that most of respondents (40 and 43%) were already well responsible for the environment. When all types were joined as generally positive and negative to nature, the tendency of increasing positive answers was found (mean changing from 65 to 72%). The observed tendency was verified by Wilcoxon signed-rank test (p = 0.0468) with 95% probability. So, the course appears to be effective in developing environmental competence of Ukrainian students.

**Taremwa, Nathan,** *National University of Rwanda(NUR);* **Lambert Kwizera**, *National University of Rwanda;***Jean Lambert Sebareze,** *World Vision- Rwanda*

**Engaging Local Communities in Conservation: An Opportunity to Enhance Sustainable Biodiversity Conservation in Rwanda**

This study investigates the strategy to engage local communities living adjacent to Akagera National Park in conservation as an opportunity to enhance sustainable biodiversity conservation in Rwanda. The main objective of the study was to determine the strategy that would be adopted to enhance sustainable biodiversity conservation in national parks of Rwanda. The focal point were the local communities living adjacent to the Akagera National Park, located in the Eastern Province of Rwanda. A sample size of 70 was used and 66 agricultural households living adjacent to ANP and 4 people from the park, local administration were surveyed. Multiple regression analysis was used to determine factors contributing to the productivity and the willingness to pay (WTP) or accept (WTA) for the plan of conservation measures. Results showed that land and crop production influence the crop yield and that revenue local communities obtain from the selling of the harvest at the market was the major determinant of WTP. Other socio-economic characteristics were not statistically significant. The study recommends the provision of agricultural extension services and application of environmental valuation tools in assessing local communities' attitudes toward biodiversity conservation to enhance decision making for effective and sustainable conservation. Key words: Local Communities, Biodiversity Conservation, Akagera National Park, Rwanda

**Tariku, Haile Yineger,** *Australian Rivers Institute, School of Environment, Griffith University;* **Daniel Schmidt**, *Australian Rivers Institute, School of Environment, Griffith University;***Jane Hughes,** *Australian Rivers Institute, School of Environment, Griffith University*

**Forest fragmentation in Northwestern Ethiopia: Genetic effects on an endangered medicinal tree species**

Habitat loss and fragmentation may have harmful impacts on genetic diversity, population structure and overall viability of tropical trees. Here we test the hypothesis that habitat loss and fragmentation cause lower genetic variability and higher genetic differentiation in small and isolated and seedling populations of Prunus africana in Northwestern Ethiopia. We selected 8 remnant patches of variable sizes and isolation for leaf and /or bark sample collection. DNA was extracted from 210 adult and 232 seedling samples. Based on 7 microsatellite markers, negative effects of fragmentation were demonstrated. Genetic diversity (based on allelic richness) was significantly (P0.05) with patch size or isolation. These results demonstrate adverse effects of forest loss and fragmentation on genetic diversity and population structure of P. africana in NW Ethiopia. Conservation and restoration activities that promote protection of the natural forest remnants from further destruction and fragmentation as well as enhance habitat connectivity and expansion may help to mitigate such adverse effects of fragmentation and to maintain viable populations of valuable trees in this region.

**Tavano, Joseph,** *Clemson University;* **Amber Pitt**, *Clemson University;***Robert Baldwin,** *Clemson University;* **Thomas Waldrop**, *USFS, Southern Research Station*

**Effects of fuel reduction treatments on movement and habitat use of American toads in a southern Appalachian hardwood forest**

Prescribed fire is a commonly used management technique for maintaining fire-adapted ecosystems, yet empirical data regarding its effects on amphibians are limited and contradictory. We used radio-telemetry to examine the effects of prescribed fire on movements, mortality, and habitat selection of American toads (Anaxyrus americanus) in a southern Appalachian upland hardwood forest. We tracked 26 adult A. americanus between 27 January - 30 May 2012. Toads exhibited non-breeding site fidelity and traveled 993.5 m (± 265.9 m) mean (± SD) route distance between the breeding ponds and last recorded locations. We found no evidence of direct mortality of A. americanus from prescribed fire. Forward stepwise discriminant analysis revealed that the availability of coarse woody debris (CWD) was a significant discriminator between microhabitats used and random plots. Toads also maintained shorter distances from CWD in the burned than in the unburned locations. Our results indicate that prescribed fire as implemented in this study did not cause direct mortality, nor did it appear to inhibit migratory movements of adult A. americanus. However, fire reduced the diversity and availability of refugia, especially deciduous leaves, though the availability of alternative cover objects (e.g., CWD) in burned treatments allowed toads to inhabit those areas, suggesting the importance of maintaining near-ground structural complexity for A. americanus in fire-managed forests.

**Tavernia, Brian,** *North Carolina State University;* **Mark Nelson**, *Northern Research Station, USDA Forest Service;***Peter Caldwell,** *Southern Research Station, USDA Forest Service;* **Ge Sun**, *Southern Research Station, USDA Forest Service*

**Water Stress Projections for the Northeastern and Midwestern United States in 2060: Anthropogenic and Ecological Consequences**

Future climate and land-use changes and growing human populations may reduce the abundance of water resources relative to anthropogenic and ecological needs in the Northeast and Midwest (USA). We used output from WaSSI, a water accounting model, to assess potential changes between 2010 and 2060 in (1) anthropogenic water stress for watersheds throughout the Northeast and Midwest and (2) native fish species richness (i.e., number of species) for the Upper Mississippi water resource region (UMWRR). Six alternative scenarios of climate change, land-use change, and human population growth indicated that future water supplies will, on average across the region, be adequate to meet anthropogenic demands. Nevertheless, the number of individual watersheds experiencing severe stress (demand > supplies) was projected to increase for most scenarios, and some watersheds were projected to experience severe stress under multiple scenarios. Similarly, we projected declines in fish species richness for UMWRR watersheds and found that the number of watersheds with projected declines and the average magnitude of declines varied across scenarios. All watersheds in the UMWRR were projected to experience declines in richness for at least two future scenarios. Many watersheds projected to experience declines in fish species richness were not projected to experience severe anthropogenic water stress, emphasizing the need for multi-dimensional impact assessments of changing water resources.

**Taylor, Erin,** *New England Aquarium;* **Regen Jamieson**, *New England Aquarium;***Tim Smith,** *World Whaling History*

**Connecting New England to the Pacific: Historic American Sperm Whaling in the Phoenix Islands Protected Area**

The Phoenix Islands Protected Area (PIPA) represents the largest marine protected area in the Pacific Ocean and a substantial oceanic conservation effort by Kiribati, a least developed country. In the mid-19th century, the PIPA was part of a hotspot for American whalers known as the "on-the-line" grounds. These whalers from New England particularly targeted sperm whales (Physeter macrocephalus), prized for their valuable oil. The vigorous whaling by the American fleet contributed to major declines in global whale populations. Sperm whale populations in the PIPA do not seem to have recovered, as they are rarely reported there today despite their known historical presence and the pristine condition of the PIPA ecosystem. Our research connects information on historic and current whale populations in the PIPA region. We investigate historic whaling logbook data of global whale sightings and kills that were compiled and mapped in previous studies. By revisiting this data and narrowing our regional focus, we have been able to recreate maps that offer insight into the historic temporal, spatial, and seasonal distributions of sperm whale populations in the PIPA region. This research provides new insight into the baseline population of sperm whales in the PIPA, which can be used to make inferences about current populations, reasons behind their slow recovery despite the pristine ecosystem, and the larger implications for PIPA managers and stakeholders.

**Taysom, Alice,** *Victoria University*

**Mixing with Mallards: The integrity of the Australian Pacific Black Duck at risk due to hybridisation with Mallards?**

The threat of hybridisation with Mallards (Anas platyrhynchos) posed to many dabbling duck species is one that is commonly overlooked. Introduced Mallards have interbred with the Pacific Black Duck (A. superciliosa), to the extent that the New Zealand subspecies is now considered endangered. In Australia, introduced Mallards are typically of domestic origin and were originally believed to be restricted to urban areas. The degree of hybridisation between Mallard and the Pacific Black Duck is currently unknown, largely because hybrid backcrosses are difficult to visually identify. A technique using microsatellite markers was established to genetically identify hybrids. This system utilises 12 markers that were tested on putatively pure Pacific Black Ducks and domestic Mallards. Assignment tests, performed with the program Structure, had a 99% likelihood that specimens of a known species (Mallard or Black Duck) were assigned to the correct group. The marker set established was used to test the rate of hybridisation throughout rural Victoria and Tasmania. Assignment tests performed, as previously, on 200 specimens found the likelihood that individuals were of Mallard origin was

**Tenggardjaja, Kimberly,** *University of California, Santa Cruz;* **Giacomo Bernardi**, *University of California, Santa Cruz;***Brian Bowen,** *Hawaii Institute of Marine Biology*

**Endemism, connectivity, and marine protected areas: A population genetics comparison of endemic and widespread reef fishes in the Hawaiian Archipelago**

One of the key biological criteria for deciding which sites should be designated as marine protected areas (MPAs) is biodiversity, and endemism contributes to the biodiversity value of a potential MPA site. Limited dispersal potential and restricted geographic ranges characterize endemic species, placing them at a greater risk of extinction than widespread species. Because of these attributes, it is assumed that endemic species have lower levels of connectivity than widespread species. This study utilized genetic markers to investigate whether endemic and widespread reef fishes exhibit different patterns of genetic connectivity. The Hawaiian Archipelago is a hotspot for endemic reef fishes, making it an ideal system for this study. Levels of genetic connectivity were assessed throughout the archipelago for two Hawaiian endemic (Abudefduf abdominalis and Chromis ovalis) and two Indo-Pacific (A. vaigiensis and C. vanderbilti) damselfish species. Both of the endemic species demonstrated multiple genetic breaks in the archipelago, as did C. vanderbilti. In particular, these three species shared a break between the Main Hawaiian Islands (MHI) and the Papahānaumokuākea Marine National Monument - a break also seen in two other endemic damselfishes. Management of the archipelago should be mindful of this emergent pattern among endemic damselfish species, which suggests limited connectivity between the MHI and the largest marine conservation area under U.S. jurisdiction.

**Terauds, Aleks,** *Australian Antarctic Division;* **Steven Chown**, *Monash University;***Dana Bergstrom,** *Australian Antarctic Division*

**Antarctic Conservation Biogeographic Regions: management implications of a new bioregionalisation approach for terrestrial Antarctica**

Over the past decade there has been increasing recognition of the biogeographical complexity of terrestrial ice-free Antarctica. Concomitant with this recognition is an increased understanding of the biology of these areas. The vulnerability of these terrestrial ecosystems has also become more evident, in the face of increasing human presence and a changing climate. Here we provide an entirely new perspective on the biogeography of the Antarctic. By using a comprehensive new biodiversity dataset, in conjunction with previously unpublished spatial frameworks, we identify a set of Antarctic Conservation Biogeographic Regions (ACBRs) that best represent biodiversity across the terrestrial Antarctic. Our work provides a novel, first tier set of sites that now form the basis of a systematic conservation planning framework, as is required by the Protocol on Environmental Protection to the Antarctic Treaty. It also shows that the current network of Antarctic Specially Protected Areas fails to represent biodiversity adequately. The ACBRs also provide a first tier set of sites among which biosecurity measures within Antarctica must be improved to prevent homogenisation of biodiversity. This work is already changing the way area protection and conservation is undertaken in Antarctica. In its current form and through future development at finer resolutions, the ACBRs form a foundational element of evidence based Antarctic conservation policy.

**Terrell, Kimberly,** *Smithsonian Conservation Biology Institute;* **Richard Quintero**, *Smithsonian's National Zoological Park;***Suzan Murray,** *Smithsonian's National Zoological Park;* **Bradley Nissen**, *Smithsonian Conservation Biology Institute;* **James Murphy**, *Smithsonian's National Zoological Park;* **John Kleopfer,** *Virginia Department of Game and Inland Fisheries;***Brian Gratwicke**, *Smithsonian Conservation Biology Institute*

**Cryptic Impacts of Variable Temperatures in a Declining Aquatic Salamander**

The Appalachian region of the eastern United States is a hotspot of salamander diversity, but many species are experiencing declines, including the hellbender (Cryptobranchus alleganiensis). Although climate change is considered a serious threat to these species, little is known about how temperature affects salamander health. More frequent drought and intense rain are predicted in Appalachia, resulting in more variable water temperatures for stream-dwelling species. We investigated the health impacts of variable temperatures using a captive population of hellbenders. Tank temperatures were programmed to recreate a 7-day period of rapid warming and cooling (16-26-16°C) recorded in the population's natal stream. A control group was maintained at a constant, mean temperature (21°C). Body weight, leukocyte counts, corticosterone levels and plasma bacterial killing ability (BKA) were evaluated every 14 days during 6 consecutive temperature cycles. Analyses revealed increased BKA in hellbenders exposed to variable temperatures (P < 0.05), while all other metrics were similar to the control group. These data indicate that in situ patterns of temperature change elicit a functional immune response in hellbenders. Furthermore, this "cryptic" physiological response is not detectable using conventional stress indicators (i.e., corticosterone or leukocytes). Collectively, our findings highlight the need for a comprehensive approach to understanding climate change physiology.

**Tewksbury, Josh,** *WWF International*

**Bringing talent to the table - providing incentives, opportunities, and collaborative structures for scientists to influence conservation**

21st century conservation must balance the demands of a growing human footprint with the capacity of a finite set of natural resources, requiring us to focus on combined solutions to environmental and social challenges. Delivering effective outcomes requires consistent collaboration between conservation implementing communities (largely in NGOs and the public and private sector), policy communities, and a wide range of largely academic discovery communities ranging from natural and physical sciences to social sciences, economics, and sociology. Here we review current efforts within academic institutions, governments and civil society to bridge these gaps and create these collaborative structures. Central to all of these efforts are 1) the need to deliver research results at a speed relevant to policy decision-making 2) the importance of collaborative structures that create the difficult links between communities, 3) the question of which communities should decide on the most important questions, 4) the difficulty in mapping needs, incentives and currencies, from discovery communities to implementing communities.

**Théo, FLAVENOT,** *Museum National d'Histoire Naturelle;* **ADAM Yves**, *Union Nationale des producteurs de Granulats;***BAGUETTE Michel,** *Museum National d'Histoire Naturelle;* **COULON Aurélie**, *Museum National d'Histoire Naturelle*

**Assessing the effects of quarrying activities on landscape connectivity in two amphibian species with contrasted ecological constraints**

Industrial activity is a major driver of fragmentation, but each type of activity has a different impact. Quarrying causes the removal of initial habitat and may hence increase landscape fragmentation. Conversely, it may create particular habitats such as pioneer habitats or wetlands, probably increasing this way the connectivity for species associated with those environments. Moreover, the spatial configuration of quarries (i.e. isolated, clustered, or in stepping-stone networks) may modulate those effects. To assess the effects of quarries on landscape connectivity, we used a landscape genetic approach on two niche-separated anurans: the natterjack toad (Bufo calamita) and the common toad (Bufo bufo). Because the natterjack toad prefers poor-vegetated habitat while the common toad looks for heavily vegetated and forested habitats, this study tests the hypothesis that quarry density has positive effects on natterjack toad connectivity and negative effects on common toad connectivity. We compared genetic structure, gene flow levels and directions in seven areas with different densities of quarries. We also used an optimization process to assess resistance of quarries on gene flow in both species. In light of our results, we propose integrated landscape conservation measures for quarrying activities.

**Theobald, David**, *National Park Service;* **Sarah Reed***, Wildlife Conservation Society;* **Bill Monahan***, National Park Service;* **Andy Hansen***, Montana State University*

**Measuring landscape connectivity for US biomes to inform climate adaptation**  
Increasingly, park scientists and managers need to "scale up" and incorporate information about ecological flows and landscape connectivity. One of the key ecological flows about which information is needed is the movement of terrestrial, land-based animals - which is a primary climate adaptation strategy. As part of a series of ecological forecasting and wildlife planning projects, we have developed and refined a dataset on landscape-level connectivity for mainland US. We used a gradient-based landscape connectivity approach that estimates how connected a given location is to all other locations within one of ~10 biomes across the US, assuming that movement is related to the inverse of the degree of human modification. We used a multi-scale landscape permeability model because it rests on basic tenants of conservation biology, is relatively robust to uncertainties associated with climate predictions, and directly incorporates measurable impacts due to land use change. We found that there are key linkages both within and between biomes, and that only about 15% of these areas are currently protected for biodiversity, and about 57% are unprotected.

**Thieme, Michele,** *World Wildlife Fund*

**Conserving rivers and streams: Evaluating long and short-term outcomes of a freshwater small grants program in the Southeast US**

In order to understand the short- and long-term conservation outcomes and impacts of a small grants program, we undertook an evaluation of the Southeast Rivers and Streams Support Fund, the World Wildlife Fund’s grant program in the Tennessee, Cumberland and Mobile River Basins. The evaluation included both a measurement of the project performance of each grant, as well as an evaluation by grantees of the long-term effects of the grant. Project performance was evaluated by the authors via a review of all objectives for each grant and documentation of achievement of those objectives on a five-point scale. Each project was then rated according to how well it fulfilled all stated objectives. Grantees were surveyed in order to document outcomes beyond the granting period both in terms of conservation objectives and capacity building of the organization. Since 2003, over $1,600,000 has been awarded to 81 groups spanning 224 projects. The vast majority of projects either fulfilled or exceeded their stated objectives during the term of the grant. Long-term impacts varied considerably from project to project but included restoration of a threatened fish population, greater organizational capacity for fundraising, and a reduction in storm water run-off due to rain garden plantings and rain barrel projects. This evaluation provides a model for evaluating short- and long-term outcomes from a portfolio of projects.

**Shelly Thomas,** *James Madison University*

**ASSETS for Community-based Conservation in Kenya: An Eco-Scholarship Fund for Secondary School Students**

The Arabuko-Sokoke Forest, the largest remnant of East Africa Coastal Dry Forest, is home to six globally endangered bird species. The forest merges with Mida Creek, a tidal inlet and roosting site for migrant birds. Together they form an UNESCO Biosphere Reserve. Famous for its birds and rare mammals, this reserve attracts more than 4,000 tourists every year. Nevertheless, the cost of living drives families to overexploit these sites through illegal hunting, ﬁshing, and logging. For years, Kenyan reserves were regarded as government property; neighboring communities had no say in management or direct beneﬁts accrued from natural resources. This resulted in antagonism between conservationists and those earning their livings from these resources. In order to link conservation and development efforts, A Rocha Kenya designed ASSETS (Arabuko-Sokoke Schools and Eco-Tourism Scheme), a program that channels income accrued from sustainable eco-tourism to the nearby communities for secondary school scholarships. This school year 135 students are supported; 485 students from many communities have been supported since initiation. This is contributing to a signiﬁcant change of attitude toward the reserve from beneﬁciary communities. Furthermore, students and their families planted >20,000 trees around their homes, including >1,500 mangroves at Mida Creek. This is an excellent model for other conservation projects in Kenya and around the world.

**Thomasson, Kelly,** *University of California, Santa Barbara;* **William Avery**, *California State University, Sacramento*

**Insufficient regulation of Maui's Marine Protected Areas may reduce Benthic Biodiversity**

The waters of Maui County are essential to the livelihood of its residents. In addition to sustenance value, annual revenue from international tourism and marine activities keeps the island's economy afloat. Overuse of Marine Protected Areas (MPAs), due to their appeal as aesthetically vivid, conservation districts, has potential to degrade the very systems that MPAs are intended to protect. Marine ecotourism activities have been previously indicated as factors involved in coral reef degradation. We attempted to establish whether or not there was a notable decline in benthic substrate biodiversity in the MPA-managed areas of Maui County relative to that of non-conserved areas. Based on biodiversity indices, we hypothesized that there would be lower benthic biodiversity at MPA sites relative to those sites with no protected-status, within the boundaries of Maui County. Photographic quadrats of benthic organisms and substrate from 4 accessible conservation sites and 8 biogeographically similar controls were quantified and assessed through the use of biodiversity indices at two depth ranges. Using MANOVAs, we found significantly lower biodiversity indices in MPAs relative to control areas. Given the lengthy establishment of MPAs in Maui County and the importance of marine preservation for the aesthetics, economy and biology of Maui county, these results suggest the need for change in the level of MPA usage and regulation of that usage.

**Thomsen, Philip,** *University of Copenhagen*

**Monitoring marine fish and whale biodiversity using environmental DNA from seawater samples**

Marine ecosystems worldwide are under threat with many fish species and populations suffering from human over-exploitation. This is greatly impacting global biodiversity, economy and human health. Intriguingly, marine fish are largely surveyed using selective and invasive methods and misidentification of species represents a major problem. For the first time, we investigated the potential of using metabarcoding of environmental DNA (eDNA) obtained directly from seawater samples to account for marine fish and mammal biodiversity. We show that such marine eDNA can account for marine fish biodiversity using high-throughput sequencing. Promisingly, eDNA covered the fish diversity better than any of 9 methods, conventionally used in marine fish surveys. Additionally, we show that even short fish eDNA sequences in seawater degrades beyond detectable levels within days. The method is also used for detection of marine mammals focusing on the cetacean species harbor porpoise. The eDNA approach consistently detected the porpoise under controlled conditions, but in natural environments the method was less successful than acoustic detections. However, at one site, long-finned pilot whale – a species rarely sighted in the target area – was detected. Although further studies are needed to validate the eDNA approach in varying marine environmental conditions, our findings provide a strong proof-of-concept with great perspectives for future monitoring of marine biodiversity and resources.

**Thornhill, Jennifer,** *George Mason University*

**Can New Metrics Help Us Bridge the Gap? A case study in the measurement of scientific literature's impact on decision making.**

The emphasis that academic departments and publishing companies place on citation rates and impact factors may be a barrier to bridging the gap between science and decision making. Not only are activities and publications that bridge the gap often not encouraged or recognized for their value, there is no systematic way to measure the impact of these activities when they do occur. Development of a robust way to track "real world" impacts of publications could increase the value that is placed both on the underlying research and outreach efforts that are directed at decision makers. Examining 987 citations from five federal wolf delisting regulations, I found that literature that is used by decision makers ("high management impact literature") differs from literature that is deemed high impact in academic and publishing circles. This case study of the use of scientific literature in decision documents is a first step in creating an alternative method of measuring the impact of scientific publications-a "management impact index." A better understanding of the real world impacts could challenge academic institutions and publishers to reconsider the value placed on applied research and outreach, which in turn can provide much needed incentives for academic researchers to engage in research that can be directly applied to issues faced by decision makers.

**Thornhill, Alan,** *US Interior Department*

**Scientific Integrity -- The Process of Protecting the Integrity of Science in Forming Conservation Policy-- The Administration's Progress**

A Presidential Memorandum, a Dept. of Interior (DOI) Secretarial Order and the President’s Science Advisor’s memo directed Federal agencies to protect the integrity of science throughout the government. At DOI decisions are made by combining at least three foundational principles: Maintain fidelity to the law; Seek to protect long-term public interests; Use best available, credible, science. To protect the integrity, the credibility and trustworthiness of the science and scholarship used by DOI, the Department created its Policy on Scientific and Scholarly Integrity in 2011. The policy puts scientists in leadership roles by designating experienced scientists as Scientific Integrity Officers (SIOs). Their role is to promote and monitor integrity within their bureaus, act as confidential ombudsman for employees who request assistance, and process allegations of integrity loss. Having scientists in these roles encourages open dialog about science and scholarship and their proper roles in decision making and setting policy. The preventative nature of the policy helps to deal with minor irregularities and disputes early, allowing corrective action to prevent loss of integrity or worse. Leadership has embraced the policy, the SIO role, and scientists’ active role in handling allegations. As a result, science at DOI is held in high regard and the processes and products of science are respected. We are revising the policy to incorporate two years of lessons learned.

**Thurman, Lindsey,** *Northwest Climate Science Center;* **Tiffany Garcia**, *Oregon State University*

**In hot water: developmental plasticity to a warming climate in a high elevation amphibian assemblage**

The rapid loss of habitable climate space in montane ecosystems has resulted in a disproportionate number of extinctions in high elevation-restricted amphibian species. However, species capable of plastically altering life history traits, such as larval development rate, may exhibit optimal strategies for resisting a warming climate. We examined the larvae of three high elevation Anuran species from the US Pacific Northwest, the Cascades frog (Rana cascadae), Western toad (Anaxyrus boreas), and Pacific chorus frog (Pseudacris regilla), for their ability to increase larval development rates in response to warming. Each species was exposed to two temperature regimes: the control treatment simulated historical, summer temperatures for the decade of 2001 to 2011; the warmed treatment mirrored the seasonal trend, but simulated a 4°C average increase in temperature. We quantified multiple larval growth characteristics to compare the variability in development as a function of these temperature regimes. We found significant acceleration in larval development rates under the warmed temperature regime (F=21.68, P

**Tingley, Reid,** *ARC Centre of Excellence for Environmental Decisions, University of Melbourne;* **Rod Hitchmough**, *Department of Conservation;***David Chapple,** *Monash University*

**Life-history traits and extrinsic threats determine extinction risk in New Zealand lizards**

A species' vulnerability to extinction depends on extrinsic threats such as habitat loss, as well as its intrinsic ability to respond or adapt to such threats. We investigate the relative roles of extrinsic threats and intrinsic biological traits in determining extinction risk in the lizard fauna of New Zealand. Consistent with the results of previous studies on mammals and birds, we find that habitat specialization, body size and geographic range size are the strongest intrinsic predictors of extinction risk. However, our analysis also reveals that lizards that occupy areas with high levels of annual rainfall and are exposed to exotic predators and high human population densities are at greater risk. Thus, while the intrinsic traits that render species prone to extinction appear largely congruent across vertebrate taxa, our findings illustrate that both extrinsic threats and intrinsic traits need to be considered in order to accurately predict (and hence prevent) future population declines. Our predictions are currently being used by the New Zealand Department of Conservation to guide conservation rankings for poorly understood species, and to identify stable species that are prone to future decline.

**Tiwari, Brajesh,** *North-Eastern Hill University;* **Manjumani Tiwari**, *St. Mary's College. Shillong*

**Technological innovations in shifting agricultural practices by three tribal farming communities of Meghalaya, northeast India**

Technological innovations in shifting agricultural practices by three tribal farming communities of Meghalaya, northeast India B. K. TIWARI Department of Environmental Studies, North-Eastern Hill University, Shillong 793022, Meghalaya, India Abstract: Shifting agricultural practices of three tribes of Meghalaya viz., Khasi, Garo and Karbi were studied to analyze and understand the technological innovations adopted by these communities in this age old practice. The methods used for this study involved participatory data collection on the socio-economics, agricultural practices and bio-physical resources through Participatory Rural Appraisal (PRA), household survey and participatory resource mapping of the villages. The study was carried out in six villages viz., Khrang, War-War, Kuswai, Khulia, Chekwatgre and Sasatgre two each inhabited by Khasi, Karbi and Garo tribes respectively. It was observed that a variety of indigenous technological innovations have been introduced by these communities for making the system more productive, less degradative and able to generate cash income for modern living. The innovations include: use of cover crops, retention of trees, prudent management of weeds, use of poles and logs for soil conservation, introduction of cash crops and fallow management. Evolved and adopted by these communities through experiential learning, these innovations have ample potential of replication elsewhere.

**Tognelli, Marcelo,** *IUCN/CI Biodiversity Assessment*

**Freshwater biodiversity assessments in North America, and identifying priorities for conservation action**

Freshwater species in North America are, as a group, far more imperiled than terrestrial species. According to NatureServe conservation status ranks, 35-60% of freshwater fishes, amphibians, mussels, snails, crayfish, stoneflies, and mayflies are threatened with extinction, whereas no terrestrial group, including vascular plants, has more than 28% of its species listed as threatened. Moreover, freshwater species have already suffered far more documented extinctions than terrestrial species. Two decades of highlighting the plight of freshwater species in North America has placed them (even invertebrates) firmly on the conservation agenda. For example, virtually every State Wildlife Action Plan has freshwater mussels in their lists of species of greatest conservation need. Targeted conservation actions, such as habitat protection, riparian restoration, and dam removal are benefitting some species. However, a review of change in conservation status ranks indicates that these efforts are at best staving off extinction – conservation statuses for these species have not shown a tendency toward improvement. Examining current stressors to freshwater animals indicates that restoring hydrological flow regimes remains the most pressing need for their conservation. With climate change threatening to lower water quantity and quality even more, we must redouble our activities to protect freshwater species to prevent many more from slipping to extinction.

**Toline, Catherine,** *National Park Service;* **Alex Chow**, *Clemson University;***Xubiao Yu,** *Clemson University*

**Microplastics in the marine environment: Potential effects in US National Parks**

The annual global demand for plastics has consistently increased and is now estimated at approximately 245 million tons. Nearly a third of the plastic resin production is converted into consumer packaging material that include disposable single-use items commonly encountered in beach debris. A particular concern is the occurrence of smaller pieces of plastic debris including those not visible to the naked eye, referred to as microplastics, in the world's oceans. Ingestion of microplastics by microbiota, presents a very real problem. The concern is their potential for delivery of concentrated persistent organic pollutants (POPs), mainly those picked up from sea water, to the organisms . It is these dissolved POPs that are toxic. To begin to understand the threat of microplastics and associated contaminants on wildlife, we are developing the capacity to quantify, and sampling for, microplastics and selected contaminants across multiple marine parks, from remote to highly-urbanized. These data will provide the basis for identifying the need to increase focus on management of marine debris, monitoring and management of species particularly susceptible to effects of microplastics (e.g. shorebirds) and development of education and outreach materials to increase awareness of this threat to the environment.

**Tonra, Christopher,** *Smithsonian Conservation Biology Institute;* **Kim Sager-Fradkin**, *Lower Elwha Klallam Tribe;***Peter Marra,** *Smithsonian Conservation Biology Institute*

**Tracking Responses to Marine Derived Nutrients in Riparian Consumers in the Context of the Largest Dam Removal in United States History**

Man-made dams have had many deleterious environmental impacts throughout the world. In western North America, dams obstruct the main vector of nutrient subsidies to freshwater ecosystems from marine environments, salmon (Oncorhynchus spp). These subsidies have beneficial effects on recipient food webs. This has led to the removal or proposed removal of many dams, including the removal of two dams on the Elwha River, WA. To quantify the impacts of this unprecedented restoration, we are using stable isotopes (C, N) to track marine derived nutrients in a sensitive indicator of aquatic food web quality (American dipper Cinclus mexicanus). We examined impacts of salmon obstructions on body condition and migratory behavior. Stable-isotope ratios were more enriched in tissues from areas with intact salmon migrations, indicating greater consumption of salmon tissues and potential enrichment of invertebrate prey. Females breeding in areas with salmon migrations were in better condition and both sexes were more likely to occupy territories in fall. Juvenile dippers show the opposite trend in condition suggesting greater investment in reproduction in areas without salmon. Adult condition patterns were more pronounced behind anthropogenic, compared to natural, obstructions. These patterns indicate that dams have sizable, individual level impacts on aquatic consumers and provide a valuable baseline to track the recovery of this watershed following completion of dam removal in 2013.

**Toomey, Jim,** *Creator, Sherman's Lagoon*

**Large marine reserves as seen through the Eyes of Sherman the Shark**

For the past 20 years Jim Toomey has been writing and drawing the syndicated comic strip Sherman's Lagoon, which appears daily in over 150 newspapers. Through his cartoon, Toomey explores many ocean conservation issues and exposes his readers to odd forms of marine life and strange places. Using the ocean as a stage, he takes his characters far and wide. For example, Sherman and his friends have probed the depths of the Marianas Trench and hiked the Mid-Atlantic Ridge. They’ve visited hydrothermal vents and collected manganese nodules for fun and profit. Toomey has also taken his story line to many marine reserves, such as Papah?naumoku?kea, the Great Barrier Reef, and Monterey Bay, where his characters frequently involve the native marine life in their harebrained schemes. In his presentation, Jim will address the challenge of informing the public about marine conservation issues through cartoons, with a particular emphasis on his many story lines that are set in marine reserves.

**Torabi, Nooshin,** *RMIT University*

**Using Bayesian Belief Networks (BBNs) in modelling socio-cultural drivers of private landholders participating in biodiverse carbon plantings**

Carbon sequestration and biodiversity management are two synergistic global environmental initiatives that have the potential to help private landholders generate income while benefiting both climate change abatement and biodiversity preservation. To improve the outlook for biodiversity and meet the emission reduction abatement in Australia, an alteration in the management of agricultural landscapes will be necessary. Identifying the social and cultural drivers of private landholders who contribute to biodiverse carbon plantings can facilitate the success of bio-sequestration projects and biodiversity conservation programs. Bayesian Belief Networks (BBNs) have been applied as a decision support system to show the causal relationship. BBNs facilitate decision making process where policy makers have the chance to rationally choose between various actions, considering socio-economic and ecological outcomes. A social prototype has been built based on the literature review and experts opinion to explore the opportunities for higher participation of private landholders in biodiverse carbon plantings. The result reveals that strong social networks and availability of information are among those factors that impact the involvement of private landholders in such schemes. This reveals the areas that related policy design needs to be modified to tackle climate change and biodiversity degradation simultaneously.

**Tougas, Stephanie,** *Fordham University;* **Rose Carlson**, *Fordham University*

**Drivers of darter fish (Percidae) species composition in creeks and small rivers in Tennessee, USA**

Darters (Percidae) are benthic dwelling fish that inhabit small streams and are often used as bioindicator species in assessments of stream quality. Darters have small home ranges and specialized habitat requirements such as clean substrate and high flow. Darters are also sensitive to many factors associated with degraded aquatic habitats, particularly urban environments, such as high turbidity and temperature. Existing studies have analyzed urban-associated species composition changes at the fish community level, but few examine effects within one fish family. Identifying key anthropogenic stresses on composition changes within the darter family will shed light on how sensitive fish species are expected to respond to an increase in these stresses in an urbanizing landscape. My study analyzes drivers of darter composition of creeks and small rivers across ten sites, along an urban to rural gradient in Tennessee. I identified 22 darter species, with richness ranging from one to nine species. A multiple linear regression with richness as the response variable and dissolved oxygen, turbidity, water temperature and pH as explanatory variables revealed that the best predictor of richness was a model including both turbidity and water temperature. In addition, I am using GIS to analyze impacts of road and population density on darter composition and richness. These findings will help focus fish conservation efforts to avoid extirpation of sensitive species such as darters.

**Towns, Alexandra,** *Naturalis Biodiversity Center (section NHN), Leiden University;* **Tinde van Andel**, *Naturalis Biodiversity Center (section NHN), Leiden University;***Sofie Ruysschaert,** *Ghent University*

**The role of secondary vegetation in providing medicinal plants for women's health and childcare in Bénin, West Africa**

African conservation literature often frames the extraction of herbal medicine as an environmentally destructive activity. These medicinal plants, however, are frequently not classified into different vegetation types, leading to a misinterpretation of the pressure placed on the environment by their harvest and use. In Bénin, West Africa, plants are the main source of healthcare and women are the primary healthcare providers for women's and children's health. Does this plant extraction lead to resource decline? We investigated which vegetation type women access to harvest medicinal plants by conducting 92 questionnaires on women's and children's health among female herbal medicine merchants and urban and rural women. We also collected plant species and information on their vegetation type and cultivation status. Preliminary results reveal that 80% of the 370 collected species came from secondary vegetation and home gardens. The five most commonly cited species were: Ocimum gratissimum, Sarcocephalus latifolius, Securidaca longipedunculata, Citrus aurantifolia and Momordica charantia. Women who sold plants on the marketplace used more primary forest species than rural and urban women who harvested for personal use due their access to medicinal plants through trade. Since the majority of these plants are either cultivated or growing in human-altered vegetation, plant extraction for women and children's healthcare in Bénin can be considered a sustainable use of resources.

**Traill, Barry,** *Pew Environment Group-Australia*

**Protection isn't enough - the problem of too few people in the Outback. Managing a huge landscape to prevent extinctions.**

Outback Australia is one of the very few huge natural landscapes remaining on Earth. Its diverse tropical, arid and temperate ecosystems include enormous tracts of country which have not been directly impacted by industrial or agricultural activities. However, all its regions face ongoing high rates of extinctions of native plants and animals. In some regions threats to wildlife are posed by accelerating mining and associated water extraction, industrialization and fragmentation of habitat. However, Outback landscapes also face a suite of threats from a lack of active management, especially altered fire regimes and invasive feral animals and weeds. However, most of the Australian Outback now has fewer people residing and managing it than at any time in the last 50,000 or more years. Due to this lack of management many Australian plants and animals face ongoing declines and regional extinctions. Conservation in the Outback therefore requires both protective tenures and ongoing active management. Innovative new programs for Indigenous Rangers and improved management in national parks and privately owned reserves are providing a template for better management over Outback lands. These offer a way forward that works for wildlife, country and people.

**Traylor-Holzer, Kathy,** *IUCN SSC Conservation Breeding Specialist Group;* **Kristin Leus**, *Copenhagen Zoo - IUCN SSC Conservation Breeding Specialist Group (Europe Office);***Philip McGowan,** *Newcastle University;* **Robert Lacy**, *Chicago Zoological Society;* **Onnie Byers**, *IUCN SSC Conservation Breeding Specialist Group*

**Integrating Identification and Critical Evaluation of Ex Situ Management Options into Species Conservation Planning as Part of a One Plan Approach**

Climate change, increasing habitat loss, human activities, and other threats mean that more species are in need of some form of intensive population management in order to avoid extinction. In situ and ex situ communities can maximize their conservation impacts by working together to develop one overall plan with a common goal to conserve a species. A threats and viability analysis can identify potential conservation role(s) for ex situ management that can be evaluated for feasibility and effectiveness. Potential benefits offered by ex situ activities may include offsetting the impact of specific threats, preventing imminent extinction of vulnerable populations, and/or preventing species extinction through assurance populations or biobanks. IUCN is finalizing a revision of its guidelines for the use of ex situ management for species conservation, which outlines a five-step decision process that defines potential ex situ conservation roles, determines the type of ex situ activities needed to fulfill those roles, and identifies the feasibility, risks, and likelihood of success. These guidelines will be applicable across taxa and for situations in which ex situ management is or is not currently underway. By identifying and critically evaluating specific ways in which ex situ strategies can improve population viability or prevent extinction, ex situ management can be used more effectively as a conservation tool as part of an integrated approach to species conservation planning.

**Tredick, Catherine,** *San Diego State University;* **Rebecca Lewison**, *San Diego State University;***Douglas Deutschman,** *San Diego State University*

**Using citizen-scientists to monitor species trends and inform management of habitat connectivity in San Diego County, California, USA**

The San Diego Multiple Species Conservation Plan (MSCP) exemplifies the challenges of developing robust monitoring programs for multiple species across multiple jurisdictions. One of the primary goals of the MSCP is to maintain and monitor functional connectivity for wildlife. Although connectivity monitoring efforts have been in place since 1996, managers still struggle to answer whether preserved lands are functionally connected and whether certain species are declining in response to increased development. The San Diego Tracking Team (SDTT), a citizen-based volunteer organization, has collected extensive data on mammal tracks throughout San Diego County since 2000. We used these data to determine spatial and temporal trends in species occurrence and assess large-scale habitat associations and impacts of land use changes for tracked species (coyote, mule deer, bobcat, raccoon, gray fox, and mountain lion). Results showed significant declines in species occurrence for coyote, mule deer, raccoons, and mountain lions as well as significant differences in species occurrence across sites. Although trends were detectable using these data, our ability to infer drivers of those trends was limited due to the lack of fine-scale landscape and habitat covariates at sampling sites. We conclude by providing recommendations to improve the SDTT's protocol to better inform connectivity management and wildlife response to habitat fragmentation.

**Triska, Maggie,** *The University of Western Australia;* **Richard Hobbs**, *The University of Western Australia;***Michael Craig,** *The University of Western Australia;* **Vicki Stokes**, *Alcoa;* **Roger Pech**, *Landcare*

**Promoting reptile recolonization of restored mine sites in the Jarrah forest of southwestern Australia**

The jarrah (Eucalyptus marginata) forest in southwestern Australia is contained within a biodiversity hotspot; however there is limited knowledge about the distributions and habitat requirements of most of its native fauna. Mining and restoration in the region have created a mosaic of seral and mature forest. Native fauna species have been documented in the restored forest, but their continued use of these areas ultimately depends on their habitat requirements. We determined the habitat attributes of unmined forest influencing the occupancy of 5 native reptile species, in the family Scincidae, using data obtained at 35 unmined sites over 5 years. This information was used to create predictive occupancy maps and was compared with species data obtained in restored sites (3-20 years post restoration). Species generally occurred in restored sites less frequently than expected based on unmined preferences. This suggests that management of restored sites after initial planting is required to promote reptile recolonization. Recommendations, based on surveys and habitat models, for improving restoration and reptile return are species specific and include debris piles, thinning and increasing heterogeneity. Our study addresses 5 of the potential 26 native reptiles in the region due to low detection rates, and thus provides an initial study into improving restoration to maintain reptile diversity and highlights the need for research on the less common or cryptic species present.

**Tucker, Kimberly,** *Stevenson University;* **Clayton Hurd**, *Haas Center for Public Service, Stanford University;***Jan Mackinnon,** *Georgia Department of Natural Resources Coastal Resources Division;* **Keith Johnson**, *Stevenson University;* **Amber LaPeruta**, *Stevenson University;* **Steven Arbitman,** *Stevenson University*

**Connecting Students and Communities to Conservation through Service-Learning**

Conservation of natural areas frequently requires volunteer assistance. Volunteers gain from these experiences, but do not always learn much. By integrating Service-Learning into course curricula, students learn about the science going into conservation planning and restoration projects. Three examples of courses will be presented. Marine Biology, focused on the ubiquitous problem of marine debris by examining the path of trash to the Chesapeake Bay. Students in this course collected data about trash along the Jones Falls Watershed and shared that information with the community. A second course, Science of the Chesapeake Bay, is a course for non-science majors. Students in this course partnered with a local homeowners association, preparing seeds, growing plugs, and beginning a pilot study for a shoreline restoration project. The service component was completely integrated into the curriculum for the third course, Conservation Biology. This course focused on coastal conservation, but specifically focused on monitoring the ecological relationship between the Spartina marsh ecosystem and the eastern oyster. Students worked directly with the Georgia Department of Natural Resources, gaining valuable experience, while providing manpower and data. These types of courses can provide hands-on learning about scientific principles, opportunities for learning about conservation organizations and their functions, and directly connect students to their community and natural environment.

**Tulloch, Ayesha,** *Centre for Biodiversity & Conservation Science;* **Hugh Possingham**, *Centre for Biodiversity & Conservation Science;***Liana Joseph,** *Wildlife Conservation Society;* **Joe Bennett**, *Centre for Biodiversity & Conservation Science;* **Martina Di Fonzo**, *University of Queensland;* **Will Probert,** *Centre for Biodiversity & Conservation Science;***Richard Maloney**, *Science and Technical Group*

**The Conservation Manager's Dilemma: Save more species with higher risk of management failure or fewer species with greater chance of succeeding?**

Conservation managers charged with designing and implementing threatened species management decisions in an uncertain world, face a dilemma: Should they invest in actions that result in small but certain gains or invest in actions with a higher risk of failure but greater potential benefits? By exploring levels of possible risk aversion of a management agency and using these as thresholds, we demonstrate how a decision can be selected that either (a) maximises expected returns for a given level of risk, or (b) minimises the risk of a decision for a given expected return. We examine two different approaches and a range of risk aversion thresholds to explore the consequences of investing in projects with uncertain outcomes, using a case study of managing threatened species in New Zealand. We define benefits in three ways: (a) total number of species managed, (b) representation of taxonomic groups, and (c) pooled extinction risk of species selected for or excluded from management. The species selected differ depending on the management objective, and on the way in which benefits are defined, highlighting the importance of clear objectives in the decision-making process. Accepting high risk selects more species for management, which are more likely to go extinct without management. Low risk tolerance prioritises more costly species with lower extinction risk and taxonomic diversity. We discuss how managers can best identify thresholds where the risk-return trade-off is balanced.

**Tulloch, Vivitskaia,** *ARC Centre of Excellence in Environmental Decisions;* **Hugh Possingham**, *ARC Centre of Excellence in Environmental Decisions;***Stacy Jupiter,** *Wildlife Conservation Society;* **Chris Roelfsema**, *Biophysical Remote Sensing Group;* **Ayesha Tulloch**, *NERP Environmental Decisions Hub;* **Carissa Klein,** *Australian Research Council Centre of Excellence for Environmental Decisions*

**Designing robust marine reserves under uncertainty: trading off socio-economic costs against the risk of failing to meet conservation targets**

Conservation planners should consider uncertainty associated with ecological data to minimize their effects and make informed decisions. Maps of conservation features are subject to high error, though this is rarely accounted for in conservation decision-making. We present a novel reserve design method that accounts for uncertainty in coral reef habitat data from the Kubulau fisheries management area, Fiji, balancing ecological and socio-economic objectives, and trading-off important attributes of conservation planning: risk, representation, and cost. We use the probability of occurrence of each habitat (mapping accuracy), derived from remote sensing data, to design marine reserve networks with a high chance of protecting every habitat. We compare this with a standard reserve design approach, and present 4 key results: 1) including mapping accuracy changes the location of priority conservation areas, with errors of omission and commission likely if mapping accuracy is ignored; 2) reserve networks with a high chance of protecting all habitats cost more, but are less risky as they are unlikely to miss representation targets; 3) less costly reserve networks are possible if we triage low accuracy habitats; and 4) increasing the probability of all habitats meeting targets from 50% to 99% would cost fishers less than an estimated 1% of their total income. Uncertainty should be explicitly accounted for in all decisions to maximize the chance of successful conservation outcomes.

**Tumas, Hayley,** *University of Maryland;* **Maile Neel**, *University of Maryland;***Brittany West Marsden,** *University of Maryland;* **Katia Engelhardt**, *Appalachian Laboratory*

**Determining the Effect of Water Quality Goals on Submerged Aquatic Vegetation Growth and Ecosystem Benefits**

Pollution has reduced submersed aquatic vegetation (SAV) in the Chesapeake Bay to a fraction of its historic abundance and distribution. SAV serves important ecological functions in the Bay, providing food and habitat to other species and affecting nutrient cycling, sediment stability, and shoreline erosion. The Environmental Protection Agency recently established Total Maximum Daily Load values for pollution levels that are predicted to increase SAV distribution by improving water clarity. We used the dioecious SAV species Vallisneria americana to determine the effect of water clarity on growth rate, expansion rate, and ecosystem benefits. Individuals from three genetic regions within the bay were grown in the target TMDL water clarity level and two levels above to measure growth, sexual and vegetative reproduction, and palatability which affect ecological function. We found that water clarity does not affect plant presence (X2=4.62, p=0.099), but caused a significant difference in horizontal expansion (ramet production, F=4.8, p=0.009) and vertical growth (leaf length, F=7.69, p=0.00061). A light level above the TMDL target had the greatest horizontal growth. Among treatments, the source population, sex, and genotype affected horizontal growth and genotype affected vertical growth. Our results will determine the effectiveness of current pollution restrictions and help to inform the public about the importance of the TMDL.

**Turner, Sara,** *Mercyhurst University;* **J. Campbell**, *Mercyhurst University*

**Genetic characterization of brown bullhead populations with skin tumors from Lake Erie**

Fish health can be a key indicator of ecosystem health, with fish species such as the brown bullhead (Ameiurus nebulosus) serving as sentinels of environmental quality. Decades of fish sampling to monitor tumors in brown bullheads in Lake Erie have not yet successfully identified the cause of external tumors in this sentinel species, and the unresolved issue remains a stumbling-block in delisting Great Lakes Areas of Concern. A general explanatory model and review of potential causes of external tumors in brown bullhead indicate possible involvement of microbial and other agents, as well as genetically-based immunodeficiencies. We summarize progress to-date in the development of genetic markers and genetic characterization of brown bullhead (with and without tumors) from Lake Erie sites presenting varied histories of environmental degradation.

**Tutupoho, Shelly,** *University;* **Makoto Tsuchiya**, *University*

**Microhabitats provided by burrower sea urchin Echinometra mathaei**

Sea urchin Echinometra mathaei is a burrower species that excavates limestone to live inside after they settle from larval stage. Niche sharing inside sea urchins' burrows with some other species has been well-known. Interestingly, based on various researches, Okinawan Echinometra mathaei should be divided into 4 types: Type A, B, C, and D, which the last three types are burrower and the first one is not. The associated fauna of 3 habitats (Type A as non-burrower sea urchin, Type B as burrower sea urchin, and burrow without sea urchin) were compared in this study. Not less than 29 species were found in 303 unit habitats. Species richness of fauna found in burrow without sea urchin was the lowest, whilst that of non-burrower and burrower sea urchin was not significantly different. This result revealed that instead of the burrow, even the sea urchin itself takes a role as habitat for their associates. As the conclusion is that the presence of sea urchin Echinometra mathaei is important in preserving biodiversity.

**Tyre, Drew,** *University of Nebraska-Lincoln*

**Stepping out of the Ivory Tower while still calling it home: tales from the trenches**

There is widespread belief that solving the pressing environmental issues of our time requires the participation of academics from all disciplines. However, carving out a life in the Ivory Tower means meeting the expectations of colleagues, chairs, directors, deans and all the rest. It is not obvious how helping to solve a real-world problem can translate into the kudos needed to achieve tenure and promotion. So how to do it? What are the tips and tricks of the trade that allow you to follow your heart and save the world, while still ensuring success in the Ivory Tower? I'll distill the experiences of some of the world’s most successful conservation academics, along with my own experiences, to get the conversation started.

**Ubeda, Armando,** *LightHawk;* **Jonathan Milne**, *LightHawk*

**Aerial perspective, a useful tool to understand large-scale environmental issues and bring stakeholders together for successful conservation campaigns**

Large-scale environmental issues, patterns and processes are difficult to understand and visualize. The larger the spatial scale of an issue, the more challenging it is to effectively monitor, manage and address. Larger-scale issues affect more species and habitats, and require more detailed and up to date information to attend them. Problems affecting larger areas must be considered in a larger context often occurring across jurisdictional and ownership boundaries, requiring an integrated approach to obtain successful results. With the use of the aerial perspective much can be accomplished including but no limited to: 1) a better understanding of the interconnections between species and habitats, 2) comprehensive monitoring of vast and remote areas from a small plane is cost effective and requires less time, 3) threats and opportunities can be identified, documented and presented to the public more effectively. From the air, political boundaries are invisible, providing an excellent opportunity for stakeholders to reach consensus, find solutions and opt for better conservation practices. This presentation will focus on two cases studies (Klamath River Basin in OR, USA and the Delta of Rio Colorado in Mexico) where the use of the aerial perspective has been instrumental in leading successful and collaborative conservation campaigns.

**Underwood, Jared,** *U.S. Fish and Wildlife Service;* **Mike Silbernagle**, *U.S. Fish and Wildlife Service;***Mike Nishimoto,** *U.S. Fish and Wildlife Service;* **Kim Uyehara**, *U.S. Fish and Wildlife Service*

**Managing Conservation Reliant Species: Hawaii's Endangered Endemic Waterbirds**

Hawaii's coastal plain wetlands are inhabited by five endangered endemic waterbird species. These include the Hawaiian Coot, Hawaiian Duck, Hawaiian Stilt, Hawaiian Gallinule (Moorhen), and Hawaiian Goose. All five species are categorized as being "conservation reliant". The current strategy to recover these endangered birds includes land protection and active management. To assess the effectiveness of the current management paradigm, we compared species population trends across the state to those on six actively managed wetland National Wildlife Refuges (Refuges) thought to be critical for the survival of these endangered species. To perform the evaluation we relied on systematic semiannual population counts that have been conducted across most wetlands in the state and monthly population counts have occurred on the six Refuges during the same time period. We found that statewide and Refuge populations of these five endangered bird species have rebounded from historic lows and over that last 20 years have slowly increased or remained stable. We also documented that Refuges are important to each species year-round and that a disproportionate percentage of the population for each species is found on them. Our understanding of why Refuges successfully house a disproportionate percentage of these "conservation reliant" species can inform current conservation efforts and increase long-term population viability for these species.

**Valdes, Sally,** *Bueua of Ocean Energy Management, The U.S. Department of the Interior*

**The Bureau of Ocean Energy Management's Avian Research in the Western Atlantic**

The Bureau of Ocean Energy Management (BOEM) manages offshore energy development in federal waters, including wind development. To prevent or minimize potential impacts to birds from wind development on the Atlantic Outer Continental Shelf (OCS) it is important to understand how birds use the Atlantic OCS and synthesize this data for environmental assessments and decision-makers. In furtherance of this goal BOEM's Environmental Studies Program has supported a number of avian studies. Many were developed and implemented through partnerships?find out how you might become involved. Examples include: shipboard seabird surveys (with National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (FWS), U.S. Geological Survey (USGS), the Manomet Center for Conservation Science, and the College of Staten Island/City University of New York); a pilot study of aerial, high-definition imagery surveys; a joint, multi-year survey effort for marine protected species, including seabirds, along the East Coast with NOAA and FWS; development of automated analysis of bird vocalizations recordings; a study on potential interactions of endangered, threatened and candidate bird species with offshore wind including tracking of red knots; and a database that compiles georeferenced seabird and shorebird information for the entire Atlantic Coast (with USGS, FWS and others), including data from above-mentioned studies.

**Vale, Cândida,** *CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da UP;* **Stuart L Pimm**, *Duke University;***José C Brito,** *CIBIO/InBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos da UP*

**Micro-hotspots of biodiversity within hostile environments: the case of mountain rock pools in the Sahara desert.**

The world is undergoing exceptional biodiversity loss, particularly in biodiversity hotspots. Most conservation efforts target these areas of exceptional endemic richness. Their identification is often carried at global/continental scales, thus likely missing regional patterns and small sized rich areas, i.e. local hotspots. The Sahara desert provides an excellent example. Generally, it is a species-poor area, but locally it exhibits high species richness in small and fragile humid habitats, like mountain lagoons. In Mauritania, recent studies have emphasized the conservation importance of these habitats, as they hold endemic fauna and range-margin populations of widely distributed species. We identified micro-hotspots of biodiversity, where high concentrations of species are threatened by human pressures and/or climate change, located in mountain rock pools (locally known as gueltas) of Mauritania (West Africa). The size of gueltas ranges between 0.001 ha and 1.0 ha and they concentrate about 36% of all Mauritanian vertebrates. The seasonal character of these habitats and relatively intense human use threatens biodiversity. Gueltas are crucial for long-term conservation of Mauritanian biodiversity. The patterns identified may be representative for all mountains of Sahara desert, where high concentrations of species are expected to be found in restricted and small sized gueltas. Such features constitute micro-hotspots of biodiversity deserving global attention.

**Vale, Mariana,** *Departamento de Ecologia Universida*

**Importance and Challenges for Roadless Areas in Latin America and the Caribbean**

We provide an overview of roadless areas in Latin America and the Caribbean, identifying both where they are and the threats that they face. We then discuss limitations of the Google Maps dataset with respect to identifying roadless areas in the region. Not surprisingly, the main roadless areas coincide with some of the region's known wilderness areas: Honduras/Nicaragua border, the Amazon, the Atacama Desert, and Patagonia.The Amazon is specifically important, housing the largest tracks of roadless tropical rainforestsin the world, with ca. 84% of its area (~5,420,000 km2) at least 50 km away from a major road. In the Amazon, as in other tropical rainforests worldwide, the main threat from roads is not direct impact on wildlife such as road kills, but the access that roads provide to pristine areas, which catalyzes uncontrolled colonization. To measure adequately the “roadless” character of the region, what is needed is not a map of roads per se, but rather a map of access routes. Current data for the region are deficient in this regard, failing to capture the actual status of existing roads and in adequately incorporating river access, which is crucial for a region such as the Amazon.

**Van Burm, Els,** *University of Melbourne;* **Michael McCarthy**, *University of Melbourne;***Geoff Heard,** *University of Melbourne*

**Retrospective study of monitoring design to inform management of the endangered growling grass frog (Litoria raniformis) in Melbourne, Australia**

Decision makers in conservation biology often have to make trade-offs about how to spend resources while dealing with considerable uncertainty. This uncertainty can be reduced by gathering more information about the system through monitoring. However, this extra knowledge does not always contribute to better decision making, meaning that resources spent on monitoring could have been spent elsewhere. This study investigated the case of creating new wetlands in Melbourne, Australia. These wetlands were created to offset urbanisation by reducing the extinction risk of an endangered frog (Litoria raniformis). The management question was to determine the number of new wetlands that need to be created to offset losses due to urbanisation. A stochastic patch occupancy model was used to describe the metapopulation dynamics of the frog. We investigated whether gathering more information about these dynamics contributed to the optimal decision. A simulation was run using different amounts of data and assuming particular costs for data collection and wetland creation. Results show that increasing the amount of data does not always change the estimate of the optimal number of extra wetlands. With this case study we conclude that the benefit of increasing the knowledge about a system will not always outweigh the cost of gathering the extra information.

**Van Vleet, Eric,** *Florida International University*

**A Sub-regional Study of Forest Conservation in Seven Communities in the Sierra Norte of Oaxaca, Mexico**

The Sierra Norte of Oaxaca (SNO) is an often targeted area for systematic conservation planning because of its high biodiversity and absence of formal reserves. The sub-region is a part of the Mesoamerican Pine-Forest Ecoregion with the World Wildlife Fund. Conservation International has named the sub-region as a Mesoamerican Forest hotspot as well as a hotspot for Madrean Pine-Oak Forests. Regionally, communities on two separate occasions in the Sierra Norte have democratically voted against the creation of Biosphere Reserves that would have included their community lands. Yet, despite their refusal of government reserves, this sub-region of SNO composed of seven communities has maintained high forest cover from 78% to 95% on communal forest lands despite widely varying land uses, settlement patterns, economic marginalization, population densities and long historic habitation. The study communities are analyzed by classifying them into four pathways that have all resulted in high forest cover: 1) successful community forest management and economic diversification 2) Farming communities with large territories and smaller areas of community forest management 3) Farming communities in tropical forests without community forest management and 4) Small, recently established farming communities in tropical forests.

**Vance-Borland, Ken,** *The Conservation Planning Institute*

**How might insights gained from stakeholder network analysis be integrated into conservation decision-support tools?**

Social networks play an important role in facilitating effective and sustained connections between regional systematic conservation plans and local conservation actions. Yet, social network analysis has not been incorporated into conservation planning initiatives, even though social network analysis has developed as a structured approach to identify characteristics of social networks that make them more or less effective at solving resource management problems. We discuss three contributions of social network analysis to conservation planning: (1) identifying stakeholders and their roles in social networks and characterizing relationships between them; (2) designing and facilitating strategic networking to strengthen linkages between local and regional resource management; and (3) prioritizing management and conservation actions using social connectivity measures alongside ecological data. Using data on coral reef areas in the Solomon Islands and a measure of the network centrality of NGOs operating in those areas, we found that Marxan identified high-biodiversity areas that were more likely to gain conservation implementation considering the network connections of NGOs working there. We propose that social network analysis can be a valuable tool to inform decision making in conservation planning, and identify challenges and future research questions to be addressed before social network analysis can be fully operationalized into conservation planning processes.

**Vargas-Rodriguez, Renzo,** *Departamento de Biología, Universidad de La Serena, IEB, CEAZA.;* **Francisco Squeo**, *Departamento de Biología, Universidad de La Serena, IEB, CEAZA.*

**New population estimations and the recategorization of the threatened Borrowing parrot: implication for conservation**

The Species Classification Regulation (CER) of Chile, offers protection to species, subspecies and significant population segments of vertebrate species at risk to allow to the Agriculture and Livestock Service (SAG) to manage in a flexible and pragmatic way the threatened species. The Burrowing parrot is considered a vulnerable species (VU) in its southern distribution range and as Endangered (EN) in its northern range. We perform an assessment of the population status of the species in the northern end of its distribution by focusing on monthly census in the cliffs of breeding colonies and foraging sites from 2010 to 2012 and compared with past census periods (1987-1990 ). The population sizes are significantly higher than those recorded in the past (1987-1990: 109.7 ± 39.4 vs. 2010-2012: 950.7 ± 303.5), reaching over 1200 individuals in the most important reproductive cliffs in the area during 2012. This and other studies would realize a population greater than 2700 individuals in the northern distribution range of the species which would merit a change in status from EN to VU. Currently, the restrictions to work with endangered species, imposed by SAG, prevent even conducting research necessary for the conservation of the species. The status change would allow greater flexibility in the application of the norm and allow the research necessary to facilitate the conservation of the species in its northern range

**Vargo, Tim,** *Urban Ecology Center*

**Using Citizen Science and community partnerships as tools for studying urban stopover habitats in Milwaukee, WI**

Migratory birds utilize a variety of stopover habitats while on migration between their breeding and wintering grounds. One important set of habitats that are often neglected in these investigations, however, are those which fall within urban areas. These urban habitats include parks, disturbed habitats, residential areas, and natural areas. The Milwaukee BIOME (Biodiversity Monitoring and Education) project is a community partnership that formed to assess habitat use and quality of urban green spaces in Milwaukee County as stopover sites for migratory birds and bats. Over the course of seven years, the project has been successful in tapping into community networks and resources to provide quality research and monitoring experiences for close to 1,000 volunteers. The latest phase of this project has been to identify available resources such as e-bird and citsci.org and community partners such as the Urban Ecology Center, the University of Minnesota's Driven to Discover project and the Citizen-based Monitoring Network to provide opportunities for citizen scientists of all ages to analyze, visualize and present data. This presentation will look at the Milwaukee BIOME project as a case study in best practices for engaging the public in academic and applied research.

**Vasques, Jason,** *Coral Reef Alliance*

**Considerations in developing credible and useful ecosystem health and management effectiveness report cards**

Marine resource management includes the difficult task of weighing conservation and social needs resulting in decisions that affect natural resources and people’s livelihoods. Therefore, management decisions must be based on the best available information. However, with increasingly complex pressures like climate change, ocean acidification, sea level rise and the widespread effects of overfishing, and a rapidly growing pool of data on how marine ecosystems function, interpreting the best available information for decision making can prove daunting if not outright paralyzing. Ecosystem health report cards are increasingly touted as the path forward for science informed decision making. However, designing and developing an effective report card is a complex undertaking. In this presentation I will introduce the overarching theme of this symposium and highlight some of the important considerations in report card development, including process steps, expert selection, policy drivers, and communications tools. This talk provides the framing for exploring successes and failures in report cards from around the world.

**Venter, Michelle,** *School of Earth and Environmental Sciences, James Cook University;* **Micheal Bird***, School of Earth and Environmental Sciences, James Cook University;* **Wouter Dieleman***, James Cook University;* **Anurag Ramachandra***, Conservation International ;* **David Gillieson***, School of Earth and Environmental Sciences, James Cook University*

**Looking beyond avoided deforestation to realistic land-use options for REDD+ in Papua New Guinea**  
Reducing emissions from Deforestation and forest Degradation (REDD+) is one of the most promising strategies for mitigating future climate change. While most of the mechanism's proponents and supporting scientists have focused on avoiding deforestation, other complementary land management options exist in tropical landscapes. In this study we explore the full suite of options for communities surrounding the YUS conservation area in Papua New Guinea to participate in REDD+. To do this, we combine a time series analyses of land cover change with field measurements of vegetative and soil organic carbon across an extensive network of primary forest plots and anthropogenic land-uses. We find that while 80% of biomass and soil carbon is stored in primary forest, deforestation in the area is minimal and therefore avoided deforestation has limited carbon potential. Instead we discovered that anthropogenic land uses could actually yield high carbon sequestration outcomes. In particular, assisted natural regeneration of grasslands could deliver high carbon benefits and appears feasible given existing local expertise. On the other hand, shade coffee plantations yield positive carbon benefits and provide high community co-benefits by giving access to coffee market revenues. Our findings indicate that global climate objectives can be attained through natural and working tropical landscapes, but comprehensive analyses of land management options is required to identify workable options.

**Veit, Peter,** *World Resources Institute*

**Legal Frameworks for Land Use in East Africa**

In Africa, most land and many natural resources are the property of the state and/or vested in the government for the people. Governments have established separate, distinct rights regimes for land and many resources (e.g., oil, natural gas, minerals and wildlife), governed by different laws and administered by various institutions. Rural people may legally hold a relatively small bundle of land rights—usually limited to surface rights and some rights to certain natural resources (e.g., water rights for domestic use only). Often, rights to high-value natural resources are allocated to outside, foreign entities for large-scale operations. As a result, rights to various resources on/under a plot of land may be held by various individuals and entities. As governments promote economic development through private investments in their natural resources, instances of overlapping land and natural resource rights have become more common. Overlapping rights are a growing source of rural conflict as rights holders pursue sometimes contradictory land use practices. We provide a legal review of mineral and petroleum laws in Liberia, Ghana, Uganda and Kenya to assess the authorities of resource holders operating on private land and the rights of landholders. We provide some comparative analyses across the two natural resources and across the research countries. The recommendations are designed to reduce conflicts over land use and better secure the wellbeing of landholders.

**Venter, Oscar,** *James Cook University*

**The Human Footprint: A contemporary and prospective**

As the human population becomes larger, wealthier and more sophisticated, the pressures we exert on the natural environments around us expand and intensify at pace. Understanding the current state of these influences, as well as how they have changed in the past and might be expected to change in the future, is a fundamental prerequisite for making informed decisions about how and where to protect our remaining natural areas. Here, we present an update to the human footprint map and its complement, the last of the wild. These maps give us a quantitative metric to measure and visual at the global scale the impacts of humans on nature for the approximate periods of 1990, 2000 and 2010. By comparing across these periods we are able to identify the places on the globe that have been most significantly impacted over the last two decades, and areas that still remain largely ‘wild’. Some of this observed change is due to true expansion of human impacts, while some can be attributed to improvements in the data products that describe our understanding of these impacts. We use complementary data on economic trends to tease apart these phenomena. Using a statistical description of the observed changes in the human footprint from 1990 to 2010, we are able to project the human footprint into the future, and highlight which of the planet’s last while areas are most at risk of being lost in the future to expanding human impacts.

**Veríssimo, Diogo,** *Durrell Institute of Conservation and Ecology, University of Kent;* **Greg Vaughan**, *Geospatial Services;***Douglas MacMillan,** *Durrell Institute of Conservation and Ecology;* **. .**, *.*

**Money talks: Understanding the drivers of online donations for conservation**

Funding constrains have traditionally limited conservation interventions, with most organizations relying on individual donations as their key fundraising strategy. The WWF, for example, raised through this system in 2011, more than US$ 415 million, about 53% of its total income. As such, an understanding of what drives individual donations is key to improve fundraising for conservation. One popular system of capturing individual donations is through symbolic animal adoptions. In this context, we set out to understand what were the factors driving animal adoptions on WWF-US website. To achieve this, we used a four year dataset on adoptions of 104 species. We used best-subsets regression and AICc values to identify the strongest model, which explained about a third of the variation in donations to different species. Species physical attributes such as appearance and body size played an important role in driving donations, with more attractive but smaller bodied species receiving more donations. Another key was the amount of online coverage that WWF-US dedicated to a species, with more coverage leading to an increased in donations. Lastly, the number of similar species within the dataset was also an important factor, with more distinctive species receiving more donations. This study is one of the first to investigate the drivers of real monetary donations to conservation, showing that both flagship species and marketing strategy can be crucial to fundraising.

**Verschuuren, Bas,** *Sacred Natural Sites Initiative*

**The right to say NO! - Traditional guardians of sacred sites, scientific research, ethics and protocols**

**Veysey Powell, Jessica,** *University of New Hampshire;* **Kimberly Babbitt**, *University of New Hampshire*

**What Size Buffer? Using a Landscape-Scale Experiment to Test How Buffer Width Affects Pool-Breeding Amphibian Demography**

Forested buffers are a common management tool for pool-breeding amphibians in eastern North America, yet the demographic consequences of buffer size have not been experimentally tested. We used clear cuts to manipulate buffer width at 11 vernal pools in central Maine. We assigned each pool to one of three treatments: uncut (i.e., reference), 100m buffer, or 30m buffer. From 2004 to 2009, we captured all adult spotted salamanders (Ambystoma maculatum) and wood frogs (Lithobates sylvaticus) using these pools. We assessed the relative importance of buffer treatment and other factors on abundance, recapture rates, sex ratios, and size. Buffer treatment affected salamander abundance, but pool hydroperiod mediated treatment effects. Wood frog abundance increased with mean hydroperiod across all treatments. For both species, the proportion of recaptured adults was lowest at 30m pools. Salamander sex ratio increased post-cut at both cut treatments, while frog sex ratio did not vary with treatment, year, or hydroperiod. Salamanders and frogs were smallest at 30m pools. Salamander, but not frog, recapture rates and size recovered with time. Our clear cuts were associated with short-term negative demographic consequences for these species, with 30m-treatment populations experiencing the most severe impacts. Conservation plans for these species should address both buffer width and pool hydroperiod.

**Villamagna, Amy,** *Virginia Tech;* **Paul Angermeier**, *2U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit;***Beatriz Mogollon,** *Virginia Tech*

**Collateral benefits of conservation: a comparison of ecosystem services provision on public and private conservation lands**

Public lands traditionally have been the primary focus of biodiversity conservation, but does this approach sufficiently protect the capacity for and flow of ecosystem services (ES) for people across the broader landscape? Conservation easements on private lands provide an alternative approach that may be equal in magnitude to public land conservation (acre for acre), but has the potential to deliver benefits to more people due to their proximity to human population centers. However, individual easements are smaller and may be closed to the public, which limits the capacity for some services (e.g. recreation). Using GIS, spatially-explicit ES models, and publically available data on land conservation and human population, we compared measures of ES capacity and demand between traditional public conservation areas (national wildlife refuges, parks and forests) and private conservation easements in Virginia. We estimated the relative value of both conservation approaches based on the services provided and the number of people potentially affected. Our focal ES include surface water production, groundwater protection, riparian filtration, recreational fishing and birding. We found that conservation easements protect critical services in areas where public conservation is no longer an option and discuss a strategy for enhancing ES conservation through easements in areas facing already high and increasing service demand.

**Visconti, Piero,** *Microsoft Research*

**Perfect policy, imperfect implementation - balancing efficiency and likelihood of implementation in conservation planning**

Systematic conservation planning focuses on optimizing trade-offs between conservation objectives and human activities. However, the most efficient plan can be very dissimilar to any other plan achieving the set of conservation objectives. This is problematic if all or part of the plan becomes unattainable, e.g. if sites are lost before they are acquired, and there are no replacement sites available. We demonstrate this by solving different conservation problems and showing in which conditions the optimal plan has limited chances to be implemented and where implementation attempts would miss the objectives. To balance optimality and likelihood of implementation we propose a new method for identifying conservation priorities and scheduling conservation actions. We generate a family of alternative plans and select that with the highest density of nearby plans in a non-metric multidimensional scaling space (i.e. plans with similar site composition). When perfect implementation is uncertain - a common reality - our method outperforms both all other heuristics tested and stochastic programming in terms of likelihood of achieving objectives and similarity of the conservation plan implemented with the plan intended. Our method can assist planning authorities to prioritize conservation efforts in the face of uncertainty about future sites' condition and availability.

**Viyakarn, Voranop,** *Chulalongkorn University;* **Suchana Chavanich**, *Chulalongkorn University;***Daiki Nomura,** *National Institute of Polar Research;* **Kentaro Watanabe**, *National Institute of Polar Research*

**Potential changes of feeding behaviors of Antarctic fish at Syowa Station, Antarctica**

Feeding habit of an Antarctic fish Trematomus bernacchii under the fast ice around Japanese Syowa Station was investigated between the summer of 2004/2005 and 2009/2010. This fish is a dominant species in the coastal water of the Antarctic continent. However, little information was known on temporal changes in the diets of T. bernacchii under the changes of the climate in the northeastern part of Antarctica. The results showed that amphipods and krill were the major prey items. However, there was a significant difference in the proportions of larger invertebrates such as crabs, squids, and octopus found in the fish stomachs between 2009/2010 and the previous years. Moreover, the percentage of amphipods and krill in the fish stomachs was decreased during the 5-year period in all fish size classes. In addition, more ectoparasites were observed on fish samples collected during 2009/2010 expedition. Several factors including sea ice melting, habitat and environmental changes may influence the pattern of feeding behavior of the Antarctic fish.

**Vogel, Sandra,** *University of New South Wales;* **Jennifer Sinclair**, *University of New South Wales;***William Sherwin,** *University of New South Wales*

**A range-wide conservation genetic study of Little Penguins (Eudyptula minor): Augmenting population genetics at neutral loci with adaptive immune gene**

Neutral genetic markers, i.e. genes not directly targeted by selection, are frequently used to quantify genetic diversity of populations and often provide the basis for management plans. However, patterns of variation and divergence in adaptive traits such as immune competence are not always correlated with variation in neutral markers. The validity of approaches using only neutral markers for development of conservation strategies is therefore questionable. The present study of conservation genetics and demography in E. minor aims to assess connectivity between penguin colonies along the Australian coast of New South Wales (NSW). A fine-scale analysis of genetic structure is being conducted to determine the extent of dispersal among these colonies and compare their genetic variability. In addition to using neutral genetic markers (microsatellites and mitochondrial DNA), we present the first study investigating non-neutral genetic diversity in penguins. Sequencing of an immune gene of the major histocompatibility complex (MHC) showed high allelic diversity at the functionally relevant peptide binding groove of the MHC molecule in penguins from Western Australia (WA). It is thus an ideal candidate gene to augment the population genetic study in NSW. This new genetic marker will be used to facilitate the choice of management strategies for E. minor and related species with a particular focus on resilience to pathogenic threats and immunogenetic population viability.

**Vogler, Donna,** *State University of New York- Oneonta;* **Eamonn Hinchey**, *State University of New York- Oneonta*

**Early Detection and Rapid Response to the Invasive European Marsh Thistle, Cirsium palustre L. (Asteraceae)**

The European Marsh Thistle, Cirsium palustre, is an invasive species first reported in New York in 1994. By 2005 it appeared to be spreading to natural wetlands and agricultural lands. The goals of our study were 1) to document current distribution and population sizes using the iMaps database system, 2) to predict the speed and potential direction of spread into other areas of the State, and 3) develop a control protocol. Our maps reveal several prime areas for invasion in the northern Catskills and in the southern Adirondacks. An EDRR protocol involved volunteers and included experimental cutting at or after flowering at five sites. A demographic study revealed this monocarpic species is not a true biennial, but lives 2-5 years in the rosette stage prior to flowering. Population surveys of life stages indicated this approach may be useful to distinguish new populations with uneven life stage distributions from entrenched populations with stable age distributions and more accurately define the leading edge.

**Von Holle, Betsy,** *University of Central Florida;* **John Weishampel**, *University of Central Florida;***Jennifer Irish,** *Virginia Polytechnic University;* **Scott Hagen**, *University of Central Florida;* **Annette Spivy**, *University of Central Florida;* **Monette Schwoerer,** *University of Central Florida*

**Investigation of the effects of sea level rise on sea turtle, shorebird, seabird, and beach mouse nesting within the South Atlantic Bight**

Sea level rise (SLR) and disturbances from increased storm activity are expected to diminish coastal habitats available for sea turtle, seabird, shorebird, and beach mouse nesting by removing habitat as well as inundating nests during critical incubation periods. The goal of our research is to evaluate past nesting patterns of fourteen coastal nesting species and predict future effects of sea level rise on nesting beaches along the South Atlantic Bight. Our study links long-term survey data for three species of sea turtle, three species of shorebird, five species of seabird, and two beach mouse species to maps of coastal vulnerability to sea level rise (SLR) in order to understand the effects of sea level rise on population viability. First, we will present habitat suitability maps for coastal nesting species along the South Atlantic Bight. Second, we will integrate a model of future SLR along with long term field biological observations in order to predict vulnerability to nesting habitat loss for sea turtle, seabird and shorebird, and beach mouse species within our study region. Maps of coastal vulnerability to SLR combined with historical data sets of long-term and spatially extensive nesting habitat will lead to models that enhance our understanding of the complex environmental changes occurring from global climate change and their effects on globally imperiled species.

**Wainger, Lisa,** *Chesapeake Biological Lab*

**Overcoming barriers to restoring multiple ecosystem services in the Chesapeake Bay**

Solving one environmental problem at a time can be costly when compared to policies that address multiple problems simultaneously. Yet, programs to achieve multiple restoration goals must overcome technical, social, institutional and financing barriers. Despite these challenges, a number of programs within the Chesapeake Bay watershed have found innovative ways to overcome barriers. I draw lessons from several successful programs and a workshop of local decision-makers to highlight what is working. The case studies include approaches for promoting reforestation and engaging farmers in reducing nutrient runoff. Some take home lessons from the programs are that innovation can be fostered through flexible and creative use of existing programs. Keys to success include allowing participants to define goals and methods to achieve them, being entrepreneurial in partnering with regulators, and using market forces to enhance cost-effectiveness and engage a wide array of actors. Work remains to enhance program cost-efficiency and diversify funding sources. Past successes will also be examined in the context of promoting multiple successful outcomes of the Bay Total Maximum Daily Load (TMDL) program. The TMDL is the first milestone in the Bay’s restoration and it sets nutrient and sediment caps for achieving aquatic habitat goals. Yet, the program’s focus on water quality alone means that opportunities to produce multiple benefits could be missed, if lessons learned are not applied.

**Waits, Lisette,** *University of Idaho, Moscow, ID*

**Approaches for ensuring accuracy in aquatic environmental DNA studies**

Environmental DNA (eDNA) analyses provide great potential for detecting rare species, monitoring invasion fronts, re-discovering species thought to be extirpated, confirming successful removal of non-native species, and quantifying biodiversity. This novel method allows researchers to detect the DNA of species of interest from a water sample and has been shown to improve detection probability and cost efficiency compared to traditional field surveys. Since 2008 when the method was first demonstrated, the application of eDNA approaches has expanded rapidly. These eDNA samples are likely to be degraded, include inhibitors, and contain low quantities of target species DNA, requiring special precautions. As the use of this method escalates for monitoring purposes, it is critical to consider possible sources of error and develop field and laboratory protocols to ensure accurate results. This talk will review key approaches for avoiding error and contamination during the following stages: sample collection and handling, molecular assay design, DNA extraction, and molecular assay implementation. Careful consideration of sources of error and approaches for minimizing and avoiding these errors is key to the future development of eDNA methods for conservation biology.

**Wald, Dara,** *University of Florida;* **Susan Jacobson**, *University of Florida*

**A Multivariate Model of Stakeholder Conflict over the Lethal Management of Outdoor Cats**

Over 25 million free-roaming cats in the U.S. represent a significant animal welfare issue and potential environmental threat. Wildlife and birding organizations have launched campaigns aimed at confining cats indoors and removing cat colonies using lethal and non-lethal methods. Debate over these techniques has contributed to conflict among animal welfare and wildlife conservation groups, stakeholders that can influence management initiatives. To test a psychological model of intention to support non-lethal management, we administered a mail survey to randomly selected stakeholders in Florida (n=1,596), where conflict over the management of outdoor cats has been wide-spread. The hypothesized model fit the data acceptably (CFI=0.946, RMSEA=0.058) and explained 58% of the variance in management support. Specific attitudes about the humaneness of management had the largest impact on management support. Positive beliefs about outdoor cats influenced general attitudes toward cats, but had no direct relationship on attitudes toward lethal management or management support. These results will aid managers in the development of outreach campaigns and materials aimed at garnering support for the management of both native and non-native species. These results suggest that management preference is multifaceted and highlight the importance of understanding the variables driving stakeholder conflict and support for management.

**Walsh, Jessica,** *The University of Cambridge;* **William Sutherland**, *University of Cambridge;***Lynn Dicks,** *University of Cambridge*

**Does it matter that practitioners have poor access to the scientific literature?**

Research on the effectiveness of conservation interventions is supposedly carried out for the benefit of practitioners. However, limited access to scientific literature is one of the barriers preventing practitioners from using science to inform their management decisions and its consequences for conservation practice are unknown. This study aims to test if improved access to scientific evidence in a concise, summarised format could change practice. We studied the views of conservation practitioners on 28 management interventions to reduce predation on birds by invasive or other problematic species, which is an important global conservation issue. These were collected using two online questionnaires, before and after providing the practitioners with a summary of the scientific literature on the effectiveness of these interventions. Conservation practitioners were likely to change their views about an intervention on average 45.7% of the time after reading the literature. They were more likely to implement effective interventions and avoid ineffective actions. Practitioners who had more experience in the conservation field were less likely to change their management practices, despite having a lower awareness of the existing science. The practitioners' willingness to change their opinions when the evidence was easily accessible and clearly summarised, suggests that poor access to scientific literature can affect management decisions and limit overall conservation outcomes.

**Walter, Robert,** *Franklin & Marshall College;* **Dorothy Merritts**, *Franklin & Marshall College;***David Bowne,** *Elizabethtown College;* **Jeffrey Hartranft**, *Department of Environmental Protection ;* **William Hilgartner**, *Johns Hopkins University & Friends School of Baltimore;* **Candace Grand Pre,** *Franklin & Marshall College;***Paul Mayer**, *US Environmental Protection Agency;* **Michael Rahnis,**

*Franklin & Marshall College;* **Aleah Miller,** *Elizabethtown College*

**Habitat Restoration in Watersheds Impacted by Legacy Sediments and Implications for the Bog Turtle (Glyptemys muhlenbergii)**

New understanding of the cumulative impacts of historic anthropogenic landscape change is guiding a restoration experiment with implications for expanding Glyptemys muhlenbergii (bog turtle) habitat. Located in the Appalachian Piedmont of Pennsylvania, which contains a large segment of the historic range of the bog turtle (an endangered species), the Big Spring Run (BSR) restoration site is a headwater tributary in the Chesapeake Bay watershed. Muhlenberg first collected and described the bog turtle several km from BSR in the late 1700s. The Chesapeake Bay is an impaired water body, as are many streams in the watershed. Efforts to improve ecological health of the watershed through stream restoration have met with mixed success due - in part - to misdiagnosing a primary cause of watershed impairment. Our research shows that construction of milldams in the 17th - 19th centuries, not modern land use, led to widespread valley bottom sedimentation (legacy sediment). Subsequent dam breaching led to incised streams and eroding banks. Legacy sediment buried and degraded stable Holocene aquatic ecosystems that were similar to present-day bog turtle habitat. Removal of ca. 18,000 m^3 of legacy sediment at BSR in November 2011 restored the buried Holocene wet meadow and key ecosystem components that are characteristic of bog turtle habitat. The potential to restore bog turtle populations is one of several long- term benefits of this new restoration strategy.

**Walters, Linda,** *University of Central Florida;* **Joshua Solomon**, *University of Central Florida;***Jennifer Manis,** *University of Central Florida;* **Melinda Donnelly**, *University of Central Florida;* **Paul Sacks**, *University of Central Florida*

**Simulating the impact of sea level rise on the intertidal oyster Crassostrea virginica**

The eastern oyster Crassostrea virginica is an ecologically and commercially important species along the western Atlantic seaboard and Gulf of Mexico. With a goal of modeling the impact of sea level rise on intertidal C. virginica in the northern Gulf of Mexico, we deployed 10 oyster ladders in Apalachicola Bay, FL and 10 in Grand Bay, MS. Each ladder provides 36 oyster shells and 1 sediment trap at each of 5 intertidal heights (range: 30 cm increments from near mean low water to near mean high water). Hence, inundation time was our proxy for sea level rise. Oyster ladder data being collected for our model includes: oyster recruitment, oyster growth rates, oyster orientation, biodiversity (richness and abundance) of sessile and motile species, sediment loads, total suspended solids and abiotic variables. More sediment accumulated in traps closer to the benthos. Significant differences were also found with oyster recruitment - numbers peaked at intermediate submersion times while growth was greatest with longest submersion. Our data and subsequent model will be essential to resource managers and restoration specialists working to protect shellfish reefs over the long-term.

**Wang, Dajun,** *Peking University;* **Peng Zhao**, *The Nature Conservancy, China;***Tong Jin,** *TNC China;* **Sheng Li**, *University of Wisconsin-Madison;* **Shuang Zhang**, *TNC China*

**Exploring a new protected area mechanism under China's new forest tenure reform policy: case study of the first private land-trust nature reserve**

China has experienced a high-speed economic growth in the past 30 years, resulting in both remarkable human society improvement and critical environment crisis. Although Chinese government has devoted immense resources to establish protected areas (PAs), the limited funding is still the primary impediment for expanding their coverage and promoting their effectiveness. China's land tenure system is characteristic of state owns all lands, the forest tenure reform started in 2009 provided private investment opportunities being incorporated in PA establishment and management. Meanwhile the remarkable privates' wealthy accumulation leads to increasing interest in private owned and managed PA. As the attempt of this model, Laohegou, as China's first land-trust PA, is establishing in Sichuan Province since 2011, which is in the global biodiversity priority region. The new exploration is facing big challenges involving complex practical, political and legal issues that are all new to China: new funding mechanism is being established, new forest ownership pattern needs legal recognition, new management system based on science is being built, and new cooperation relationship between PA and local community is forming. This case will be a demonstration of emerging private PAs in China. The experience and lesson learnt from this exploring will benefit the PA management both in China and elsewhere, and provide guideline to the increasing private funding devoting to nature conservation.

**Wang, Fang,** *Smithsonian Conservation Biology Institute;* **McShea William**, *Smithsonian Conservation Biology Institute;***Dajun Wang,** *Peking University;* **Sheng Li**, *University of Wisconsin*

**Restoring Effective Migration Corridors in Giant Panda Habitat: A Species-specific Study**

Giant panda are restricted to 30 isolated populations, 13 of which are small enough to be considered a high extinction risk. However, without adequate knowledge about how pandas move across landscapes, corridor establishment between existing populations is hypothetical. Assessing panda movement across the landscape outside of reserves, as well as movement for other large species, is the first step of an effective management plan. We surveyed 205 sites with camera traps, sign transects and vegetation plots along a presumptive panda corridor from 2010-2012 in Qinling Mountains, China. Occupancy models were constructed for 11 large mammal species to determine the relationship between species distribution, environmental variables and human infrastructure. The results were used to establish habitat suitability map and dispersal resistance surface. A network of hypothetical dispersal corridors was generated using least cost analysis. In addition, a scenario analysis was conducted to predict the effectiveness of different management options. The results suggest corridor connectivity varies among mammal species; small and medium-sized ungulates appeared neutral to human infrastructure, while small carnivores exhibited preference to human-caused fragmentations. Panda, black bear and takin avoided areas close to human infrastructure and lack migration corridors. Two potential movement corridors which cross highways are critical and should be considered conservation priorities.

**Ware, John,** *SeaServices, LLC*

**How much coral have you killed today: Relating CO2 emissions to loss of coral reefs**

There are frequent complaints about the inability of scientists to communicate their concerns about global climate change and its potential impact on the environment to the both decision makers and the general public. There are at least two underlying causes for the communication gap. First, the measures scientists often use, gigatons of carbon as CO2 or partial pressure of CO2 in the atmosphere, are not readily interpretable in terms that are meaningful to the average person. Second, there is seldom a direct connection established between individual activities aimed at reduction in CO2 emissions and environmental impact. I propose an example that relates CO2 emissions to the loss and degradation of a charismatic ecosystem, tropical coral reefs. Using data derived from real world observations combined with simulation results, I am able to determine a quantitative relationship between emissions and ecosystem impact. For each metric ton of carbon as CO2 that is not emitted, 0.3 to 0.6 m2 of coral reef that would have been lost may be saved. Application of this result allows both decision makers and the average person to see a direct effect of, for example, reducing energy consumption by using more energy efficient appliances or reducing fuel consumption through use of more efficient vehicles or simply driving less. In addition, it should be possible to extend the basic idea to other ecosystems to further encourage energy conservation.

**Watson, James,** *Wildlife Conservation Society*

**Climate change corridors across the Albertine Rift: comparing species distribution models, vegetation models and models based on geophysical stages**

One of the most species rich regions in Africa, the Albertine Rift region contains many threatened and endemic species that occur on mountain tops and as a result are likely to be sensitive to climate change. The high human population density in this region will exacerbate the impacts of climate change and there is a need to assess where dispersal corridors need to be conserved before they are lost to other land uses. Here we used three approaches to determine where corridors should be located: a) Modeling the current and predicted (in 2080) distributions of 93 endemic and threatened large mammals, birds and plants; b) modeling five key vegetation types both currently and in 2080; and c) identifying gradients in abiotic conditions which are likely to support a diverse set of habitat types today and under future climate change. This is the first time that such a three-pronged approach has been used to identify corridors. Results found key overlap areas for both species and vegetation types, many of which are found inside protected areas, and also identified critical corridors outside protected areas. Some key areas are the forested area between Maiko/Tayna and Kahuzi Biega Parks in DR Congo and between Ugalla and Moyowosi /Kigozi Game Reserves in western Tanzania.

**Watson, James,** *Wildlife Conservation Society*

**Wilderness, protected areas, and future conservation priorities: an Australian case study**

Most approaches to conservation prioritization are focused on biodiversity features that are already threatened. While this is necessary in the face of accelerating anthropogenic threats, there have been calls to conserve large intact landscapes to ensure the long-term persistence of biodiversity. This is because intact areas sustain ecological and evolutionary processes that are vital for the ongoing persistence of biodiversity. Here we examine the implications of a recent systematic prioritization for future conservation investments in terrestrial Australia. Our analyses reveal that a comparatively small amount (19%) of Australia’s terrestrial wilderness is under formal protection and there is a significant (p<0.05) negative relationship between bioregions considered to be a priority for future reserve prioritization and the amount of wilderness they contain. While there is an urgent need to protect threatened species and landscapes, we believe future prioritization approaches should move towards recognizing the role large wilderness landscapes will play in conserving biodiversity in the long term. Prioritization approaches need to go beyond using measures of past threats as a surrogate for future threats and also incorporate key ecological processes within the planning framework.

**Watson, James,** *Wildlife Conservation Society;* **Daniel B. Segan**, *Wildlife Conservation Society;***Andrew J. Plumtpre,** **Sam Ayebare**, **Grace Nangendo**,

**Optimizing tradeoffs in woodland ecosystems: carbon, conservation and communities**

Rapid population growth, human-forced climate change and the quest of economic development is changing how governments and local communities view the landscapes they live in. In the past decade we have seen significant changes to ecosystems as they have been reshaped to meet the demands of a variety of stakeholders from subsistence farmers, to forestry and extractive industries. In allocating scarce conservation resources from funding sources like REDD+, stakeholders that include governments, local communities and large scale industrial developers have been challenged to deliver co-benefits for biodiversity conservation and sustainable livelihoods through the protection of ecosystem services. However it is not clear whether there are always win-wins for the environment and the development community. Using the Marxan decision support tool, we outline a scenario planning based approach to landscape analysis designed to allow different stakeholders to identify clear land-use objectives, explore trade-offs in achieving those objectives and promote thoughtful and informed land-use decisions. We discuss the experiences in applying the methodology in three East African landscapes.

**Watts, Sean,** *AAAS S&T Fellow, Assigned to NSF*

**Supporting applied research through public funding for pure science**

Support for research on the impacts of human activity has increased in agencies of the U.S. Federal Government. This stems from a number of factors, including: decreasing uncertainty about near-term impacts of climate change and other human-induced global changes, new initiatives emerging from the Executive Branch, and Legislative oversight. Executive agencies have created or transformed programs to explicitly incorporate human dimensions into basic research, promoting interdisciplinary research within and among agencies, and conducting internal assessments that demonstrate the broader impacts of publicly funded research. In this talk I present a brief overview of federal agency programs that support research on natural resource management, highlighting innovative programs at the nexus of environmental, social and economic sustainability. Most of the presentation will then discuss cultural change at the National Science Foundation (NSF) with 1) renewed emphasis on the Broader Impacts Criterion of Merit Review and 2) recent efforts to promote interdisciplinary research on sustainability. As “the only federal agency whose mission includes support for all fields of fundamental science and engineering” (except biomedical science), NSF reflects the tensions between conducting academic research and applying it. I hope to prompt practical discussion of how best to strike this balance while continuing to support basic research in an era of strained budgets.

**Webb, Christine,** *Columbia University;* **Tory Higgins**, *Columbia University*

**Regulatory focus theory as a framework with potential utility for conservation psychology**

A central tenet of conservation psychology is that cultivating environmental concern requires an understanding of what motivates people to act. Surprisingly however, few formal theories of human motivation have been applied to this question. Regulatory focus theory (RFT) provides a promising new approach. RFT posits that people are primarily motivated via one of two self-regulatory orientations: promotion or prevention. While promotion emphasizes advancement toward desired ends, prevention emphasizes maintenance of current states. In this study, participants are given a wildlife conservation pamphlet in either a promotion- or prevention-frame. We then assess their level of motivation, defined as their concern for the initiatives in those brochures and their willingness to act (by donating a proportion of their compensation to support relevant causes). We are interested in the effectiveness of wildlife conservation communications depending on: 1) whether they are framed as a promotion or a prevention message, 2) chronic (or induced) promotion/prevention differences in the audience to which one is presenting the message, and 3) the 'fit' between the way the message is framed and the orientation of the audience. The results of this ongoing study will shed light on the potential utility of applying RFT to wildlife conservation communications effectiveness, and can illuminate a fruitful intersection between formal human motivational theory and conservation psychology more broadly.

**Weckworth, Byron,** *Panthera;* **Juan Li**, *Center for Nature and Society;***Hang Yin,** *Shan Shui Conservation Center;* **Dajun Wang**, *Center for Nature and Society;* **Zhala Jiagong**, *Shan Shui Conservation Center;* **Zhi Lu,** *Center for Nature and Society and Shan Shui Conservation Center*

**Economic, personal and cultural impacts of human-snow leopard conflicts in the Sanjiangyuan Region of the Tibetan Plateau**

Human-wildlife conflicts have been a constant through human history. Across the world's pastoral communities, conflict with carnivores predating on livestock threatens the economic welfare of families and is often responded to with retaliatory killings. In Central Asia, herding communities must coexist with an entire suite of carnivores, including the endangered snow leopard. Loss of snow leopards to retaliatory killings is an important conservation concern. In 2009-2011 we conducted surveys with 144 households to better understand the economic, personal and cultural impacts of snow leopards and other carnivores on stakeholders in the Sanjiangyuan Region of the Tibetan Plateau. Of the interview respondents, 58% knew of snow leopard parts being used in traditional customs in the past. Results also showed that livestock mortalities cost local herder households nearly $6200 USD per year. Yet, only 10% of losses were attributed to snow leopards, as compared to 45% for wolves and 42% to disease. Snow leopard deaths to retaliatory killings may be disproportional to their depredation contribution as they may also be unintentionally killed by poison traps meant for wolves. We recommend multi-stakeholder actions to incorporate compensation and insurance programs; to better train and equip veterinarians to treat diseases; and to provide the public education necessary to alleviate the responses to human-wildlife conflicts that negatively impact snow leopards and other carnivores.

**Weeks, Emily,** *National Land Resource Centre;* **Susan Walker**, *Landcare Research;***Jake Overton,** *Landcare Research*

**The value of validated vulnerability data in conservation planning**

Data needed for informed conservation prioritization are generally greater than the data available, and surrogates are often used. Although the need to anticipate dynamic threats is recognized, the effectiveness of surrogates for vulnerability to habitat conversion is seldom tested. Here we consider the importance of using validated vulnerability data in conservation planning tools that assist prioritization of conservation land in grasslands. We compared properties of two different vulnerability surrogates that have been applied in our study area to a validated prediction of habitat conversion-vulnerability based on recent assessment of land-use change. We found that neither surrogate was a particularly effective predictor of validated vulnerability. Importantly, both surrogates performed poorly in places where grasslands were most imminently threatened with habitat conversion. Our study suggests the integration of validated estimates of vulnerability into conservation planning tools may be an important requirement for effective conservation planning under dynamic threats and in rapidly changing landscapes. We apply our results to discuss the practical considerations and potential value of incorporating validated vulnerability into conservation planning tools both generally and in the context of New Zealand's indigenous grasslands.

**Weeks, Rebecca,** *ARC COE for Coral Reef Studies*

**Contrasting implementation strategies for marine conservation planning in the Western Pacific**

Pacific Island cultures and livelihoods are inextricably linked to the ocean; thus, it should not be surprising that Pacific Island Nations have established targets for protecting marine and coastal resources that greatly exceed those set by international conventions and treaties. Yet, whilst commitments are made and conservation priorities identified at the national scale, management actions are undertaken primarily by communities and local governments. Too often, national protected area network designs and community-driven actions proceed in parallel, with neither effectively informing the other. I will discuss two contrasting implementation strategies from the region that show promise in bridging this gap. In Palau, a nationwide protected area network (PAN) planning process undertaken in 2006 produced a design that did not adequately take local ecological knowledge or socioeconomic factors into account, and consequently did not result in implementation. Seven years later, national PAN planning is being revisited, this time as a locally-led process with an implementation strategy from the outset: the National PAN design will be refined through subsequent State level planning to incorporate fine-scale socioeconomic information. In Fiji, an implementation strategy is developing from the bottom up: systematic conservation plans developed and implemented in one district have inspired adjacent districts, and later Provincial Governments, to engage with planning processes.

**Wegmann, Martin,** *CEOS SBA Biodiversity at German Aerospace Center, U. Wuerzburg;* **Nathalie Pettorelli**, *Institute of Zoology, Zoological Society of London*

**Unifying Conservation and Remote Sensing approaches**

Climate change and landcover modification are one of the major challenges for conservation and biodiversity loss. Pereira et al. (2013) identified this challenge and argue for a coordinated global monitoring program. Necessary parameter to monitor biodiversity similar to the Essential Climate Variables are discussed within the Essential Biodiversity Variable discussion. This EBV system is currently defining relevant globally applicable variables and some of these variables can be derived by means of remote sensing. Space borne measurements like habitat extent or its vertical structure and its changes over time is relevant for e.g. CBD targets and especially for on the ground conservation efforts. These new measurements need a strong interdisciplinary coordination effort in order to provide valuable variables for biodiversity monitoring as well as grasping the full capacity of remote sensing technology. The development and launch of new space borne sensors which are filling identified gaps needs a strong political joint effort. These sensors could be space borne LIDAR and hyperspectral data sets as well as multi-spectral data sets with a strong emphasis on providing long-term comparable information. We will present a range of case studies how remote sensing is used currently to derive valuable parameters for monitoring and as well future perspectives of integrated remote sensing biodiversity variable development including the political initiatives driving it.

**Weiser, Emily,** *University of Otago;* **Catherine Grueber**, *University of Otago;***Euan Kennedy,** *Department of Conservation;* **Ian Jamieson**, *University of Otago*

**Unusual Effects of Inbreeding in the Highly Inbred Chatham Island Black Robin**

Inbreeding depression can jeopardize the survival of endangered species. However, the effects of inbreeding depend on the genetic history of the species in question, and can be strongly influenced by chance events. The black robin (Petroica traversi), one of New Zealand's iconic bird species, has recovered from a single-pair bottleneck in 1979 to 260 highly inbred adults today. Despite apparent demographic viability thus far, there is concern that inbreeding depression may eventually threaten this species; though either previous purging of deleterious alleles or historic fixation of mildly deleterious alleles could reduce the effects of further inbreeding. We found no effects of inbreeding on adult survival, but moderate inbreeding depression on juvenile survival and annual reproductive success of males. In contrast, we found an unexpected positive effect of inbreeding on reproductive success of females, strongest when females were closely related to their mates. To our knowledge, this is the first positive effect of inbreeding that has been clearly documented in a wild vertebrate population. The combination of positive and negative effects of inbreeding will have implications for the continuing conservation of the endangered black robin; and underscores the fact that the effects of inbreeding, while often negative, are influenced too strongly by chance and past events to be managed without an in-depth analysis.

**Weldon, Orion,** *Rutgers University;* **Neubauer, Phillip,** *Rutgers University*

**Linking lasers, land, and life: a multi-scale approach to species/habitat relationships and management**

Forest breeding birds are a highly threatened group in the Northeast US, with many species suffering from habitat loss. Conservation and restoration efforts have been hindered by our poor understanding of the forest structure required by these species. Here we combine vegetation structure metrics extracted from lidar data, collected across northern New Jersey and eastern Pennsylvania, with abundance data for twelve species of bird from the Breeding Bird Survey. Of these, six species were early successional breeding birds, and six were mature forest breeding birds. Forest structural metrics consisted of a range of height categories and differing measures of vegetation heterogeneity and texture. We used a bayesian hierarchical model to define relationships between habitat characteristics and abundance at each of five scales ranging from .2 to 50 ha. These Lidar derived habitat descriptions resulted in empirically-based habit models relating the influence of vegetation structure at different scales simultaneously. These results address two major questions in avian conservation research; what is the specific structure of forest vegetation influencing bird abundance for each species, and at what scales does vegetation structure influence these same bird abundances. Using these models enables land-managers to make specific decisions regarding how to augment or preserve forest characteristics to benefit threatened forest breeding bird species.

**Weller, John B. ,** *Flimmaker & Author*

**Protecting the Ross Sea: A Journey to and through the Last Ocean**

The Ross Sea is special. The National Science Foundation stated back in 1998, “Little, if any of the ocean remains unaffected by fisheries, agricultural runoff, sewage, aquaculture and industry.” The oceans are in serious trouble. The situation is getting worse. For one, we are catching fewer fish. Estimates are that we’ve eaten our way through 90% of the top predatory fish in the ocean since 1950. We have pushed many ocean ecosystems to the brink of collapse worldwide. The evidence, if we dare to look at it, is clear. But the Ross Sea, protected by its 500-mile-wide shield of ice, has remained largely insulated from this depletion. Many scientists have stated they believe that the Ross Sea may be the most healthy open ocean ecosystem left on earth. John started working on The Last Ocean, an outreach project directed specifically at the Ross Sea, with Antarctic Ecologist Dr. David Ainley in 2004. Since then he has worked full time on the project as fundraiser, organizer, designer, writer, photographer and filmmaker. His efforts have catalyzed an international movement to protect the Ross Sea. John is a SeaWeb Fellow and was awarded a prestigious Pew Fellowship in Marine Conservation in 2009. Weller’s first short film on the Ross Sea was a finalist in the 2010 Blue Ocean Festival. The film has gained wide acclaim from peers in the photographic, filmmaking, and conservation worlds.

**Wells, Jeffrey,** *International Boreal Conservation*

**When they spoke people listened: experiences of two science-policy think tanks focused on large landscape conservation issues in Canada and Australia**

Scientists can have a special role in shaping civil society environmental policy issues because of their often unique understanding and insights of the workings of natural systems. Most scientists who are engaged in providing information to help in formulating sound environmental policy must do so on their own and without assistant in the best ways to communicate their knowledge to the public and policy makers. We describe here two science-policy think tanks, one in North America and one on Australia, that have operated over the last decade to bring top-level scientists from different disciplines together to develop communications that have been successful in influencing the public debate about environmental policy issues in Canada and Australia.

**Wepprich, Tyson,** *North Carolina State University;* **Erik Aschehoug**, *North Carolina State University;***Heather Lessig,** *North Carolina State University;* **Frances Sivakoff**, *North Carolina State University;* **Nick Haddad**, *North Carolina State University*

**Leave it to beavers: habitat restoration and source-sink dynamics in an endangered butterfly metapopulation**

Although managers commonly use habitat restoration to conserve rare species, we rarely test whether we inadvertently create population sinks or ecological traps, which decrease population viability. The endangered Saint Francis' satyr butterfly (Neonympha mitchellii francisci) lives only on Ft. Bragg military base in North Carolina, USA and requires disturbance-dependent wetland habitat historically maintained by beavers and wildfires. We removed hardwoods and dammed creeks in a factorial design to experimentally test how restoration affects source-sink dynamics in a butterfly metapopulation. We demonstrate how top-down (predation) and bottom-up (host plant resources) processes change habitat quality for different life-stages. Predator exclusion experiments show that restoration increases egg predation and that partial inundation increases caterpillar survival. Hardwood removal made host plants less nutritious (higher %C) but more palatable (lower silica content) for caterpillars. We released butterflies and observed their movement behavior to measure how adults assess and respond to habitat quality. Movement behavior did not differ with restoration treatments. We discuss future experiments to determine which life-stages drive source-sink dynamics and share lessons for management of endangered species that are dependent on ephemeral habitat.

**Westerman, Kame,** *Blue Ventures Conservation;* **Alasdair Harris**, *Blue Ventures Conservation;***Kirsten Oleson,** *Blue Ventures Conservation*

**Building social-ecological resilience to climate change through community-based coastal conservation and development: experiences from Madagascar**

Climate change impacts fall disproportionately on the world's poorest, most marginalized communities, particularly those highly dependent on direct use of natural resources. In many countries, strategies to address vulnerability are still largely theoretical, with little meaningful field implementation. Furthermore, programming is still too often implemented in sectors and therefore does not adequately address the dynamic nature of vulnerability. We examine a program in rural Madagascar that incorporates both marine conservation and socioeconomic development activities in order to foster holistic resilience. Ecological resilience is supported through a combination of management tools, including no-take-zones and bans against destructive fishing practices. At the same time, sustainable octopus fishing and aquaculture are promoted as a means to increase food security and income. Further social resilience is fostered through initiatives that address maternal and child health, reproductive health, and hygiene and sanitation. Formal education is also a key element, which allows youth access to careers not dependent on a changing environment. Programs like this one successfully address multi-faceted vulnerability, and do so with higher community buy-in, at lower cost, and with better outcomes in all sectors. Such holistic community-based approaches should therefore play a key role in global adaptation efforts.

**Wheat, Rachel,** *University of California, Santa Cruz;* **Yiwei Wang**, *University of California, Santa Cruz;***Jarrett Byrnes,** *University of Massachusetts, Boston;* **Jai Ranganathan**, *National Center for Ecological Analysis and Synthesis*

**Crowdfunding for Conservation: Using Social Media to Build Support**

Presently, the great majority of scientific research never reaches a broader audience, contributing to mistrust and misunderstanding of science among the general public and hindering conservation initiatives. Crowdfunding is a new funding model that has the potential to shift this paradigm by encouraging scientific transparency and public involvement in the earliest stages of the research process. Since cultivating early connections with a wide audience often determines the success of crowdfunding drives, this type of funding model can foster ties between scientists and nonscientists and develop early and lasting support for conservation projects. This presentation will highlight the utility of crowdfunding for individuals and conservation groups, the determinants of success, and how social media can aid in establishing positive relationships among researchers, project supporters, and stakeholders.

**Whigham, Dennis,** *Smithsonian Environmental Research Center;* **Melissa McCormick**, *Smithsonian Environmental Research Center;***John O'Neill,** *Smithsonian Environmental Research Center;* **Rachel Rock-Blake**, *University of Connecticut*

**Conservation of Istoria medeoloides (Orchidaceae), a tale of dormancy and fungi**

Orchids are widely threatened or endangered worldwide and of the approximately 250 North American species, 24% are listed as globally threatened and 84% as threatened nationally. Orchid dependence on pollinators and mycorrhizal fungi makes them highly sensitive to habitat change and also makes conservation and restoration efforts especially challenging. Many orchids also have a dormant vegetative stage which makes population assessment difficult. We use monitoring and experimental approaches to identify critical life stages for Isotria medeoloides, a nationally threatened species that is declining through much of its range. Rates at which plants enter and emerge from dormancy and low seed germination and seedling establishment are two factors responsible for population declines. The availability and abundance of mycorrhizal fungi may contribute to each of these stages. Mycorrhizal fungi of Isotria are Russula and Lactarius, obligate ectomycorrhizal fungi associated with tree roots. The number of tree root tips is lower in sites with dormant plants and where plants have gone extinct. This implies that management efforts need to promote trees that host needed mycorrhizal fungi and to support adequate fine root tip densities. Management of light levels may also be an important management tool to increase individual plant performance (i.e., growth and sexual reproduction) and thus reduce the incidence of dormancy.

**Whiteman, Liz,** *California Ocean Science Trust;* **Tess Freidenburg**, *California Ocean Science Trust*

**Developing a Report Card for California's MPAs California Ocean Science Trust**

Ecosystem protection goals are increasingly the foundation of conservation policies worldwide, and assessments of ecosystem condition are being used to support evaluation of management effectiveness. However, assessing the condition, or ‘health’, of an ecosystem is not a straight-forward task. Often, managers rely on expert judgments, in which a diverse group of experts develops an assessment of condition based on a broad range of scientific data and results. These assessments are often communicated to policy-makers, managers and stakeholders using various report cards. Currently, despite some common theoretical underpinning, there is no clear framework for using expert judgment to develop such assessments. The lack of consistency of approach renders the tool of expert judgment, and the judgments themselves, vulnerable to attack and dismissal as “opinion”, jeopardizing the use of this essential tool just as the needed transition to ecosystem-based management approaches is gaining momentum globally. Using data collected in support of MPA monitoring in California, we are implementing an expert judgment process designed to provide assessments of the condition or ‘health’ of these regional ecosystems. A key outcome of this project is the development of a report card to communicate the results of these health assessments in a way that is clear, intuitive and useful for informing management.

**Whittier, Christopher,** *Smithsonian National Zoological Park;* **Suzan Murray**, *Smithsonian National Zoological Park;***Angelique Todd,** *WWF;* **Peter Walsh**, *University of Cambridge*

**Breaking down barriers: Application of veterinary medicine to conservation of critically endangered species.**

Applied veterinary medicine can be a valuable tool in conservation efforts with wildlife and especially endangered species. There are increasing examples across the globe where veterinarians have played integral roles in helping to sustain and conserve wildlife at both the individual and population levels. For different reasons and under different scenarios pro-active involvement of veterinarians and applied in-situ veterinary care and interventions with wildlife are sometimes welcomed, and sometimes rejected. There are complex reasons for this relationship, some based on subjective feelings and dogmatic approaches, some based on objective science and risk assessments. This talk will explore some of those issues as we discuss successful efforts to increase veterinary involvement and applied veterinary medicine to western lowland gorillas (Gorilla gorilla gorilla) in the Central African Republic. A partnership between multiple conservation institutions, individuals, and other local and global stakeholders has led to significant strides in applied veterinary medicine for this critically endangered species. Successful campaigns to deliver preventative medicine in the form vaccinations, to treat serious infectious disease group outbreaks, and to save an individual gorilla from a life threatening ensnarement have all been accomplished in the past two years and will be briefly presented.

**Whitton, Jeannette,** *University of British Columbia*

**An Analysis Of Recovery Strategies For Canada's Species At Risk**

Science-based recovery strategies are powerful tools with the potential to guide species recovery. In Canada, listed species require a finalized recovery strategy within one-two years of listing for endangered, threatened and extirpated species. We analyzed over 200 finalized recovery strategies produced since Canada’s Species at Risk legislation came into force in 2003. We scored the strategies for species traits, timeline to completion, threats, recovery objectives and description of critical habitat. We found that production of recovery strategies lags far behind set timelines, with the pace and likelihood of including critical habitat increasing since 2009. Analysis of threats reveals that recreation, and residential and commercial development are the most common threats in recovery strategies, and that certain threats decreased the probability of having received a finalized recovery strategy. Analysis of recovery objectives indictaes that the most common targets involve maintaining numbers of individuals, populations and area, with no apparent relationship of the objectives to the criteria used in status assessment. For example, species assessed as endangered based on population declines were no more likely to to target increases. On the whole, our analysis finds that a low bar is being set in the documents intended to set benchmarks for species recovery, raising serious concerns about the prognosis for recovery of Canada’s Species at Risk.

**Whitty, Tara,** *Center for Marine Conservation and Biology, Scripps Institution of Oceanography*

**Interdisciplinary methods for mapping conservation-scapes: Focus on Irrawaddy dolphins and small-scale fisheries in Southeast Asia**  
Mitigating bycatch of dolphins in small-scale fisheries is an urgent conservation priority, and requires interdisciplinary methods to holistically assess the "conservation-scape" of which these dolphins and fisheries are a part. Focusing on Irrawaddy dolphins (Orcaella brevirostris), I conducted in-depth conservation-scape mapping at one site in the Philippines, and rapid mapping at three sites in the Philippines, Thailand, and Indonesia. Methods included ecological methods for studying dolphins and human activity (line-transect surveys and photo-identification), and social science methods (750 household surveys and 73 key informant interviews) for assessing local ecological knowledge, bycatch, fisheries trends, sociocultural and economic drivers, migration, governance, and perceptions of conservation and management. At the main site, results suggest that bycatch is unsustainable, and occurs in the context of declining fisheries yield, high in-migration of fishers, uncontrolled illegal fishing, lack of village-level coordination for management, municipal corruption, and incomplete fisher registration. Several issues were common across sites, though environmental threats and adaptations for management at the village level differed. These results demonstrate the utility of the conservation-scape approach for collecting management-relevant data at sites with diverse governance structures, sociocultural and economic conditions, human activity levels, and management efforts.

**Wiest, Whitney,** *University of Delaware;* **W. Shriver**, *University of Delaware;***Kent Messer,** *University of Delaware*

**Improving the Protection of Salt Marshes for Tidal Marsh Bird Conservation Given Limited Financial Resources in Delaware**

The northeast tidal marsh ecosystem provides critical ecological services to coastlines, including storm protection and erosion control. However, salt marshes have been continually subject to degrading forces and its unique wildlife requires immediate conservation action. We tested two methods to determine the optimal combination of parcels with unprotected tidal marsh habitat that would yield the greatest conservation benefit (bird abundance) per conservation dollar spent. Three budget level scenarios ($10M, $15M, and $20M) were applied to the models. For each scenario, the parcel portfolio developed by the binary linear programming optimization method consisted of a greater number of parcels, marsh area, and birds, than the traditional benefit targeting method. Across the scenarios, increases in total portfolio marsh area and bird abundance ranged from 7.2-9.6% and 7.3-12.8%, respectively, when optimization was used. The optimized portfolios represented the best use of conservation dollars to maximize conservation benefits and conserve important core areas inhabited by tidal marsh bird species in Delaware. Increases in inundation from sea level rise due to global climate change poses a real immediate challenge to the persistence of tidal marsh bird populations and the marshes themselves. Optimization models can be further employed to help develop comprehensive strategies that protect natural habitats that may serve as areas for future marsh migration.

**Wilberg, Mike,** *University of Maryland Center for Environmental Science, Chesapeake Biological Lab;* **John R. Wiedenmann**, *University of Maryland Center for Environmental Science, Chesapeake Biological Lab and Institute of Marine and Coastal Sciences, Rutgers University;***Jason M. Robinson,** *University of Maryland Center for Environmental Science, Chesapeake Biological Lab*

**Fits and starts with oyster conservation in Chesapeake Bay**

Oysters (Crassostrea virginica) are important ecosystem engineers in Chesapeake Bay because of their capacity to modify coastal and estuarine habitats and the highly degraded status. However, models to predict dynamics of ecosystem engineers have not previously included the effects of exploitation. We developed a linked population and habitat model for autogenic ecosystem engineers undergoing exploitation and parameterized the model to represent eastern oyster in upper Chesapeake Bay. We evaluated the effects of a range of management and restoration options including sustainability of historical fishing pressure, effectiveness of a newly enacted sanctuary program, and relative performance of two restoration approaches. Historical fishing mortality rates in upper Chesapeake Bay for oysters were above the levels that would lead to extirpation. Reductions in fishing, such as was done with the recent implementation of large-scale sanctuaries, were projected to lead to long-term increases in abundance and habitat. For fisheries to become sustainable outside of sanctuaries, a substantial larval subsidy would be required from oysters within sanctuaries. Restoration efforts using high-relief reefs were predicted to allow recovery within a shorter period of time than low relief reefs. Models, such as ours, that allow for feedbacks between population and habitat dynamics can be effective tools for guiding management and restoration of autogenic ecosystem engineers.

**Wilcox, Chris,** *CSIRO Australia;* **Denise Hardesty**, *CSIRO Australia;***Erik van Sebille,** *University New South Wales*

**A global risk assessment for marine debris impacts on seabirds**

Marine debris is a global pollution problem, and thought to be a major threat to biodiversity. Seabirds appear to be among the most heavily impacted taxa, with evidence for reduced body condition, fecundity, and direct mortality from both ingestion and entanglement in debris. We developed the first global risk assessment for marine debris impacts on seabirds. We use an oceanographic model to predict the distribution of debris in the ocean, considering both the sources of the debris and the likely pathways of movement. We overlay this with the distribution of all the major seabird taxa to evaluate the exposure of each species to debris based on spatial overlap. We compare these estimates of exposure to the results of a major review of seabird diet studies to evaluate whether exposure is a reliable predictor of debris ingestion. Based on a statistical analysis of differences between exposure and observed ingestion, we evaluated which ecological characteristics are likely to bias seabirds towards significantly higher or lower rates of debris ingestion. Our results speak directly to management actions to address debris impacts on seabirds, as we provide a list of the relative exposure to debris and predictions for which species are likely to be heavily impacted based on their ecological characteristics.

**Wilkerson, Cynthia,** *The Wilderness Society*

**Moving Climate Science into Policy: Connecting Land and Water for Fish, Farms and Families in Washington State**

Application of climate science goes beyond research. Washington's Yakima Basin is the 12th largest agricultural producing region in America. Once home to fish runs upwards of 800,000, Yakima Basin numbers have plummeted due to land and water use. This tenuous situation is made worse by climate projections - already reality with five economically devastating drought years since 1995. Instream flow and water supply modeling demonstrate that adding 500,000 acre-feet of water storage could meet future supply needs for native fish recovery while accommodating agricultural and municipal needs. A multi-stakeholder group created the Yakima Basin Integrated Plan, an innovative plan that meets water supply needs in the face of climate projections. Results indicate that agricultural demand can be met and fish recovery will result in the largest sockeye run in the lower 48 states. The presentation will explore key conservation components of the plan and lessons learned through development and early implementation. Conservation tools include land acquisition, headwaters protection, public lands designation, recreation management and habitat restoration. Conclusion: to implement the direction of climate science, skilled conservation biologists, negotiators, and advocates must engage tribes, local governments, and recreationists. Lessons: 1) Diverse stakeholders must sit at the table; 2) Internal and external communication is crucial; and 3) leaders must rapidly adapt to new developments.

**Wilkerson, Marit,** *University of California, Davis*

**Exploring potential downsides of conservation linkages: plant invasion in Southern California linkages**

The potential downsides of conservation linkages or corridors remain a recurrent yet still largely unexplored issue in the connectivity and conservation world. This research examines one major understudied concern: how invasive plants interact with conservation linkages. As part of a multisystem and multiscale study to address the potential problem of linkages facilitating invasive plants, I examined the patterns and potential mechanisms of plant invasion associated with large-scale conservation linkages in Southern California. I collected data from eight linkages dominated by chaparral and coastal sage scrub in two Southern California counties. Surveys confirm that plant invasion has a spatially explicit structure, with linkage interiors being more invaded than their edges. I show how that spatial pattern changes depending on the type of directly adjacent habitat (e.g., suburban housing vs. agricultural orchard). Moreover, I examined how those spatially-and-matrix dependent patterns change depending on species dispersal mode. What constitutes a landscape for a wind-dispersed invasive species is not the same as that of an animal-dispersed invasive species or a bird-dispersed species. By demonstrating the probable hotspots for certain types of invasive plants along a linkage edge and the associated factors that play into those patterns, this research will help land managers/owners better plan, design, and manage their conservation linkages.

**Willette, Michelle,** *University of Minnesota The Raptor Center;* **Julia Ponder**, *University of Minnesota The Raptor Center*

**Wildlife health monitoring systems in North America: from sentinel species to public policy**

The case for monitoring wildlife health is compelling. The potential benefits include: detection of emerging infectious or zoonotic diseases; control of certain diseases in domestic animals, especially livestock; ascertaining effects of habitat change or invasive species; increased understanding of disease ecology and wildlife biology; and wildlife preservation. While there are systems in place for monitoring emerging disease in humans and some domestic animals, there is currently no comprehensive, integrated, national strategy for the monitoring or surveillance of wildlife disease in the United States. There are inherent challenges to creating an effective system for wildlife disease monitoring and surveillance. A surveillance system is dependent on the ability to collect an adequate number of biological samples from a representative wildlife population, analyze those samples for the presence of disease agents, interpret the results, identify trends and respond to emerging issues. Such a system requires a mandate, strategic planning and significant training and funding resources for implementation. Veterinarians involved in wildlife rehabilitation have a critical role in monitoring wildlife health, need to practice a more enlightened and comprehensive level of medicine, and should use the resultant information to educate and inform public policy.

**Williams, Candace,** *Mississippi State University;* **Ian Johnston**, *Mississippi State University;***Andrew Kouba,** *Memphis Zoological Society;* **Scott Willard**, *Mississippi State University;* **Darrell Sparks**, *Mississippi State University;* **Ashli Brown,** *Mississippi State University*

**Symbiotic diversity of intestinal microbiota of an obligate bamboo forager, the giant panda: Connecting systems and disciplines for biofuel production**

Next-generation metagenomic sequencing may provide insight into the giant panda's unique gastrointestinal tract's (GIT) microbial system and how this carnivore makes use of a bamboo diet. Moreover, the distinctive GIT microflora of the giant panda may have inherent cellulolytic aspects that would be beneficial in the production of second-generation lignocellulosic biofuels for green energy. Metagenomic analysis (Illumina GA) elucidated seventeen cellulolytic, six lignolytic, seven oleaginous, five nitrogen-fixing, and seven alcohol-producing microorganisms, and these organisms have also been validated using species-specific PCR. In our preliminary study, these organisms have been shown to degrade cellobiose (cellulose surrogate) and accumulate transesterifiable lipids under anaerobic conditions. Analyses indicate that 65.4 % of cellobiose was consumed (HPLC/ELSD), and that transesterifiable lipids were accumulated (GC-FID) suggesting the giant panda microbes' ability to convert lignocellulosic biomass into lipids. The integration of new genomic technologies provides novel insights into how symbiotic animal-microbial diversity impacts animal nutritional ecology and also connects disciplines for the development of green energy in the form of biofuels.

**Williams, David,** *African Wildlife Foundation;* **Philip Muruthi**, *African Wildlife Foundation;***Daudi Sumba,** *African Wildlife Foundation*

**Community-based Conservation in Africa: utilizing high resolution satellite imagery towards a simpler approach to assess conservation impact**

Community-based Conservation (CBC) has been advocated as a means to address the degradation of the wildlife habitat outside formal protected areas. Assessments of CBC conservation impact in Africa, however, have been hampered by a lack of quantitative data and analysis as monitoring and evaluation efforts were constrained from a lack of practical and cost-effective tools, especially for use by overstretched conservation and development staff. We used GIS to perform relatively simple but cogent spatial analyses to assess threat management for 2 tourism-based CBC projects in Kenya. Comparing high resolution imagery from project onset to the present, we applied straightforward image interpretation techniques to capture changes in land use and settlement patterns across CBC land management zones. In both cases, we found the CBC projects adhered well to their land use plans in not permitting settlement or cultivation in the conservation land use zones. CBC land management practices prevented further habitat degradation in valuable wildlife corridors and buffer zones contributing to significant threat reductions and increased wildlife use. Our approach is relatively easy to apply, uses increasingly affordable and available imagery, generates results that are easily communicated and replicated over time, and as such should complement the growing toolset for evidence-based conservation.

**Williamson, Matthew,** *Grand Canyon Trust;* **Brett Dickson**, *Conservation Science Partners;***Christine Albano,** *University of California - Davis;* **Thomas Sisk**, *Northern Arizona University;* **Ethan Aumack**, *Grand Canyon Trust*

**Targeting collaborative conservation actions using novel spatial datasets: a case study from the Grand Canyon's North Rim**

Confronting increasingly complex environmental challenges (e.g., climate change, wildfire, invasive species, etc.) requires conservation organizations to develop targeted strategies at appropriate scales. Advances in remotely sensed data and analysis techniques, use of citizen science, and improvements in extant monitoring programs have broadened the foundation for decision-making; however, integrating this information into successful conservation action can be challenging. We describe an approach using a variety of high resolution datasets describing forest structural conditions, wildlife habitat quality and connectivity, livestock grazing intensity, annual grass invasion risk, and risk of uncharacteristic wildfire to prioritize conservation on the Grand Canyon Trust's (GCT's) Kane and Two Mile Ranches (Arizona, USA), a 340,000-ha public lands ranch on the Grand Canyon's North Rim. The Kane and Two Mile Research and Stewardship Partnership?a public-private partnership between land management agencies, academic institutions, and conservation organizations?used this data to prioritize values and threats to generate spatially explicit recommendations for action. Values differed among partners; however, risk of severe wildfire and invasion by Bromus tectorum were identified as high priority threats by all parties. This approach resulted in an integrated, transparent, and spatially explicit strategy for targeting and evaluating advocacy and management by GCT and their partners.

**Wittmaack, Christiana,** *Nova Southeastern University Oceanographic Center;* **Caryn Self-Sullivan**, *Nova Southeastern University Oceanographic Center;***Curtis Burney,** *Nova Southeastern University Oceanographic Center;* **Garet Lahvis**, *Oregon Health and Science University;* **Denise Greig**, *the Marine Mammal Center;* **William Van Bonn,** *the Marine Mammal Center;***Dr. Edward Keith**, *Nova Southeastern University Oceanographic Center*

**Developing a New Diagnostic Technique for Domoic Acid Toxicosis in Zalophus californianus, a Sentinel Species of Oceanic Health**

Domoic acid (DA) is a bio-accumulated neurotoxin produced by the diatom Pseudonitzschia australis that targets the hippocampus in the California sea lion (Zalophus californianus). Laboratory diagnostics are challenging due to a short excretion time. Similarity of clinical signs to other diagnoses further complicates diagnostics. Annual strandings of Z. californianus have occurred since 1998 (excluding 1999) and the abundance of DA producing blooms of P. australis appears to be increasing. The goal of our research is to formulate behavioral criteria for diagnostics. From May 2011 - December 2012 we observed 152 Z. californianus undergoing rehabilitation at the Marine Mammal Center in Sausalito California. Focal animal continuous scans were done for up to 15 minutes on each animal by a single observer. Abnormal behaviors were quantified from an ethogram. Animals with DA toxicosis preformed head weaving (Wilcoxon's Z=6.38050 p.001) more often than animals with other diagnoses. Animals with DA toxicosis experienced muscle fasciculations both at the center and on the beach during rescue (Fisher's Exact Test, P

**Wittmer, Heiko,** *Victoria University of Wellington;* **Andrew Marshall**, *University of California*

**Do we need a certification system to maximise conservation on private lands?**

Conservation initiatives on private lands are becoming increasingly important for the maintenance and restoration of biodiversity worldwide. Simultaneously, scope and ambition of such initiatives have also been increasing. There is, however, currently a lack of legislation governing private conservation efforts in many countries and little transmission of information among stakeholders both before and after conservation efforts are implemented. This makes assessment of the efficiency of projects nearly impossible. We present results showing that management on private lands negatively affected the viability of endangered huemul deer in Chilean Patagonia. Specifically, following the large-scale removal of livestock, together with the abrupt cessation of predator control efforts, huemul mortality from predation increased threatening their viability. Although these negative effects have been documented in the peer-reviewed literature, the private landholders have not implemented management to counteract them. We use this example to illustrate the urgent need for an independent certification system for conservation on private lands. Such a certification system could disperse information and provide scientific guidance to private landowners prior to the implementation of restorative management, while simultaneously acting as a repository to document associated outcomes. Ideally such a program would be spearheaded by a large international conservation organization, such as the IUCN.

**Wolfe, Barb,** *The Wilds*

**Sorta situ': The New Reality of Management Conditions for Wildlife Populations in the Absence of 'Wild' Spaces**

Many anthropogenic drivers are compromising ecosystems and rapidly changing the landscape and the availability of ‘wild’ spaces. One outcome of these changes is the manifestation of a new global reality for wildlife. Where truly ‘wild’ populations are increasingly rare and more animals are managed in protected zones, refuges and conservation centers, the difference between in situ (wild populations in native habitat) and ex situ (captive populations in non-native habitat) becomes less distinct. In fact, most wildlife populations of today and tomorrow exist on a continuum between in situ and ex situ. We define this new reality as ‘sorta situ’ ‒ neither one nor the other‒ to describe the changing nature of population management in the 21st century. The continuum of conditions for sorta situ populations can be viewed across two key variables: available habitat including space, habitat quality and the maintenance of ecosystem processes; and management intensity including health care and protection from outside threats. In the past, wildlife populations lived in their native habitat, without human intervention. Diseases and populations were, for the most part, self-limiting, and terrestrial animals were free to move in response to seasonal and dietary needs. On the other end of the spectrum, zoos managed animals outside their native habitat in small captive groups, treating disease and injury on an individual basis and controlling nutritional input and reproductive output. Today, fences, borders and human habitation limit the spaces wild populations can occupy, and small, fragmented populations require careful monitoring and management to avoid devastating population declines and extinction.

**Wollney, Seth,** *College of Staten Island;* **Eugenia Naro-Maciel**, *College of Staten Island*

**Colonization of reconstructed habitat at Fresh Kills Landfill by Painted Turtles (Chrysemys picta)**

Fresh Kills Landfill on Staten Island, NY has not received materials since April 2001, and is now is being converted into Freshkills Park. Habitat destruction is the leading cause of biodiversity loss, but the value of reclaimed habitats, such as Freshkills, to make up for such loss is still poorly understood. Turtles are long lived and occupy a high level on the food web turtles are a prime organism for long-term monitoring on reclamation efforts. In the summer of 2012, we began a long-term monitoring of the freshwater turtles at Fresh Kills(FK) and Long Pond(LP), a reference pond to assess the stage of colonization of the reclaimed habitat. We tested the null hypothesis of no difference between shell length and body mass, sex ratios and age-class distribution of painted turtles at Freshkills (n=29) and Long Pond (n=48). The null hypothesis was accepted for shell length (mean FK = 120.2mm; mean LP=120.1mm), and the sex-ratio (both locations = 1:1). Body mass (mean FK = 271.6g; mean LP = 295.0g) show statistical difference; visual assessment of age-distribution curve reveal an older distribution at Freshkills, whereas a normal curve was found at Long Pond. These results indicate that Freshkills is in the early stages of colonization by painted turtles. Blood samples were taken to assess the rate of health issues and parasite load at the two sites. Currently, little is known colonization of reconstructed habitats that we are providing new data on these processes.

**Wongbusarakum, Supin,** *The Nature Conservancy*

**Achieving forest conservation and human well-being: REDD+ efforts in Indonesia and Brazil**

Originally established as an international funding mechanism by developed countries to reduce carbon emissions from deforestation and forest degradation (REDD), REDD+ has become a means in many developing countries to finance and enhance local collaborations and policy development that support forest conservation, natural resource management, and the welfare of local communities. This presentation examines the efforts of The Nature Conservancy (TNC)'s Forest Carbon Programs to bridge forest conservation and human well-being. It focuses on a participatory process of identifying human well-being objectives, and indicators to measure the impacts of forest conservation on different aspects of human well-being. Two REDD+ projects will be used to illustrate the process. The first is in Berau, Indonesia. TNC works closely with local communities and governments to improve the societal welfare of forest dependent communities. Their well-being is defined as having 3 main constituents: 1) security through community forest management rights, 2) opportunities in livelihood and social services, and 3) empowerment. The second is in Central Xingu, in the Brazilian Amazon. There, the REDD+ effort is led by a coalition of multiple stakeholders to operate a program of incentives to reduce deforestation and degradation and to promote sustainable development. Both cases offer important lessons for how forest conservation and bettering human welfare are interdependent and mutually beneficial.

**Wood, Eric,** *University of Wisconsin-Madison;* **Anna Pidgeon**, *University of Wisconsin-Madison;***Volker Radeloff,** *University of Wisconsin-Madison;* **Patrick Culbert**, *University of Wisconsin-Madison;* **Nicolas Keuler**, *University of Wisconsin-Madison;* **C. Flather,** *United States Department of Agriculture Forest Service*

**Housing development, protected areas, and avian community conservation**

Biodiversity conservation is a primary goal of protected areas. However, over the last half-century in the United States, housing growth on private inholdings and on nearby private lands of protected areas has increased abruptly. It is unclear how this affects the conservation benefit of these lands. We used data from the North American Breeding Bird Survey to explore how the proportional abundance of species of greatest conservation need (SGCN), land cover affiliates (e.g. forest breeders) and synanthropes, within protected areas, are associated with housing density on inholdings and nearby private lands from 1970 to 2010. SGCN and land cover affiliates were generally strongly negatively associated with housing density on inholdings whereas the opposite pattern was found for synanthropes. The strength of the association varied geographically. In the densely developed eastern forests, as housing development increased on inholdings from 1970 to 2010, SGCN and land cover affiliates steadily declined whereas synanthropes steadily increased. In the sparsely populated west, we found similar trends, though the effect was not as strong. Housing density on nearby private lands of protected areas was also negatively associated with SGCN and land cover affiliates in eastern forests and the deserts. Our results raise concern that as housing development continues on inholdings and nearby private lands of protected areas, the conservation benefit of these lands will likely be diminished.

**Woolery, Lee Ann,** *University of Missouri*

**Explore science: Enter through the arts; Art-Based Perceptual Ecology, a novel research strategy used in collaboration with scientific inquiry**

The environmental challenges of the 21st century-notably loss of biodiversity-require creative and inspiring collaborations and demand that we work across disciplines. Science and art can complement one another and offer an integrative approach to conservation science. This presentation will highlight a natural resource inventory at Saguaro National Park, AZ, employing Art-Based Perceptual Ecology (ABPE), a novel research strategy used in collaboration with traditional scientific inquiry. Findings from the researcher's study: "Art-Based Perceptual Ecology as a way of knowing the language of place," demonstrate that practicing ABPE provides a shift in awareness, opening the researcher to detail in the landscape at scales previously unnoticed. The ABPE practice lends itself well to conservation, as accessibility to multiple scales in ecosystems is of great relevance to scientists studying global environmental change. Art-Based Perceptual Ecology does not reveal all of the answers, but it does offer a new language that may generate good questions and work synergistically with scientific inquiry to provide new solutions for scientists working in conservation and restoration efforts. Today we are in need of bringing more attention to the field of science-novel research strategies such as ABPE may be one way to inspire and attract creative minds to the field of science through the portal of the arts.

**Woolley, Skipton,** *School of Botany.;* **Timothy O'Hara**, *Museum Victoria;***Brendan Wintle,** *Quantitative and Applied Ecology Group, School of Botany;* **Piers Dunstan**, *CSIRO Wealth from Oceans Flagship*

**Deep star shift: Turnover of bathyal brittle stars (Ophiuroidea) across Australia and New Zealand.**

The deep sea in increasingly being exploited for fisheries and mineral resources. Describing and visualizing turnover of deep-sea (200-2500 m) biodiversity is urgently required by government and international agencies for area-based conservation and resource management. Despite thousands of research expeditions, our knowledge of large scale biogeography in the deep sea is largely based on qualitative analyses or environmental and physical surrogates. The prospect of producing maps of turnover based on a statistical analysis of distribution data has remained elusive. This study uses distributions of brittle star species (Ophiuroidea) to model beta diversity across Australia and New Zealand. The nature of data available from the deep-sea severely restricts the types of analyses available for use. Here we use a 'predict and then assemble' approach to determine regional and inter-regional changes in species distributions. Our results suggest the presence of transitional zones rather than abrupt biogeographical breaks. Primary production regimes and oceanographic currents, rather than sea surface temperature (solar radiation) appear to be driving latitudinal turnover. Models of turnover will help describe biogeography in the deep-sea and contribute to developing a strategy for broad-scale spatial prioritization for bathyal marine ecosystems.

**Wrathall, David,** *United Nations University, Institute of Environment and Human Security;* **Kendra McSweeney**, *Ohio State University;***Erik Nielsen,** *Northern Arizona University*

**Mesomerica's Narco-Laundered Forests**

Bridging as it does key global regions of cocaine supply and demand, Central America has become a primary conduit for trafficking from South America to the United States. As interdiction closed other northward pathways through the 1990s and 2000s, a Golden Spike for drug flows has emerged: the Meso American Biological Corridor (MABC). These remaining forests between Nicaragua, Honduras and Guatemala now serve as the primary relay point for trafficking activities, but other related activities -repackaging, smuggling and money laundering- have left a more enduring impact on forests. Satellite imagery shows a rapid spatial and temporal pattern of deforestation that coincides with trafficking relay points. For decades, a tension has existed in MABC conservation strategy around the questionable conservation dividend of indigenous-led forest management, and this tension has contributed to the weak land entitlement to indigenous communities. But now, drug trafficking is both driving deforestation and displacing indigenous communities, who are the last hope for an integrated solution.

**Wright, Andrew*,*** *Aarhus University*

**It's Good to be Liked: Effective conservation outreach in the Age of Facebook**  
It used to be relatively simple for scientists to reach the masses with information about conservation issues. However, newer technologies have devalued print advertisement (ads), public service announcement (PSAs) on the radio, and celebrity PSAs on television (the previous gold standard). The demand for the attention of the public is much greater than ever before, making it much harder to get your message across. Fortunately, hope can be found in some of the sources of the problem. Social networking is a powerful option for spreading information, with little or no effort. Pieces that score Likes and Shares run rampant on the internet, creating newsworthy real-world sensations. Well-crafted pieces detailing your particular conservation problem are not enough to achieve this. It requires a more intangible quality that is much harder to obtain. Although this X-factor is undefinable there are certain tricks that can help improve your chances. Perhaps most importantly, and most troublesome for scientists, is the need to abandon almost all of the information in your message. People widely Share and Like pictures with one line of snappy text, or short videos of cats falling asleep, but not longer videos detailing environmental issues. Attention is limited and people respond to style over substance in a much more instinctual way than logical scientists are familiar with. Addressing this will require us to rethink public outreach and engage people on a new, much more basic level.

**Wright, Andrew,** *National Environmental Res. Inst.*

**Where are marine highways going?**

Efforts to secure roadless areas will need to address current and likely future human usage patterns. Thus, “roadless” areas of ocean will need to consider commercial shipping as 90% of world trade is carried by ship. Shipping is the most efficient way to transport goods per weight and distance in terms of fuel consumption and carbon emissions. Increasing oil prices are thus driving an increase in local sea freight transport, known as short-sea shipping. This will bring more ships into coastal waters and increase risk of collision with whales and other species. Similarly, the opening Arctic will bring more traffic into largely unused northern areas of ocean. Bringing pollutant sources closer to the Arctic environment, particular concern surrounds black carbon and noise. Black carbon (mainly soot) is not generally transported over large distances in the atmosphere. Local sources could thus rapidly and dramatically increase heat absorption by Arctic ice sheets. Likewise, increasing vessel passage will substantially alter the acoustic environment of the high Arctic Ocean. The commercial value of shipping will be a large obstacle to establishing roadless ocean areas, especially in the economically importance of coastal and Arctic waters. Compromise and potentially sacrificial areas will be needed. However, given the lack of physical roads in the marine environment and the existence of mitigation technologies, road-impact-less areas might be a more realistic goal.

**Wu, Lan,** *Center for Nature and Society, Peking University;* **Juan Li**, *Center for Nature and Society, Peking University;***Ruiling Song,** *Center for Nature and Society, Peking University;* **Zhi Lu**, *Center for Nature and Society, Peking University;* **Dajun Wang**, *Center for Nature and Society, Peking University;* **George Schaller,** *Panthera*

**Living in a Bear Country: Ecological Study of Human-Brown Bear Conflicts in Sangjiangyuan Area, Tibetan Plateau, China**

Brown bear Ursus arctors is the largest carnivore on Tibetan plateau.Human-bear conflicts such as house damaging and livestock killing have become serious problems in the past decade and retaliatory huntings were increasing.Understanding ecological process of them will be the first step in making a conservation plan. We conducted sign surveys and community-based interviews since 2009. 3 bears were captured and tracked with GPS collars, which was the first time to collar brown bear in China. In addition, 12 electric fences were set for a pilot houses-protection experiment. GPS collar data suggests both male and female bears had ~2,000 km2 annual home range area,which is large for females compare to other studies.27% feces contained human-related food and the main natural food is marmot.The peaks of house damaging occurred in May and Aug,when local people moving to summer range and leaving their food storage unguarded while most marmots were hibernating.In addition,77% of livestock killing happened in Sep and Nov, right before bears went into hibernating.Binary logistic regression shows that conflicts are significantly correlated to the efforts people paid to looking after their house. The study indicates that brown bears are more likely to seek human-related food when the availability of natural food drops down.Therefore measurements should be taken to protect bears' prey,taking care of houses,as building electric fences partially reduced human-brown bear conflicts

**Wyatt, Sarah,** *Global Environment Facility;* **Diego Zárrate-Charry**, *Sierra to Sea Institute/ProCAT Colombia;***José González-Maya,** *Sierra to Sea Institute/ProCAT;* **Florencia Montagnini**, *Yale School of Forestry and Environmental Studies*

**The Conservation Value of Oil Palm Plantations and Remnant Habitat in Colombia**

African oil palm (Elaeis guineensis) cultivation has expanded dramatically since the 1970s, often in megadiverse countries with highly threatened lowland tropical forests. Sustainable oil palm standards (e.g. RSPO) require the preservation of riparian and high conservation value areas (HCV) without evidence that these practices benefit biodiversity. Colombia is the fourth largest oil palm producer in the world and home to significant biodiversity. The objective of this study was to understand how different taxa are affected by oil palm agriculture and how management practices influence these impacts. In summer 2011, conventional and RSPO-certified farms were sampled in César, Colombia. Standard methods were used to survey birds (point-counts), butterflies (Van Someren-Rydon traps), and amphibians (visual encounter survey transects). Birds, butterflies, and amphibians showed different responses in diversity and abundance related to farm management practices, suggesting that the impacts of oil palm are not uniform. Mostly wide-ranging, disturbance tolerant species were found on farms. Overall, oil palm has limited value for conservation of endemic or threatened species, but riparian corridors and reserve areas did maintain some of these species. These results show that oil palm could serve as a corridor and that remnant habitat has conservation value, particularly in converted landscapes.

**Wyborn, Carina,** *University of Montana*

**Overcoming the 'coordination challenge': Connecting actors across scales to build effective relationships between science and practice**

Over the past decade landscape scale conservation has risen to surprising prominence in Australia. These efforts are ambitious in their scale and scope, seeking to connect public, private and civil society actors to align conservation efforts across very large spatial and temporal scales. While these efforts have significant government and civil society support, they face significant challenges of collaboration and communication across vast, diverse landscapes, communities and agendas. Building on a long history of collaborative conservation practice, these efforts provide fertile lessons for a newly emerging National Network for Wildlife Conservation in the US. This presentation draws on the experiences of Habitat 141°, an emerging initiative which faced significant challenges at the outset of the collaboration. Despite strong support for the goals and aspirations of the initiative, Habitat 141° struggled due to an inability to reconcile fundamentally different perspectives on how to turn their vision into action. These challenges can be traced to a lack of funding and capacity as well as an inability to build the necessary relationships to link science with practice. The story is not entirely negative, as a number of local to regional scale initiatives emerged from Habitat 141°’s conservation planning efforts. This presentation will give an overview of the structure of Habitat 141°, critical factors shaping the negotiations and lessons to be learned from their experiences.

**Wyner, Yael,** *City College of New York;* **Rob DeSalle**, *American Museum of Natural History*

**Using the evolutionary-ecological land ethic to frame environmental science courses**

Grounding environmental science courses in Aldo Leopold's evolutionary-ecological land ethic can link students to the ecological interactions of the natural world. Applying Leopold's philosophy to environmental science would allow students to learn ecology in the context of daily life and environmental issues. It can also improve teaching of the concept of sustainability by integrating it with ecology. This presentation describes why framing environmental science in the evolutionary-ecological land ethic is a useful approach for learning the ecological concepts, environmental issues and sustainability of environmental science. It also presents a model for how to root courses in this theme. This model unlocks the evolutionary-ecological complexity that connects everyday human actions to environmental issues and sustainability by depicting environmental issues as the result of human actions that disrupt normal ecological function. This ecological framing is in contrast to current models that do not integrate ecology. Performance of 2,230 students on pre/post exams that measured student learning of ecological function and environmental issues was compared between secondary school students who used the model and students who used their regular human impact program. Results indicate that students who used the model for learning performed significantly better on the post-test exams than the students who used their regular human impact program.

**Yaffee, Steven,** *University of Michigan;* **Julia Wondelleck**,

**Ecosystem-Based Management on Land and in the Sea**

Based on 20 years of research on ecosystem-based management in diverse social and ecological contexts, Steven Yaffee and Julia Wondolleck will report on the similarities and differences among land and ocean-focused ecosystem-based approaches. They will highlight a just released online database that includes 65 marine ecosystem-based management cases from around the world, and the lessons learned from this large set of comparative cases. Key themes addressed in these analyses include management strategies pursued, accomplishments, facilitating factors, challenges, governance, monitoring, evaluation, and ways in which science was used to advance ecosystem-based management in different settings. They will conclude with a perspective on how the policy environment surrounding the adoption of terrestrial EBM evolved in ways that undermined a shift in management toward an ecosystem approach, and ask whether the conditions underlying management of marine systems are likely to follow the same pathway.

**Yeakley, Alan,** *Portland State University*

**Portland-Vancouver ULTRA-Ex: Analyzing the connection between governance and environmental quality in urban ecosystems**

In our Portland-Vancouver ULTRA-Ex project, we are examining the role of governance in urban ecosystem sustainability in cities in our bi-state metropolitan region. We are assessing multiple pathways through which human actions, governance systems, and the built and social infrastructure affect ecosystem functions and services provided by landscape vegetation pattern and regional water quality. Our findings suggest that local land use, rather than regional governance, is the primary determinant of water quality in streams. Hedonic analyses show that water quality is correlated with property values in residential areas. Our findings also suggest that while green infrastructure strategies (e.g. bioswales) provide environmental benefits, the perception of their value by local citizens is mixed. We have also found that heavy metal accumulations (i.e. Cu, Pb, Zn, Cd) have not reached toxic levels in bioswale soils; yet, bioswales were found to retain these metals effectively during storms. For urban greenspace conservation, while the rates of riparian area losses have continued over the past two decades, those rates are slowing in our six study cities; in Portland gains in riparian areas due to restoration efforts have even begun to outpace riparian losses. Overall, our preliminary findings indicate variations in levels of civic engagement among municipalities, but general social and ecological differences among municipalities and between states are not yet clear.

**Yohannes, Liabeth,** *University of Maryland, College Park*

**The importance of babassu (Attalea speciosa) for the livelihoods of the extractivist communities of Extremo Norte Extractive Reserve, Brazil**

Landless extractivists are often the poorest, most marginalized sector of Brazilian society whose livelihoods depend on natural resources. This research focuses on the importance of babassu (Attalea speciosa), a native palm of Brazil, for women quebradeiras ('nut breakers' in Portuguese) who harvest babassu for cash income, charcoal, cooking oil, construction material and other products. The objective of the research was three-fold: (1) reveal the current livelihood strategies of babassu extractivist communities of the Extremo Norte Extractive Reserve, a RESEX established in 1992 by the Brazilian government to provide quebradeiras with natural areas for harvest, but remains a paper-park; (2) highlight the challenges quebradeiras face; and (3) understand the role of diverse stakeholders in supporting or hindering babassu extractivist activity. I used surveys and semi-structured interviews to collect quantitative and qualitative data from people who derive income or subsistence products from babassu in Tocantins, Brazil. I conclude that implementation of the RESEX would provide greater economic opportunities for the region's landless babassu extractivists, but without strengthening the market for babassu products, babassu activity will decline and the RESEX will likely fail. Such an outcome would represent a lost opportunity for forest conservation at the deforestation frontier and loss of a local culture and economy featuring the sustainable harvest of forest products.

**Yokomizo, Hiroyuki,** *National Institute for Environmental Studies;* **Taku Kadoya**, *National Institute for Environmental Studies*

**Selection of conservation areas under severe uncertainty of population dynamics in future**

Many vascular plants are threaten by various drivers such as land use change and overpopulated herbivores. More than 500 citizen botanists have archived quantitative information on population size and changing rate of population size for 1610 Japanese plant taxa twice (1994-1995 and 2003-2004). Those surveys enable us to quantify extinction risks by Monte Carlo simulations. However population size and changing rate of population size contain large uncertainty. Furthermore there is no guarantees that trend of changing rate of population size will not change in the future. We developed a robust decision-making model against those uncertainties using information-gap decision theory to derive optimal investment of conservation effort in Chiba prefecture, Japan. Our analysis recommended that different regions should be protected when we incorporated uncertainty of population size and trend of changing rate of population size. This result highlights the importance of dealing with uncertainty properly to select conservation areas effectively.

**Young, Jennifer,** *Fisheries and Oceans Canada;* **Marten Koops**, *Fisheries and Oceans Canada;***Todd Morris,** *Fisheries and Oceans Canada*

**Modelling Mussel Population Dynamics with Fish Host Density Dependence: Research Needs to Answer Management Questions**

Roughly two thirds of freshwater mussels native to North America are considered imperilled, and there is a strong need for modelling of these species to inform management and recovery of at-risk populations. Growth of native mussel populations may be hindered by their dependence on the presence of suitable fish hosts for the obligate parasitic life stage; management of host fish species for at risk mussels may also be necessary. Existing mussel population modelling has assumed that host populations are non-limiting and can be ignored. Using the framework of population matrix modelling we incorporate host density dependence to test the sensitivity of the model to the assumption of non-limiting hosts. Model results showed that a mussel population whose host is limiting is much more sensitive to the parasitic phase than a mussel population with a non-limiting host. Mussel abundance depended on: host abundance, host population trajectory, mussel life history, and host capacity for mussel transformation. When the host population was stable, a predictable, stable mussel abundance was reached. This equilibrium was sensitive to the life history of the mussel species, and to the availability of juvenile hosts but not that of adult hosts. Our work highlights areas of freshwater mussel research that are most important for answering management questions, such as the poorly understood relationship between host/mussel abundance and successful attachment to the host.

**Young, Talia,** *Rutgers University;* **Olaf Jensen**, *Rutgers University;***Brian Weidel,** *USGS Great Lakes Science Center;* **Sudeep Chandra**, *University of Nevado - Reno*

**Food web variability in a pristine north temperate lake**

Understanding food webs is one of ecology's earliest pursuits: who eats whom and what are ramifications of those patterns? Stable isotopes are a powerful tool for elucidating trophic relationships, but our understanding of natural background variability of stable isotope signatures separate from anthropogenic effects remains limited, impeding our analytic and predictive capacity. We used carbon and nitrogen isotopes to examine variability in the fish community of Lake Hövsgöl, a near-pristine lake in Mongolia. The lake is subject to almost no commercial or recreational fishing or nearby development and has only nine species of fish with no introduced species, offering an unusually pristine and ecologically simple study system for study. We found inter and intra-annual variability to be comparable for all fish species, with coefficients of variation ranging from 2-15%. We also did not find that piscivores demonstrated greater variability than planktivores as expected, suggesting that variability does not transfer simply up trophic levels. These data provide important context for conservation and management of aquatic ecosystems; studies assessing anthropogenic impacts on or restorations of aquatic systems will be more robust if they take such background variability into account.

**Yu, Fengqing,** *Wildlife Ark, China*

**Mercy Release Should not be Commercialized**

Mercy release is a traditional Buddhist practice, which encourages followers to save captured animals and release them. However, more animals are captured and harmed due to the practice. For example, magpies became hunting targets since some Buddhists believed releasing them would bring good fortune and ordered them. Suggestions offered for being more merciful include: (1) Consult an expert to assure the animals to be released are able to survive in a new environment and will not compete with native species; (2) observe animal habitats, report poaching, and protect animals against poaching instead of releasing poached animals; and, (3) do not buy or sell animals to release.

**Yuan, Chun-ming,** *Yunnan Academy of Forestry*

**Age structure and spatial distribution pattern of the rare and endangered plant Alcimandra cathcartii**

Understanding the population's change patterns in time and space is essential for decision-making to conservation of the rare and endangered species. However, most populations of these species are small, and it is difficult to use traditional quadrat sampling techniques for demographic analysis. The Ripley's L-function was used to analyze the spatial pattern of different development stages of Alcimandra cathcartii, based on the investigation data from 4 hm2 plot in a primary evergreen broadleaved forest in Gaoligong Mountain, Yunnan. The results showed that the age structure of the species was inverted "J" shape curve, and the population is stable. The distribution pattern is closely related to the spatial scale, with an aggregation distribution in less than 75 m and a random distribution in more than 75 m spatial scale. The smaller individuals showed aggregation distribution at smaller spatial scale, while larger trees were random distribution type at all spatial scales. The spatial relationships among different development stages are negative correlation at smaller scale, while it tends to be no association at larger scale. This indicates that there may be different mechanism on the formation of distributions at different spatial scales and growth stages. The results of this study implicates that it is important for conservation of small populations of A. cathcartii to strengthen the protection of the forest ecosystem with these rare and endangered species.

**Yuan, Wei,** *University of Central Florida;* **Linda Walters**, *University of Central Florida;***Eric Hoffman,** *University of Central Florida*

**Larval settlement of Crassostrea virginica with non-native Perna viridis, Mytella charruana, and Megabalanus coccopoma**

Since the introduction of Perna viridis (Asian green mussel), Mytella charruana (charru mussel) and Megabalanus coccopoma (acorn pink titan barnacle) into Florida waters, they have expanded both north and south along the Atlantic coast from their initial sites of introduction. Little is known about how these non-native species affect the already vulnerable Crassostrea virginica (Eastern oyster). A manipulative experiment was designed to test if P. viridis, M. charruana and M. coccopoma prevent C. virginica larvae from settling and metamorphosing. Our results indicate that overall, the number of settled larvae was significantly reduced with the presence of P. viridis, M. charruana and M. coccopoma when compared to a control of C. virginica shells (Random block ANOVA, p = 0.0364). However, we found there was no difference in larval settlement on oyster shells with attached non-native species versus adjacent oyster shells without non-native species (Random block ANOVA, p = 0.0864). This data indicates that P. viridis, M. charruana, and M. coccopoma do limit oyster larval settlement and suggest that non-native species can be detrimental to the native oyster ecosystems.

**Zacharie, Chifundera,** *Université Pédagogique National, UPN*

**Using Key Amphibian Areas (KAA) for improving the conservation of biodiversity in the Democratic Republic of the Congo**

Abstract. The current diversity richness and species conservation status of amphibian from the Democratic Republic of the Congo are herein recognized as bio indicator for setting priorities for biodiversity conservation and improving the ongoing protected areas management. Historical and prospective data gathered from the most recent fieldworks are used for determining sites of herpetological importance. Between 2007 and 2012 several fieldworks were carried out throughout the whole country and seasons. Standard sampling techniques and methods including time-constrained, visual observation, and site scanning were used. Data analysis was referred to the IUCN's criteria for determining the key important areas. Presently, 241 amphibian species are known from the DR Congo and include 64 endemics (26.5%) along with two endangered species while 6 are vulnerable (VU). The sites of priority for conservation are those concentrate assemblage, endemic, rare and threatened species. Accordingly, the following eight sites are defined as KAA: Itombwe Massif, Mount Kabobo, Ituri forest, Marungu Plateau, Lendu Plateau, Upemba, Virunga, and Kahuzi-Biega landscapes. Threats to species are habitat degradation or loss, and pollution. Therefore, it is evident that conservation actions should be undertaken and then be focused on these KAA for conserving the whole biodiversity in DR Congo.

**Zavadskaya, Anna,** *Kronotsky State Natural Biosphere Preserve;* **Vasily Yablokov**, *Lomonosov Moscow State University*

**Tourism In Vulnerable Ecosystems Of Kamchatka: Impacts And Management (On Example Of Kronotsky Natural Reserve, Kamchatka, Russia)**

Increased number of tourists in Kamchatka has created negative impacts on fragile ecosystems and unique natural objects that support tourism industry. However, data on limits of use and impacts of tourism are scanty. The paper draws on results of our research, conducted in 2008-2012 in tundra and thermal ecosystems of Kronotsky Biosphere Reserve and devoted to study of their transformation under recreational impacts and finding management tools for securing their long-term future. Classification of recreation impacts was given. The scale for defining condition classes and limits of acceptable changes for tundra ecosystems have been developed. As a result of multi-parameter analysis of thermal areas, using hexagon cell-based GIS-model, strong correlation between soil temperature and ecosystems recreation durability was found. The research showed that the most attractive and unique thermal areas with endemic and threatened Red-listed species (Fimbrystilis ochotensis, Agrostis geminate, Ophioglossum thermale, Lycopus uniflorus, Spiranthes sinensis, etc.) have the lowest resistance to recreational impacts. Our findings became the base for development of methodology and spatial structure of long-term monitoring for vulnerable ecosystems and establishing the system of key sites in the study area. This research was supported by the Conservation Leadership Programme (project 0454611) and the Russian Foundation for Basic Research (projects 12-04-00272, 13-05-00870, 13-04-10037).

**Zdilla, Katherine,** *University of Maryland;* **Maile Neel**, *University of Maryland*

**Social Effects of Forest Stewardship Council Certification in the Tropics and an Assessment of Methodology in Effect Evaluation**

The Forest Stewardship Council (FSC) promotes sustainable forest management by certifying forests and forest products that meet rigorous social and environmental standards. Social standards ensure workers and indigenous groups have land management rights and are included in the certification process. Despite their importance, social effects of certification in high conservation value tropical areas are not well understood. We evaluated effects and methodologies in literature from tropical regions that made specific claims about the nature or magnitude of social effects of certification published through 2010 (n=31). We categorized effects as positive or negative as well as in six categories: worker benefits, education initiatives, social services, subsistence, free and informed prior consent, and stakeholder engagement. Twenty-two studies had overall positive, and seven had slightly positive social effects, with benefit types highly variable across studies. The few negative effects were temporary or a result of the certification process itself. Only eight studies had well defined methodologies (interviews, questionnaires, or observations) and only nine explained the control group used for comparison. Broadening the geographic scope, eliminating reliance on anecdotal evidence, establishing more rigorous methodologies, defining management goals, and feeding data collection directly into an adaptive management framework would improve characterization of social effects.

**Zeh, Daniel,** *James Cook University;* **Colin Limpus**, *Queensland Department of Environment and Heritage Protection;***Michelle Heupel,** *Australian Institute of Marine Science;* **Russ Babcock**, *Commonwealth Scientific and Industrial Research Organisation (CSIRO);* **Richard Pillans**, *Commonwealth Scientific and Industrial Research Organisation (CSIRO);* **Mark Hamann,** *James Cook University;***Alana Grech**, *James Cook University;* **Helene Marsh,**

*James Cook University*

**The potential of using data-logging acoustic receivers to study the movements and residency patterns of dugongs in port environments**

An array of 28 acoustic receivers was installed over an area of 252 km2 in Moreton Bay near Brisbane and used to compare the potential of automated acoustic tracking and ARGOS/GPS tracking to inform dugong spatial management, especially in the vicinity of ports. We captured 10 dugongs in the region and fitted them with acoustic and ARGOS/GPS transmitters. Individual dugongs were tracked from 6 to 90 days. Acoustic detections closely matched the extent of occurrence and core areas of habitat use indicated by the ARGOS/GPS tags when the dugongs were within the range of the acoustic array, providing proof of the concept. Acoustic technology potentially has the following significant advantages over ARGOS/GPS technologies for studying dugong habitat use in port environments: (1) the acoustic transmitters are much less expensive allowing at least a five-fold increase in sample size for the same outlay; (2) individual dugongs can potentially be tracked for much longer using the acoustic technology; (3) the absence of a tether should greatly reduce animal welfare issues and (4) the potential to track fast swimming animals should be improved. Composite home ranges calculated from merged 0.95 and 0.50 home range data from all individuals indicated that the 10 dugongs were active in an area nearly four times the designated Go Slow Zone indicating the need to extend this area to reduce the risk of vessel strikes to dugongs in Moreton Bay.

**Zeigler, Sara,** *Virginia Tech;* **Jeffrey Walters**, *Virginia Tech;***Robert Mitchell,** *Joseph W. Jones Ecological Research Center;* **J. Hiers**, *Eglin Air Force Base*

**A novel linked landscape - demographic model to connect systems, disciplines, and stakeholders for the conservation of red-cockaded woodpeckers**

This study describes a landscape model of a fire-dependent longleaf pine ecosystem that was linked to a model of red-cockaded woodpecker (RCW) demography and behavior. We used RCW populations on Eglin Air Force Base in Florida as a case study. The landscape model was parameterized in the state-and-transition platform ST-Sim and simulated landscape change following fire, management activities, and anthropogenic development. Maps derived from ST-Sim then acted as inputs in the Decision Support System, a GIS-based simulation of RCW movement, reproduction, mortality, and social transitions. By incorporating additional complexity into RCW simulations in the form of landscape change, emergent properties of the system were revealed that were not apparent from the results of the demographic model alone, which has important implications for landscape and climate change in this system. As a result, this model is an important tool for managers, especially on military installations across the southeastern United States. In addition, this linked landscape -demographic model has been essential for connecting concepts, information, and experts from a variety of fields to create a single tool for evaluating management hypotheses and landuse planning decisions in a way that is accessible to all stakeholders, including scientists, managers, and landowners. As such, this study provides an important methodological example for conserving other endangered species on multi-use landscapes.

**Zeller, Kathy,** *UMASS, Amherst;* **Kevin McGarigal**, *UMASS, Amherst;***Paul Beier,** *Northern Arizona University;* **Samuel Cushman**, *USDA Forest Service;* **Andrew Whiteley**, *UMASS, Amherst;* **Winston Vickers,** *Wildlife Health Center, University of California, Davis;***Walter Boyce**, *Wildlife Health Center, University of California, Davis*

**Effect of GPS collar sampling intensity on habitat selection inference: Mountain lions as a case study**

In recent years, the use of Geospatial positioning (GPS) radio collars has skyrocketed due to their many advantages over VHF radio collars. However, battery life is usually the limiting factor of GPS collars and researchers are often forced to decide on a compromise between collar longevity and sampling intensity. There is little research to serve as guidance in making this decision. The studies that have examined this issue have focused on how sampling interval affects movement distance or home range size. Because GPS data is often used in resource selection functions, we looked at how sampling intensity affects inferences of habitat use. We used data collected on mountain lions (Puma concolor) in southern California at a five-minute sampling interval. We subset this data to represent longer sampling intervals, from ten minutes up to six hours, and performed both point and step selection functions. We compared the resource selection function results from longer sampling intervals to the five-minute data and found that, for both point and step selection functions, the relative bias increases sharply between the five-minute and the 60-minute interval, at which point a threshold is reached. Our results suggest fix intervals as short as an hour may be insufficient for acquiring accurate estimates of resource use.

**Zero, Vicky,** *University of Wyoming*

**Application of eDNA to Assess Amphibian Occurrence in Relation to Beaver in Southeast Wyoming**

Ecosystem engineers are key to the maintenance of ecological function in natural systems. Some of these species control wetland dynamics through changes in factors such as hydrology and biodiversity. For example, by converting streams to ponds, beaver (Castor canadensis) stabilize system hydrology. Such changes may be critical in maintaining amphibian diversity. To test the effects of habitat modification by beaver, we conducted occupancy surveys in southeastern Wyoming to examine presence at wetlands with and without beaver. Sites (n=60 in 9 drainages) were surveyed at the beginning (snowmelt) and end (post-metamorphosis) of the breeding season (2 visits per sampling period). While occupancy surveys such as these are valuable, they are time-intensive and may have high pseudo-absence rates. Molecular detection methods using environmental DNA (eDNA) from water may increase the accuracy and efficiency of occupancy surveys for rare or secretive species. Concurrent with these surveys, we developed species-specific mtDNA qPCR tests for detection of northern leopard frogs (Lithobates pipiens), boreal chorus frogs (Pseudacris maculata), and tiger salamanders (Ambystoma tigrinum) from water samples collected at each site. With the combined presence-absence data obtained from both direct (occupancy) and indirect (eDNA) detection methods, we determined that amphibians prefer to breed in beaver ponds, and that eDNA results are concordant with standard occupancy methods.

**Zethoven, Imogen,** *Global Ocean Legacy-Australia*

**The Coral Sea Marine Reserve: Australia's Answer to Ocean Protection at a Large Spatial Scale**

Australia is an island continent. Its marine environment is the most biologically diverse in the world. For over 15 years Australian governments have been working to establish a comprehensive, adequate and representative National Reserve System of Marine Protected Areas. Whilst the principle of representing each major habitat type is scientifically valid, a representative network fails to excite the public’s imagination, unless in a world-recognised icon such as the Great Barrier Reef. Without public pressure, governments are not inclined to invest scare funds in marine protection. The Global Ocean Legacy project therefore set out to ignite the public’s imagination with a bold and simple vision: to secure the establishment of the world’s largest fully protected marine reserve in the Coral Sea. A very large offshore reserve is also the most effective way to protect pelagic species and the cheapest with respect to recurrent management costs. We believed that by setting a very high bar of protection, the principle of representation would take care of itself. The 2012 proclamation proved this assumption correct: the Coral Sea Marine Reserve is now the largest reserve in the world, including the second largest fully protected area, and scores highly on representation of regional ecosystems.

**Zimmermann, Alexandra,** *Chester Zoo / Oxford University;* **Scott Wilson**, *Chester Zoo;***Nandita Hazarika,** *EcoSystems-India*

**Patterns of Human-Jaguar Conflicts across Latin America**

The jaguar occurs in 19 range states across Latin America, from southern Arizona to northern Argentina. Few pristine areas remain in which jaguars survive protected from the influences and threats presented by human populations. 65% of the remaining 11 million km2 jaguar range is outside protected areas, and it is here that they come into contact with livestock, on which they occasionally prey and which leads to retaliatory killing by farmers. Direct persecution of jaguars (and hunting of their prey) is the most serious and widespread threat to their survival. We conducted an expert-based survey of human-jaguar conflicts, involving more than 80 jaguar experts from 17 range countries. The vast majority of conflicts reported by the sample of experts surveyed occurred at the edges of protected area, and a surprisingly high proportion (85%) of the jaguar range has overlap with livestock and therefore potential for conflict with people. We combined the survey results with available GIS datasets of geographical variables such as protected areas, livestock densities, human geography and jaguar distribution, in order to examine the spatial relationships of variables relevant to such conflicts and present a predictive model of conflict "hotspots" across the species range, and validated this with experts on the ground. Such insight into emerging regions of threats to jaguars may prove useful for species and landscape-level conservation initiatives and prioritization.

**Zimova, Marketa,** *University of Montana;* **L. Scott Mills**, *University of Montana;***Jared Oyler,** *University of Montana;* **Steven Running**, *University of Montana;* **John Abatzoglou**, *University of Idaho;* **Paul Lukacs,** *University of Montana*

**Camouflage mismatch in seasonal coat color due to decreased snow duration: Will snowshoe hares keep up with climate change?**

As a result of climate change, the duration of the ground snow cover in the temperate regions has shortened. We describe a novel and striking climate change effect on wildlife, whereby seasonal coat color becomes mismatched with background snow or lack of snow. Our objective was to quantify for snowshoe hares (Lepus americanus) the phenology of seasonal coat color change and potential for coat color mismatch, as first step in exploring whether hares can adapt to a decreasing snowpack. We quantified snowshoe hare molt phenology, mismatch and survival for three years at two sites in western Montana, USA. We monitored over 450 hares weekly with radiotelemetry, quantifying the progression of the molts and snow cover across three years with vastly different snow conditions. We observed considerable mismatch between hare coat color and their background during spring and fall seasons. Some level of plasticity was observed in the rate of the spring molt which mitigated the color mismatch; during the spring of 2011 hares completed the molt about 2 weeks later than in 2010. By contrast, onset of coat color molts remained constant. We developed global circulation models downscaled at ecologically relevant scales (30m resolution) to predict changes in snowpack hares are likely to face in the future. Without evolution in coat color phenology, the reduced snow duration will increase the number of days that white hares will be mismatched on a snowless background by 3 - 8 fold.

**Ziv, Guy,** *Natural Capital Project, Stanford University;* **Shan Ma**, *Natural Capital Project, Stanford University;***Jennifer Duggan,** *University of Washington;* **Bradley Eichelberger**, *Natural Capital Project, Stanford University;* **Gretchen Daily**, *Stanford University*

**Enlisting Ecosystem Services: A Trade-Offs Analysis on Military Training Land**

The Department of Defense (DoD) manages over 25 million acres of land in the United States of America. While their primary mission is ensuring the readiness of armed forces, these lands also represent a wide range of natural ecosystems that benefits soldiers, their families, local communities and society in general. Furthermore, they host a disproportionate number of sensitive plant and animal species. The Natural Capital Project is working with the DoD to demonstrate how values and trade-offs of ES on DoD lands can be assessed and mapped using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) toolset. Working in Joint Base Lewis-McChord (JBLM) in Washington State, we have modeled three ecosystem services of interests: timber production, carbon sequestration, and habitat provision for sensitive species. We also developed new ES models to assess training capacity on prairieland. Here we compare a "business-as-usual" scenario and four alternative management scenarios reflecting possible future mission and budget constraints. Our analysis highlights complex dynamics between drivers, stressors, and ecosystem services, and portrays an intricate trade-off between maintaining (or increasing) training and sustainable ecosystem services provisioning. These outcomes are expected to better inform conservation planning and decision-making at JBLM, to achieve the goal of jointly maintaining armed forces readiness and ecosystems sustainability.

**Zivian, Anna,** *Ocean Conservancy*

**Who knows? The role of NGOs in brokering knowledge for ocean management**

Environmental non-governmental organizations (ENGOs) play an important role in ocean and coastal governance, highlighting the need to protect, maintain, and restore healthy ocean and coastal habitats. They can have expertise in social and natural science, public participation strategies, communications, and governance. Because of their role on the periphery they are uniquely positioned to serve as knowledge brokers in ocean governance issues. At the same time, ENGOs advocate for particular policy solutions, which creates a tension between their work helping different types of knowledge travel among a range of policy, civil society, and research communities and their work advocating for specific programs. If an organization is at the same time transmitting knowledge and seeking to promote one particular perspective, can it, in fact, be a knowledge broker? While ENGOs clearly have relevant skills, do they have legitimacy? To look at these questions, I present a case study of Ocean Conservancy, an ENGO that works on the issue of ocean use planning. Its program involves educating, informing, and connecting the public, stakeholders, researchers, and decision-makers as well as advocacting for US Congressional support of science-based, participatory, comprehensive planning as a tool to achieve healthy and sustainable ocean and coastal ecosystems. Ocean Conservancy is at once an advocate, a translator of knowledge, a recipient of information, and a public communicator.