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保护：自然与社会的和谐

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ABSTRACT

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Content

Content.....	i
Oral.....	1
Indigenous knowledge and conservation.....	1
Conservation capacity building	4
Environmental sociology	8
Desert conservation	11
Mammal conservation	14
Bird conservation	18
Social Science	22
Environmental geography	25
Sustainable agriculture.....	29
Plant conservation.....	32
Climate change.....	34
Landscape ecology	37
Communications,outreach and education	41
Conservation genetics	45
Monika Zavodna, Nathalie Machon	46
Mammal conservation	49
Bird conservation	53
Student Award Session:.....	57
Disturbance ecology.....	63
Conservation in hotspots	67
Protected area planning and design.....	71
Population dynamics.....	73
Forest conservation.....	77
Ecology restoration.....	81
Freshwater conservation.....	85
Biogeography	87
Alien and invasive species	91
Marine conservation	93
Mammal Conservation.....	96
Urban Area Conservation.....	99
Recovery of endangered species.....	102
Wetland conservation	106
Community-driven conservation.....	109
Invertebrate conservation.....	113
Conservation modeling	115
Scientists and managers: bridging the gap.....	119
Fish Conservation.....	121
Inventory and monitoring	124
Environmental politics and policy	127
Community-driven conservation.....	130
Landuse planning for conservation	132

Spatial ecology and conservation.....	135
Amphibian and reptile conservation.....	138
Environmental or ecological economics.....	141
Alien and invasive species	144
Ecosystem/conservation area management	147
Poster	150
DISCIPLINES: Biogeography	150
DISCIPLINES: Communications, outreach and education.....	151
DISCIPLINES: Community-driven conservation	155
DISCIPLINES: Conservation funding and philanthropy.....	162
DISCIPLINES: Conservation genetics.....	162
DISCIPLINES: Conservation medicine	171
DISCIPLINES: Conservation psychology	171
DISCIPLINES: Ecology restoration	172
DISCIPLINES: Environmental anthropology	175
DISCIPLINES: Environmental history.....	175
DISCIPLINES: Environmental or ecological economics	176
DISCIPLINES: Environmental politics and policy.....	177
DISCIPLINES: Indigenous knowledge and conservation	179
DISCIPLINES: Landscape ecology.....	182
DISCIPLINES: Population dynamics.....	183
DISCIPLINES: Social Science.....	185
ECOSYSTEMS: Conservation at the land-water interface	187
ECOSYSTEMS: Desert Conservation.....	187
ECOSYSTEMS: Disturbance ecology.....	188
ECOSYSTEMS: Forest conservation.....	189
ECOSYSTEMS: Freshwater conservation.....	191
ECOSYSTEMS: Grassland conservation	192
ECOSYSTEMS: Marine conservation	193
ECOSYSTEMS: Savanna conservation	194
ECOSYSTEMS: Wetland conservation.....	195
ISSUES: Alien and invasive species	196
ISSUES: Climate change	198
ISSUES: Conservation in hotspots	199
METHODS: Adaptive management and monitoring	200
METHODS: Conservation capacity building.....	201
METHODS: Conservation GIS	202
METHODS: Conservation modeling.....	203
METHODS: Conservation on private lands.....	203
METHODS: Ecological restoration and reconstruction.....	204
METHODS: Ecosystem / conservation area management.....	204
METHODS: Inventory and monitoring.....	206
METHODS: Land use planning for conservation	207
METHODS: Population viability analysis	208
METHODS: Protected area planning and design	208

METHODS: Recovery of endangered species	211
METHODS: Scientists and managers: bridging the gap	214
METHODS: Spatial Ecology and Conservation.....	214
TAXA: Amphibian and reptile conservation	215
TAXA: Bird conservation	217
TAXA: Conservation of migratory taxa.....	224
TAXA: Fish conservation	225
TAXA: Invertebrate conservation.....	225
TAXA: Mammal conservation	227
TAXA: Plant conservation	233
Speed.....	235
Speed Session Population Dynamics and Conservation Genetics.....	235
Speed Session Protected Area Planning and Design and Conservation Capacity Building	241
Speed Session Mammal Conservation and Conservation Modeling.....	247
Symposium.....	253
Symposium: Applying the IUCN Best Practice Guidelines for Gap Analysis into Private and Public Sector Engagement: Tools, Opportunities and Experiences, 68447	253
Symposium: Wildlife Diseases and Biodiversity,72279	256
Symposium:Restoring Przewalski's Horses—Lessons Learned from In-situ and Ex-situ Conservation,66567	259
Symposium:Galliformes-Barometers of the State of Applied Ecology and Wildlife Conservation in Asia, 68378.....	266
RESPONDING TO COMMUNITIES LIVING AROUND PROTECTED AREAS IN SOUTHERN SICHUAN	270
Simon Dowell, Bo Dai	270
Symposium: Conservation Practices in China, 72276.....	271
Symposium: Integrated Protection and Restoration of Wetlands, Rivers and Subterranean Aquatic Ecosystems,66751	275
Symposium:Beyond Ideas: Using the Valuation of Ecosystem Services to Advance Conservation on the Ground, 66781	281
Symposium:Asian Elephants in Fragmented Landscapes: Conflict or Conservation or Both? 66328	284
Symposium: Cranes, Communities and Conservation: A Charismatic Bird Inspires Wetland Conservation Across Eastern Asia,68485.....	289
Symposium:Drivers of the 21st Century Global Wildlife Trade: Key Challenges and Opportunities for Sustainability,68382	292
Symposium: Conservation Science for Giant Pandas and Their Habitat, 68030	295
Symposium: The Asian Primate Crisis: Priorities and Actions, 68294	302
Symposium:Forest Management and Wildlife Conservation from China and International Perspectives - Seeking Harmony of Wildlife Biodiversity and Human Demands for Forest Resources, 68456.....	309
Symposium:Combining Local and Scientific Knowledge to Monitor Central Asia's Ungulates,66461	312
Symposium: Common Property, Biodiversity Conservation, and Climate Change,69006	315
Symposium: Cost of Ensuring Biodiversity Security: Making the World Protected Areas Network Resilient to Climate Change, 68238	318
The existing global protected area network represents a substantial investment by.....	319
Symposium: New Approaches to Monitoring Biodiversity,68432.....	321
Symposium: Measuring Progress Towards Aachieving CBD Targets in the Lead up to 2010 ,68311.....	324

Symposium: Conservation Challenges on the Roof of the World,68381	327
Symposium: Conserving Southeast Asia's Imperiled Biodiversity – Scientific, Management, and Policy Challenges, 66450	330
Symposium: Balance, Harmony, Power: Evaluating Trade-offs in Resource Conservation, Conversion, and Extraction in Protected Area, 68389	334
Symposium: Long Distance Wildlife Migrations in Asia: Understanding and Conserving these Spectacular Ecological Processes , 68302	337
Symposium: Making Ecosystem Services Count: Real-world Progress from Africa , 67956.....	340
Symposium: Lessons Learned from the International Marine Conservation Congress and Future Directions in Marine Conservation , 66566.....	345
Symposium: Restoration of Large River Ecological Functions for Biodiversity Conservation: Case Studies from China and USA ,66525	346
Appendix I	350
Author Index.....	350

Oral

Indigenous knowledge and conservation

315129 WILDLIFE POACHING, LIVELIHOOD AND CONSERVATION-A CASE STUDY OF GILHARA TRIBES AT INDO-NEPAL BORDER

Rohit Singh

One of the burning issues in the present times is the issue of the livelihood of tribal communities who use wildlife. During 2006-08 a survey was conducted in three districts at Indo-Nepal border in north India to collect data on origin, culture and socio-economic status of Gilhara community, who use wild animals directly or indirectly for their livelihood. Data was also collected on the species poached, hunting methods, trade routes, price of products etc. A total of 22 Gilhara settlements were surveyed and 100 Gilhara families were interviewed. Two Gilhara sub communities were identified in the region. The literacy rate in was very low (<5%) in all Gilhara villages. Most (92.3%) of the community members earn their livelihood from stone cutting. The survey revealed that all Gilhara community members kill wild animals, some kill for food and some actively involve in illegal wildlife trade. On an average every Gilhara spent 2-3 hours daily on hunting. Average monthly income from stone cutting was 1000-1200 INR. The species commonly killed by the community are jackal (*Canis aureus*), leopard (*Panthera pardus*), striped hyaena (*Hyaena hyaena*), tigers (*Panthera tigris*) etc. During the survey some community members were convinced to work as informers with the enforcement team. After the study four major seizures were conducted in the region and 6 traders were arrested.

315254 USING TRADITIONAL KNOWLEDGE WITH SCIENCE: VOICES OF THE CARIBOU PEOPLE

Archana Bali, Gary Kofinas

In order to maintain the traditions of sustainable use of natural resources it is imperative to integrate traditional knowledge with scientific research. We initiated a film-based project "Voices of the Caribou People" in partnership with indigenous people of the Arctic who subsist on caribou (*Rangifer tarandus*) to complement the on-going biological research on this important subsistence resource. From May to August 2008 we worked with six communities in the North American Arctic through video-interview of community elders, leaders, hunters, women & youth. We documented concerns about changes that are taking place in their homelands. We found that the challenges faced by these communities are very similar, such as higher energy costs in the Arctic, greater extractive development activities in homelands, and social problems of engaging youth in traditional pursuits. The participants in the project saw video as a powerful tool for communicating with policy makers, biologists and greater public. The elders saw this project as communities' legacy and a repository of traditional knowledge in changing times. The findings of this project are intended to inform western scientists working to develop conservation strategies and build resilience in times of rapid changes. By incorporating local knowledge in our scientific studies we gain a greater understanding of change

and in cooperation with the caribou users are better able to assist them in more effective adaptation.

315154 USING TRADITIONAL ECOLOGICAL KNOWLEDGE TO DESIGN AN IN-SITU PHILIPPINE CROCODILE CONSERVATION PROGRAM

Jan van der Ploeg, Merlijn van Weerd

There is a growing recognition that Traditional Ecological Knowledge (TEK) can provide a rapid and cost-effective substitute for ecological research methods to design conservation interventions. However, the validity and applicability of data collected from rural communities remains contested; particularly for rare, elusive and non-consumptive species in rapidly changing landscapes and societies. We interviewed local people on the behavioral ecology of the critically endangered Philippine crocodile *Crocodylus mindorensis* in Northeast Luzon, Philippines. Using the Cultural Consensus Model (Romney et al. 1986) we identified competent informants. We validated their answers with data obtained by standard ecological research techniques such as surveys, radio-tracking and behavioral observations. Local experts accurately describe distribution, territorial behavior, habitat preferences, home ranges and nest ecology of the Philippine crocodile, but systematically overestimate population size. Local knowledge on Philippine crocodile ecology was applied in the management of a community-based conservation program, specifically in the design of reserves and the re-enforcement of the population.

364703 THE SACRED AND THE SCIENTIFIC: LINKING BIODIVERSITY VALUE WITH CULTURAL VALUE IN SELECTING PRIORITY SITES FOR CONSERVATION

Naamal Kaushalya De Silva, Matthew N Foster, Amy Upgren, David H Knox

Too often, there is an unnecessary conceptual divide between conserving biodiversity and providing for human wellbeing. Biodiversity fills numerous critical human needs, such as food, building materials, clean water, and fuel. Healthy and diverse ecosystems also provide a host of less tangible benefits that enhance human wellbeing, including fulfilling aesthetic and spiritual needs. Demonstrating the critical link between biodiversity value and human wellbeing value is essential to protecting both. Looking specifically at the cultural and spiritual value of biodiversity, we asked whether the most important places for conserving biodiversity are also important sacred sites. Using GIS and text accounts, we examined the overlap of Key Biodiversity Areas (sites of global significance for biodiversity conservation) with sacred areas in a number of countries, including China, the Philippines, Kenya, and Guatemala. We found that there is a high degree of congruence between areas with high biodiversity and places that hold spiritual and cultural importance for local people. We propose potential methods for quantifying whether sites with cultural value outweigh alternative land uses. We also recommend that biodiversity surveys and analyses of conservation priority take into account and document cultural value.

366531 THE ROLE OF COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IN SHAPING INDIGENOUS WILDLIFE VALUE ORIENTATIONS AND QUALITY OF LIFE IN NAMIBIA

Harry C Zinn, Alfons Wahabe Mosimane, Duarte Morais

We investigated the impact of community-based natural resource management (CBNRM) projects in Namibia by comparing CBNRM communities and non-CBNRM communities in regard to: a) wildlife interaction; b) utilitarian and symbolic wildlife value orientations; c) perceived well-being; and d) perceived self-determination. Two pairs of participating and non-participating communities were selected for comparison on the basis of physical proximity, size and ethnicity. Using a controlled comparison method, we interviewed three to five small groups of homogeneous age, sex and social status in each village. Content analysis of interview responses demonstrates that residents of participating and nonparticipating villages interact with similar wildlife, hold similar utilitarian wildlife value orientations, and share similar beliefs about the benefits of participating in CBNRM. Compared to residents of nonparticipating villages, however, residents of participating villages express a richer set of symbolic wildlife value orientations and perceive themselves to have higher levels of well-being and self-determination. Results suggest that implementing CBNRM among these indigenous villages led to improved quality of life and an elaborated set of wildlife value orientations. These changes may lead to improved conservation of wildlife resources, but this relationship needs to be explicitly tested in larger-scale research that can be generalized to a larger population.

314513 SPATIAL DISTRIBUTION OF ASIATIC BLACK BEAR AND BEAR-HUMAN CONFLICTS IN SOUTHWESTERN CHINA

Fang Liu, William McShea, David L Garshelis, Xiaojian Zhu, Dajun Wang, Ji'en Gong

No reliable map has been completed of Asiatic black bear in China. Thus we conducted a systematic survey combining interviews and sign surveys to obtain presence-absence data of black bears, and assess the human-bear conflicts in Sichuan Province, Southwestern China, 2005 -2007. We divided the province into 15 ×15 km cells, stratified them by forest cover, elevation, and road density, and randomly selected 494 cells (21% of province) for surveys.

In each cell, we interviewed villagers and ground-verified reports of their reports of bear presence. We ground-truthed bear absence by conducting transects in bear-suitable habitat. We used logistic regression to identify key variables affecting presence of bears, and predict their occurrence in unsampled cells. We detected bears in 360 cells. Models correctly predicted bear occurrence in 90% of bear present cells and 84.5% of bear absent cells. Forest was a strong positive predictor of bear presence but road was a negative one. Interviewed villagers thought that bears were increasing in 32%, stable in 10%, and decreasing in 58% of present cells. Villagers considered poaching as the most common cause for bear population decline. Bears were reported to raid crops, kill livestock, and attack human in 174, 114, and 49 cells, respectively. Our fine-scale distribution map can be useful for future monitoring and management for this species. Bear-human conflicts and poaching were two major threats that bears face.

306263 MODELING THE LONG-TERM SUSTAINABILITY OF INDIGENOUS HUNTING IN MANU NATIONAL PARK, PERU: LANDSCAPE-SCALE MANAGEMENT IMPLICATIONS FOR AMAZONIA

Taal Levi, Glenn H. Shepard, Julia Ohi-Schacherer, Carlos A. Peres, Douglas W Yu

Hunting threatens the persistence of large primates and other ecologically important vertebrates. We use human-demographic, game-harvest, and game-census data to parameterize a spatially explicit hunting model. We explore how population growth and spread, hunting technology and effort, and source-sink dynamics impact the density of black spider monkeys (*Ateles chamek*) over time and space. Our study area is the 1.7 M Ha Manu National Park in the rainforests of south-eastern Peru, inhabited by Matsigenka indigenous people. In all scenarios, spider monkey populations (which are vulnerable to hunting) persist in high numbers in much of Manu Park for the next 50 years. Nonetheless, shotguns cause much more depletion than traditional bow hunting. Maintenance of the current indigenous lifestyle (dispersed settlements, bow hunting) will cause little faunal depletion, despite rapid human population growth. When guns are used, however, spider monkeys quickly become depleted around even small settlements, with depletion eventually reversing the short-term harvest advantage provided by shotgun hunting. Thus, as our models also show, when guns are used, limits on settlement numbers and spread can reduce total depletion of spider monkeys. Our framework for analyzing the landscape sustainability of hunting lets us visualize the future effects of hunting, population growth, hunting technology, and settlement spread in tropical forests.

Conservation capacity building

315242 CREATING A CONSERVATION WITH CHINESE CHARACTERISTICS

Jianchu Xu, Robert Edward Grumbine

As China increasingly becomes influential in international affairs, it is important to understand the unique characteristics of Chinese environmental values and policy processes and choices. This is especially true as China continues to develop, with resulting impacts on natural ecosystems from habitat fragmentation, urban expansion, and global climate change impacts. But current Chinese conservation, based on traditional philosophies (Confucianism, Daoism), various state national environmental policies, and bits and pieces of international conservation standards, is not well-integrated.

Looking at the village, provincial, country, and international scales, we suggest specific ways to improve conservation practices in China. At the village level, we recommend attention to community-based conservation and Payments for Environmental Services. At the provincial scale, integrating conservation into development planning is important. At the country level, we suggest ways to improve environmental rule of law, how the central government works with NGOs, and opening information for public review. At all scales, we focus on Chinese processes of decisionmaking, including how to evolve the concept of zengji and definitions of political success.

Combining traditional strengths of Chinese values with best international management practices adapted to conditions in China will help to create a "Conservation with Chinese

315281 EVALUATING SPECIES THROUGH CAMP AND PHVA WORKSHOPS: CASE STUDY OF NEOTROPICAL PRIMATES

Ernesto Rodríguez-Luna, Aralisa Shedden-González, Brenda Solórzano-García

The Conservation Assessment and Management Plan (CAMP) and the Population and Habitat Viability Assessment (PHVA) workshops, promoted by CBSG and SSC (IUCN) specialists, have become important tools for analyzing species status and establishing mechanisms for their conservation. Since the neotropical region contains 199 species and subspecies of primates, 30% of which are endangered, several workshops have taken place for primates within this area (four CAMPs and seven PHVAs) with varying degrees of success. To identify the factors that have led to failure or success of the CAMP and PHVA workshops it is essential to critically review their contribution to current conservation strategies. We analyze the results obtained during these workshops and identify how those results have been used by institutions and agents involved in primate conservation. In general, we found that factors such as the integration of governments and universities in the workshop process, the proper distribution of results, and information exchange among the participants, are determinants for the success of the workshop and the application of the results to primate conservation. This analysis also allows us to provide recommendations that may enhance the outcomes of these exercises as well as their application in conservation strategies.

315308 STUDY AND CONSERVATION OF BIODIVERSITY IN THE MESOAMERICAN REGION: A STRATEGY FOR UNIVERSITY NETWORK COLLABORATION

Aralisa Shedden-González, Ernesto Rodríguez-Luna, Brenda Solórzano-García

Although the Mesoamerican region represents only a 2% of the planet surface, it contains 12% of global biodiversity. But due to political, socioeconomic and educational problems, biodiversity in this area has been under constant and growing threats, thus receiving special attention from governments, organizations and research institutions. However, the diverse efforts that have been promoted have not been sufficiently successful to reverse these pressures. In this challenge to conserve biodiversity, we consider that Universities should have major involvement, in order to develop and maintain long term conservation strategies. The establishment of a collaboration network between Mesoamerican universities could be the basis for the development of regional conservation planning. Within this network, we promote the implementation of educational alternatives and innovations, as well as the consolidation of strategic alliances between Universities, government, NGO-s and all sectors involved in conservation issues (including communities). The network structure is internet based, and provides learning objects, which allow students, academics and researchers in every country to consult and/or present problems related to biodiversity conservation in Mesoamerica. These examples offer a learning system based on problem solving and can also be used in different contexts for decision taking, providing resources for the development of effective conservation strategies in the region.

365313 PROGRESS TOWARD AN ERA OF EVIDENCE-BASED CONSERVATION

Andrew Pullin

The concept of evidence-based conservation has been around for almost a decade. This talk will review the extent to which the theory, taken from health care, has been put into practice. The core methodology of systematic reviewing evidence on effectiveness of interventions is now well established and has been applied to a broad range of subject areas. The Collaboration for Environmental Evidence is now legally constituted as a not-for-profit organisation. A central library of systematic reviews has been established and submission rates are rising. Funders are recognising the value of systematic reviews and the funding base is now diverse and global. Publishers also recognise the value of reviews and are creating opportunities for publication. Despite these successes a number of challenges remain. Measures of impact of the evidence-based approach on the effectiveness of conservation will be slow to emerge and this is likely to inhibit large scale investment. The scientific community is unsure of the rewards for investing time in systematic reviews and this discourages formation of subject review groups. Access to data for collation and synthesis of evidence still lacks the necessary structures and cultural practices.

367057 THE A.P. LEVENTIS ORNITHOLOGICAL RESEARCH INSTITUTE: COMBINING SCIENTIFIC RESEARCH WITH COMMUNITY BASED CONSERVATION

Augustine Ezealor

Bridging the gap between scientists and managers as well as communities and conservationists through partnership building better facilitates the understanding of the need for conservation. This is especially important in developing countries where socio-economic conditions often appear to conflict with conservation priorities. The A.P. Leventis Ornithological Research Institute (APLORI), an ecological institute runs a yearly Masters programme in Conservation Biology and has successfully managed the community-supported Amurum Forest Reserve in Jos, Nigeria. The goals of the institute include: (1) addressing conservation issues through community-based sustainable management for biodiversity preservation, (2) providing local education and research opportunities by training ecologists and conservation leaders in a country that largely lacks such expertise, and (3) addressing socio-economic problems through capacity-building for improved livelihood of local communities. APLORI has trained 32 Nigerian students and provides support for visiting researchers whose research projects extend through the various biodiversity hotspots in Nigeria. This is the first conservation-based initiative in Nigeria. Through this scheme awareness on conservation and sustainability has increased while the degree of poverty in Amurum Forest support-zone communities has reduced significantly.

315173 "BUY A FISH, SAVE A TREE", A SUSTAINABLE WILD CAUGHT ORNAMENTAL FISHERY AS AN ALTERNATIVE STRATEGY TO AMAZON CONSERVATION, RIO NEGRO, BRAZIL

Ning Labbish Chao

Since the 1950s, commercial extraction of wild fishes for ornamental fish trade in the middle Rio Negro has provided employment and sustained 10,000 rural and low income people in the Amazonas, Brazil. About 20-40 million fishes belong to 100 species are extracted annually from the floodplain of the region. One species, cardinal tetra (*Paracheirodon axelrodi*), constitutes over 80% of the total catch. Since 1990, we have studied and monitored the fishery and worked with rural communities to keep the fishery commercially and environmentally viable. We found that the fishery is sustainable for most target species have a short life span, and the fishing ground is less than 10% of the floodplain habitat. The revenues of the fishery have kept the deforestation and wildlife poaching at minimum. To conserve fish diversity, Brazilian government provides a list of 200 species that permitted to export for ornamental purpose. Locally, we have been pushing a good practice of fish handling, a fare trade practice and established a participative management strategy for the local communities. Captive breeding of Amazon fishes outside the region and illegal trade may threaten the viability of the fishery. Thus, we use the slogan "Buy a fish, save a free"!

315152 EVALUATING OUTCOMES FROM CONSERVATION ACTIONS IN THE POLYNESIA-MICRONESIA HOTSPOT

Madeleine Clare Bottrill, Marc Hockings, Hugh P. Possingham

Despite the proven merit of evaluating past actions for future success, government agencies and non-governmental organizations (NGOs) rarely assess the outcomes of their investments. Evaluating past conservation actions to determine what worked and what did not, can help understand the impact of different decisions. Across Polynesia and Micronesia during the last decade, an increasing number of conservation actions have been applied in terrestrial ecosystems, such as establishing protected areas, eradication of invasive species and restoration of coastal mangroves. We evaluated outcomes of a subset of past conservation projects across the biodiversity hotspot. We judged the success of projects from three perspectives: biological (e.g., change in species persistence); social (e.g., awareness among stakeholders); and management (e.g., learning by managers). Outcomes were assessed through review of existing literature and expert judgment obtained through interviews. Our interpretation of success was formed from an understanding of regional values and context. The benefits of this research were three fold. Firstly, this study demonstrated the value of evaluation tools, which while frequently applied in other public sectors, are rarely applied in conservation. Secondly, our assessment informs managers about the attributes of, and tradeoffs between, different types of conservation actions. Finally, this evaluation provides useful information for guiding future investments.

Environmental sociology

314684 CHANGING PLACES: CONSERVATION NGOS AND LOCAL ACTORS IN CHINA'S NEW NATIONAL PARKS

John Zinda

When new protected areas (PAs) are established, who directs how parks are managed? This research examines the changing balance of influence between transnational and domestic actors in a new generation of PAs in the biodiversity hotspot of southwest China. Transnational conservation organizations (TCOs) have been instrumental in establishing new national parks here, despite weak domestic NGO activity. However, to advance their projects these organizations must engage with state organs and compete for conservation projects, compromising on some goals. I report research conducted in northwest Yunnan Province, China, through document analysis, site visits, and interviews with members of TCOs, PA planning committees, park management, tourism enterprises, governments, and rural communities,. While PA PA has been seen as exemplifying the hegemony of conservation ideas from developed countries, I show how some local actors are setting more of the terms. First, the local state is taking an active role not only in deciding how jobs and profits are distributed but in drafting rules or PAs. Second, domestic scientific experts manage PA planning, reinterpreting management guidelines. These changes impact monitoring practices, which respondents perceive as deficient. They also have consequences for local residents, who do not participate in decisions and employment as governments and INGOs have promised. I will report findings from 2008 field work and a second trip in June 2009.

367386 CONFLICT OR HARMONY WITH INVASIVE SPECIES: EMPIRICAL RESULTS FROM A SURVEY OF INVASION BIOLOGISTS

Brendon Larson, Ashley Young

While conservation biologists generally oppose invasive species because of their impacts, others argue that they result from natural biological processes and the threat they pose has been over-stated. Accordingly, some feel it is appropriate to advocate on behalf of native biodiversity with dramatic language, whereas others maintain that this compromises scientific objectivity. We require a better sense of how invasion biologists evaluate these and other foundational issues in their field. We thus surveyed reviewers of the journal *Biological Invasions* in April 2008 to obtain their response to 35 contentious claims from the primary literature. We received 422 replies, giving a very good response rate for an online survey of 42.5%. We detected a bimodal response distribution to many debates in the field, but respondents consistently indicated that contemporary invasions are unprecedented, though this was not seen as justification for hyperbolic language. In contrast to prevalent claims in the literature, we found that only 27.4% of respondents ranked invasive species as the first or second greatest threat to biodiversity, with habitat degradation, human population growth, and global climate change considered greater threats overall. We discuss these and other results in terms of priorities for invasion biology and the ongoing debate about advocacy in conservation biology.

314950 MANAGEMENT OF PROTECTED AREAS AS PUBLIC GOODS: THE RESPECTIVE ROLES OF GOVERNMENT AND MARKET

Wenjun Li, Lynn Huntsinger

There has been ongoing political and scientific debate about how to manage protected areas. One focal area has been the adoption or rejection of market approaches. Opinions are highly polarized, with those in support able to forward many advantages of market-based approaches, while opponents can argue equally numerous disadvantages. The paper fits protected areas into extant definitions of a public good, and explores the relationship between government and market in protected area management and its impacts on conservation and development. From the point of view of public good provision theory, taking Jiuzhaigou Nature Reserve of China as a case study area, this paper analyzes the changes of roles of government in different period of tourism development, and the impacts on natural resource conservation and local community development. We find that current Jiuzhaigou mode is a temporarily expedient system instead of long-term institutional ensured mechanism. The government is playing dual-roles, as both of "arranger" and "provider" of direct use value of the reserve, which compromises the local community's development although the conservation objective seems achieved in short term. We argue that both government and market approaches are necessary in protected area management, but their respective roles must be clearly identified.

315679 SOCIAL PROCESSES AFFECTING THE INTEGRATION OF CONSERVATION AND DEVELOPMENT IN CAMBODIA

Kararaina Scally

The integration of conservation and development has often posed significant challenges. Improved understanding of the complex socio-political context in which such programmes are implemented is one avenue towards improving this. Using grounded theory, this context was examined in Cambodia. 46 semi-structured interviews were conducted with 38 people during two two-month periods in 2007 and 2008 representing a range of institutions and positions within the Cambodian conservation and natural resource management sector. These were transcribed and analysed using the grounded theory approach whereby content is coded, concepts developed and theory constructed as an iterative process. A triad of central concepts emerged: power, control, and engagement. Engagement emerged as the core category, within which some important sub-categories were also identified: having faith, connectedness and time. The dynamics observed within this conceptual triad highlighted the importance of key social concepts and processes and their impact on the strength and resilience of engagement, impacting in turn on the effectiveness and sustainability of projects, programmes and policies designed to integrate conservation and development in Cambodia. Leverage points for effecting change in the triad's dynamics are identified and discussed, highlighting the importance of achieving a deeper understanding of the socio-political context within which conservation and development policy and practice occurs.

315638 THE UNEVEN TRANSNATIONALIZATION AND HYBRIDIZATION OF CONSERVATION NETWORKS IN NORTHEAST ASIA

W. Chad Futrell

There has been a groundswell of transnational awareness building, scientific and educational exchanges, and advocacy campaigns by conservation-related NGOs in Northeast Asia since the Rio Summit. Contrary to mainstream theories of global civil society and transnational social movements, however, China has become far more transnationalized in terms of conservation NGOs than open, democratic South Korea. Ethnographic and interview data collected over two years of fieldwork in South Korea and China are used to construct a network analysis of NGOs, research institutes, and government agencies working on migratory bird and wetland protection as well as those working to prevent desertification and sandstorms. Mapping these networks shows that South Korea's vibrant conservation community is relatively isolated internationally, whereas China is marked by the significant presence of international NGOs and relatively sparse number of domestic NGOs. Network analysis also reveals the bottlenecks and bridging organizations within regional networks, as well as the hybrid governance arrangements being constructed by NGOs, government agencies, research centers, and UN agencies. Along with discussing the implications of hybrid governance for particular projects, the paper concludes with suggestions on how to overcome the social, political, and linguistic obstacles to transnational conservation efforts in Northeast Asia.

306077 TOWARD IMPROVED COMMUNITY ENGAGEMENT IN ACTIONS TO REDUCE THE IMPACT OF CLIMATE CHANGE ON THE GREAT BARRIER REEF

Stephen Sutton, Renae Tobin

Climate changes is the largest threat facing the Great Barrier Reef (GBR), with severe impacts predicted under even moderate climate change scenarios. GBR climate change reduction and mitigation strategies will require significant changes in human attitudes and behaviors. We surveyed 1,622 Australian residents to understand the potential for engaging the community in GBR climate change reduction and mitigation strategies. Eighty nine percent of respondents were concerned about the effects of climate change on the GBR, and 75% believe climate change will have a major impact on the GBR over the next 25 years. Eighty three percent of respondents were interested in helping reduce the impact of climate change on the GBR, but only 21% said they were very likely to take some action in the next 12 months. The strongest constraints preventing individuals from doing more than they currently do to reduce the impact of climate change on the GBR were: not knowing what else they can do (69% of respondents), having more important priorities (51%), lack of time (47%), and inadequate understanding of the climate change problem (34%). Results suggest there is high potential for improved engagement of communities in actions to reduce the impact of climate change on the GBR if agencies can develop programs and strategies that help people negotiate these constraints.

315493 IMPACT OF CONSERVATION POLICY: GRAZING RESTRICTIONS ON LIVESTOCK COMPOSITION AND HUSBANDRY PRACTICES IN MADI VALLEY WITHIN CHITWAN NATIONAL PARK NEPAL

Bhim B. Gurung, Kristen C. Nelson, James L. David Smith

Conservation policies focused on livestock grazing restrictions in parks and reserves in developing countries are common practice. Understanding the influence of grazing restriction policies on livestock husbandry is critical, not only because local people's livelihood often depends on it, but also because of its importance to biodiversity conservation. In 2006, we collected household survey data and used secondary information to examine the impact of policy changes in livestock composition and pressure on available resources in the Madi Valley, within the buffer zone of Chitwan National Park, Nepal. We found households reduced numbers of less productive cattle and high maintenance buffalo to offset forage demand, but increased low maintenance goats to supplement income. On average, household fodder biomass available from agricultural land (2.3 tons/year) was not adequate for the demand (3.3 tons/year) from average household livestock units, requiring dependence on communal lands, community forests, and parklands for livestock rearing. The majority of households stall fed livestock as an adjustment to the policy limiting grazing areas. Higher stall feeding reduced grazing pressure but demanded more fodder cutting which has the potential to increase human/wildlife interactions, particularly with tigers in the buffer zone community forests.

Desert conservation

315720 IMPORTANCE OF TERRAIN AND HABITAT PROTECTION FOR CONSERVATION OF THE STRIPED HYENA (HYAENA HYAENA) IN HUMAN-DOMINATED LANDSCAPES OF WESTERN INDIA

Priya Singh, Ullas Karanth, Arjun Gopaldaswamy

The striped hyena (*Hyaena hyaena*) occurs in large parts of arid and semi arid areas of the Indian sub-continent. Considering most of these areas also support large human populations, we tried to identify key ecological and human factors that influence hyena abundances in such areas.

Hyena densities were estimated using photographic capture-recapture methodology across two landscapes in the arid region of western India. The first site covered 307 km² of the Kumbhalgarh Wildlife Sanctuary in southern Rajasthan while the second site covered 218 km² of an agro-pastoral landscape around the Esrana Range in south-western Rajasthan. We explored the influence of topography, livestock densities and protection status of the area on hyena abundances.

Kumbhalgarh had higher hyena densities of 6.5 ± 2.5 hyenas/100 km² while estimates obtained for Esrana were 3.67 ± 0.3 hyenas/100 km², suggesting that while hilly terrain and legal protection offered at Kumbhalgarh positively impacted hyena densities, livestock densities beyond a threshold value did not impact hyena densities.

This study provides the first reliable estimates of hyena abundance from India and the potential factors influencing it, which is crucial information for effective management programmes aimed at the species.

308157 RE-INTRODUCTION OF ASIAN HOUBARA BUSTARD IN THE UNITED ARAB EMIRATES**Pierrick Rautureau, Pierrick Rautureau, Mark Lawrence, Yassir Al Kharousi, Olivier Combreau**

The Asian houbara bustard (*Chlamydotis macqueenii*) is declining rapidly throughout its distribution range. Re-stocking depleted populations and re-establishing those that are extinct by release of birds bred in captivity is an integral part of the global conservation strategy. We initiated captive production of houbara under controlled indoor conditions in the United Arab Emirates in 1998, and have released 247 birds to the wild in the Abu Dhabi Western Region since 2004. Survival rates at one year post-release ranged from 20.0 \pm 17.9% to 63.5 \pm 5.9% according to years. Initial mortality was generally high in the first two months (ranging from 12.7% to 49.7%) but typically slowed down by the beginning of the third month. Providing pre-release acclimatization on release sites did not positively influence post-release survival. Three of the released females initiated breeding in 2007 and 12 bred in 2008. Chicks raised in the wild in 2008 survived to 6 months at the rate of 34.0 \pm 10.0%, and 5 of them survived to date (> 8 months). We propose habitat improvement by installation of irrigation systems, to supplement vegetation and thus in turn availability of food and cover, for increased success of future releases

315051 CONNECTIVITY OF THE ASIATIC WILD ASS POPULATION IN THE MONGOLIAN GOBI**Petra Kaczensky, Ralph Kuehn, Badamjav Lhagvasuren, Stephanie Pietsch, Weikang Yang, Chris Walzer**

The Gobi areas of Mongolia provide a last refuge for the Asiatic wild ass *Equus hemionus* and other threatened migratory or far-ranging mammals. Because the species is still rather numerous it is an ideal model species to identify barriers that most probably also affect other species with a presently more restricted distribution range. We assessed the connectivity of the Asiatic wild ass population in the Mongolian Gobi using telemetry, population genetics and distribution ranges.

Telemetry data identified mountains and fences as movement barriers for Asiatic wild asses. It also showed that the protected areas in the SE Gobi are not large enough to sustain wild ass population. Population genetics suggested gene flow over the entire Gobi. The number of private alleles, *F_{st}* values and Bayesian clustering identified two subpopulations and Monmonier's maximum difference algorithm pointed towards a genetic boundary between the Dzungarian- and Transaltai Gobi. Historic and recent wild ass distribution in combination with telemetry suggests that mean biomass production is a good proxy for human land use intensity.

Combining all datasets in a Gobi wide habitat connectivity maps suggests that the connectivity of the Mongolian Gobi could be greatly enhanced by opening the fence along the international border towards the Chinese province of Xinjiang. We suggest managing the border region as an ecological corridor under the CBD's PoWPA program or as a peace park.

315688 ECOLOGY AND CONSERVATION OF SPECTACLED BEARS (TREMARCTOS ORNATUS) IN LOW-LYING DESERT HABITAT IN NORTH-WESTERN PERU

Robyn Denise Appleton, Karen Noyce

Spectacled bears in cloud forests of the western Andes have been studied for years, yet much is still unknown about their ecology in the wild. Though typically considered a cloud forest species, spectacled bears may do well in low-elevation dry forests, provided human presence is low in areas where bear foods are abundant and steep cliffs provide refuge for mothers and cubs. The relatively open terrain of Peru's dry forest provides excellent visibility and unparalleled opportunity to observe wild spectacled bears. Using visual observation, remote cameras, and GPS collars, we studied bear behavior, movements, and habitat use over a 20-month period. Unique facial markings and human-tolerant behavior of some bears enabled us to identify 32 individuals. Local seasonal density appeared to be higher than cloud forest studies. Our observations suggested a seasonal influx of bears to our study area during summer coinciding with the ripening of the sapote fruit (*Capparis angulata*). Pairings of bears, vocalizations, and other behavior suggested that breeding activity may also have been occurring. Results from this work will help in identifying key areas for bear conservation in a regional government conservation initiative under development.

315431 VEGETATION COVER CLASSIFICATION OPTIMIZED TO DETECT AREAS AT RISK OF DESERTIFICATION IN WADI ALLAQI BIOSPHERE RESERVE: CASE STUDY UPON CLIMATE CHANGE

Ashraf Hussein Salem

Using the computerized technology specialized in the fields of (GIS) for satellite imagery analysis and producing statistical and historical information have great echoes on the level of regional and international authorities and decision makers. A certain study was done on Wadi Allaqi Biosphere Reserve in order to ensure the Effects of deforestation in arid lands in ED. The declassification of CORONA satellite images has now made it possible to study long-term changes in arboreal vegetation. The potential and limitations of such images for long-term vegetation studies are scrutinized in the light of this research. High-resolution images (ca. 2.7 m) from 1965 compared to field data (07/08) of individually mapped Wadi trees (*Acacia tortilis* subsp. *tortilis* and *Balanites aegyptiaca*), and others. Different sites WABR of trees mapped in 07/08 (canopy area over 70% was detected in the imagery. The study indicates that 84% of the population mapped in 07/08 was already present in 1965 and that trees grow slowly and are older than previously assumed. the resultant reduction in CA may lead to misinterpretations in change analyses. On the other hand about 16% of the studied trees were dead were recorded in the present study. It was observed that, climate changes, drought, charcoal production and human activities affected on the Loss of trees and shrub that mainly affected on the ecosystem of the area as well as the lives and livelihood of the local community and the WABR wildlife.

Mammal conservation

370533 WILDLIFE-LIVESTOCK INTERACTION: COMPETITION, FACILITATION, BOTH OR NEITHER

Khadga Basnet

Wildlife-livestock competition for resources is widely regarded as a major management issue, particularly in mountain protected areas of the Eastern Himalaya including Nepal. However, the issue has not been documented adequately in any of these protected areas. The main objective of this paper is to investigate whether the wildlife-livestock competition for resources is a real issue. Specifically, it will explore: a) available resources for the animals, b) grazing cycles, and c) timing and duration of overlapping of wildlife-livestock through case studies of blue sheep (*Pseudois nayaur*) and livestock interactions in three mountain protected areas (Shey Phoksundo National Park, Dhorpatan Hunting Reserve, and Kanchenjunga Conservation Area) of Nepal. Data on carrying capacity of alpine meadows and pastures and wildlife-livestock density, seasonal movement of both livestock and blue sheep along the altitudinal gradient, and their spatial and seasonal overlapping do not show competition between blue sheep and yak for grazing space and food. Direct observations and indirect evidence indicate a possible positive relationship between blue sheep and yak for grazing together. Yaks provide protection to blue sheep from predators. These findings suggest for a revision of the traditional list of management issues in protected areas.

364709 IDENTIFICATION AND EVALUATION OF THE CAPTIVE ENVIRONMENTAL FACTORS THAT AFFECT THE BEHAVIORS OF GIANT PANDAS IN BEIJING ZOO

Liu He, Zhang Jingguo, Wu Zhaozheng

The captive giant pandas have formed a self-sustaining population. They have become accustomed to the environmental factors of ex situ conservation. We evaluated the effects of light intensities, sound levels, ambient temperatures, humidity, and visitors on routine behaviors of giant pandas and the frequency of displaying stereotypy in Beijing zoo. There are significant differences in the behaviors between indoor enclosures and the outdoor enclosures. Captive giant pandas exhibited a strong negative correlation between temperature and the duration time of feeding. However, the increasing humidity resulted in significant increases in feeding and stereotypic behavior of head-weaving and door-direction behavior. There was a strong negative correlation between light intensity and the amount time of feeding. It is proposed this may be due to bamboo leaves losing water faster than dark light intensity conditions. Furthermore, stronger light intensity was shown to increase cumulative pacing events. The duration time and frequency of stereotypic behaviors were higher at low level of sound and visitors. Our data indicated that temperature, humidity, light intensity and especially sound level and the number of visitors may play a major role in determination of behavior and enrich the behaviors in giant pandas. These results demonstrate that understanding the effects of environmental conditions on this species is essential for animal management and optimal captive wellbeing.

315158 ATTITUDES TOWARDS STRIPED HYAENA (*HYAENA HYAENA SYRIACA*) IN HUMANDOMINATED LANDSCAPES

Mounir R. Abi-Said, Nigel Leader-Williams

Striped hyaenas are reputed to be grave-robbers and many stories and myths are told about them. Nevertheless, current attitudes of local people towards striped hyaenas in human-dominated landscapes are not well understood, and these were examined in Lebanon through a questionnaire survey in six study sites, including urban, rural and protected areas. Most (82.1%; N=797) respondents held negative attitudes towards striped hyaena, as a result of misconceptions and mythical stories. However, some (41.9%; N=797) respondents recognize their positive role in the environment, but these responses were influenced by respondents' education level and whether they had previously seen a striped hyaena. The effectiveness of awareness programmes, comprising an audio-visual seminar and awareness pamphlets were very effective at changing the views of adults towards striped hyaena and to improving their support for striped hyaena conservation, at least in the immediate short term. These results show the importance of raising awareness through different approaches to conservation education.

315202 CONSERVATION OF THE CRITICALLY ENDANGERED BROWN SPIDER MONKEY (*ATELES HYBRIDUS*) IN COLOMBIA

Andres Link, A. Gabriela de Luna

Brown spider monkeys (*Ateles hybridus*) are one of the most endangered primates in the world mainly due to habitat loss and fragmentation. Their distribution is restricted to the few remaining lowland forests of northern Colombia and Venezuela, and to date almost no information exists regarding their population status and behavioral ecology. We have established two long term research areas where we are studying the behavioral ecology and social behavior of *Ateles hybridus* in the wild. We have also estimated the population density of *Ateles hybridus* at four areas using line transects and conducted 10 short surveys in other areas to verify the presence of this species along its distribution. We have been able to identify several key areas for the conservation of *Ateles hybridus* characterized by having continuous forests and high population densities. Brown spider monkeys live in multi-male multi-female social groups that have fission fusion dynamics. Their social behavior resembles that of other species within the genus *Ateles*. Most of their diet is made of ripe fruits from a diverse array of canopy plants, but they can also feed from young leaves, dead wood and flowers specially in periods of fruit scarcity. The results of this study are being used in the designing of the conservation action plan for brown spider monkeys and are providing important information to address successful conservation actions for these primates.

**315518 SOCIAL RELATIONSHIPS AMONG SOLITARY ANIMALS INFLUENCE
TRANSLOCATION SUCCESS: A CASE STUDY WITH THE ENDANGERED STEPHENS'
KANGAROO RAT**

Debra M. Shier, Ron Swaisgood

Translocations reintroduce species to parts of their historic range. Although a popular conservation tool, most translocations fail. Long distance movement, "dispersal" from the release site, is common and makes newly released animals easy targets for predators. Efforts to improve translocation methodology have considered the composition of the founding population (e.g. sex ratio), but have largely ignored the relationships between individuals. A recent study showed that for highly social prairie dogs, founder groups composed of intact social groups had higher fitness one year after release. Solitary species may also rely on social interactions for fitness. For example, kangaroo rats have stable neighbourhoods and familiarity with neighbours facilitates mating. We examined settlement and survival of the endangered Stephens' kangaroo rats (*Dipodomys stephensi*) translocated with and without neighbour groups. Kangaroo rats translocated with neighbours groups travelled shorter distances from release to settlement, settled closer to acclimation cages and survived at higher rates than those translocated without familiar neighbours. These results suggest that even in solitary species, founder group relationships can strongly influence translocation success. More broadly, these results help to illustrate the importance of behavioral ecology in conservation.

315457 ANTHROPOGENIC ALLEE EFFECT THREATENS TROPHY HUNTED MAMMALS

Lucille Palazy, Christophe Bonenfant, Jean-Michel GAILLARD, Franck Courchamp

For some taxa, hunting remains a major threat. Prehistoric humans were responsible of many mammal extinctions through hunting only. Trophy hunting practice has soared up with the colonial period and is still a thriving market nowadays. The trophy collected by hunters depends on the species and include skulls, antlers, horns, hides or other body parts. Trophy value, which supposedly determines its price, is estimated using standardized biometric measures of those parts (e.g., SCI scoring). Despite the frequent claim of trophy value being based solely on its size, we postulate that the rarity of the species plays a major role in its attractiveness. We investigated the presence of an anthropogenic allee effect, where human attractiveness for rarity leads to an overexploitation chain reaction, by comparing the price of trophies from about 200 mammal species with both their biometric characteristics (SCI scoring) and their rarity. Passing for a trophy hunter, we also assessed the possibility to hunt for species that are listed as protected from hunting and trade. Not only did we find possibilities to hunt several such species, but we also show that the price of trophies is related to the species rarity, regardless of its size. The finding that trophy value is related to the rarity (natural or human-led) of animals is a major and alarming fact for the very survival of a large number of charismatic species and should be accounted for in conservation programs of these species.

320341 COUNTING CRYPTIC CARNIVORES: A COMPARISON OF NOVEL TECHNIQUES FOR MONITORING PREDATORS

Alex Diment

Evaluating changes in predator numbers is essential for determining the success of a wide range of conservation initiatives. For cryptic, low-density predators, obtaining appropriate measures can be very challenging. Species with distinctive markings can be individually identified from remote photographs, allowing estimates of abundance. For other species, sign surveys are often used as a measure of relative activity, though the relation of these index values to actual abundance is generally unknown.

This study was carried out during a large-scale lethal control program targeting Australia's most damaging invasive predator, the red fox *Vulpes vulpes*. A range of novel techniques were tested against standard methods for evaluating both relative and absolute changes in fox density. For measuring relative activity, remote cameras were found to be more cost effective and reliable than traditional methods of footprint detection or bait-station visitation. To estimate absolute abundance, forensic DNA from fox scats allowed individual identification; the spatial DENSITY framework was preferable to standard mark-recapture analysis. An alternative method — a modified Distance Sampling approach, with detection at a point by a remote camera and lure — was also tested to provide absolute estimates of fox density. This technique may be useful for species previously impossible to count. These new methods are widely applicable for predator research and management in forest habitats.

365119 THE IMPORTANCE OF LONG TERM RESEARCH FOR CONSERVATION OF THE CRITICALLY ENDANGERED TONKIN SNUB-NOSED MONKEY IN HA GIANG PROVINCE, VIETNAM

Quyet Le Khac

Rhinopithecus avunculus, the Tonkin snub-nosed monkey (TSNM), is endemic to a small region of northeastern Vietnam and is one of the 25 most endangered primates in the world. In 2002 a population of this primate species was discovered in a 1000ha karst forest island in the Chau Ca area of Ha Giang Province. Along with conservation activities, research on the behavioral ecology of this species has been ongoing since its initiation in 2003. Using contemporary scientific methods we have amassed various types of ecological and behavioral data. Important results to date include identification of 34 food species, the chemical and mechanical profile of preferred food specimens, preference by the TSNMs for tall trees with small to intermediate sized gaps, and a locomotor repertoire dominated by quadrupedal walking, followed by quadrupedal running, leaping, and forelimb suspension on small to medium branches. These results are of critical importance for planning a forest rehabilitation and expansion program that will start in 2010 at Chau Ca. In addition, this TSNM population appears to be growing, with the observation of more infants every year, and increasing group counts ranging from an average of 60 individuals in 2005 to 90 individuals in 2008.

Bird conservation

315104 ABUNDANCE, DISTRIBUTION AND CONSERVATION OF THE RESTINGA ANTWREN, FORMICIVORA LITTORALIS (AVES: THAMNOPHILIDAE)

Maria Alice S Alves, Mariana Moncassim Vale, Juliana F. Mattos, Maurício Brandão Vecchi

The Restinga Antwren (Thamnophilidae: Formicivora littoralis) is endemic to a small region on the coast of Rio de Janeiro state, in southeastern Brazil. Currently, it is considered Critically Endangered by the World Conservation Union (IUCN) due to continuing habitat loss within its very small and severely fragmented range. Data available to assess its conservation status, however, are scarce. From 2005 to 2007, we conducted bird surveys to produce more rigorous estimates of geographic range limits, available habitat, local population density, and global population size. We used these data and IUCN criteria to re-assess the conservation status of the Restinga Antwren. We recorded the species in a new locality (Tucuns, Armação dos Búzios), expanding its range by 5 km from the easternmost known limit. The species was present in 65% of the points surveyed within its range, in restinga fragments that cover an area of c. 42 km² (84% of the total restinga within the species' range). We estimated that this bird has an Extent of Occurrence of 233.5 km², an Area of Occupancy of 148 km², and a global population size < 5,000 individuals. We, therefore, recommend downlisting Restinga Antwren from Critically Endangered to Endangered. We also recommend that the Massambaba and the Pau Brasil Areas of Environmental Protection be transformed into Ecological Reserves, to increase restrictions on human activities in the area and preserve crucial habitat for the Restinga Antwren.

367861 AGE-RELATED VARIATIONS IN TIMING, SITE USE, AND RATE OF MASS GAIN OF FOUR MIGRATORY SONGBIRD SPECIES AT AN INLAND SITE IN

Jackson County, Lisa Marie Gardner Barillas, Yong Wang,

Age-related differences in the stopover ecology of migrating songbirds are not well known. We tested the hypothesis that adult and immature songbird migrants of the same species have different migration strategies. Birds were captured at an inland stopover site within the Walls of Jericho Management Area in northeastern Alabama during the autumns of 2006-2008. We compared body mass, fat scores, rates of mass gain, and habitat use of four species of songbirds during migration stopover. Focal species, chosen based on the total number of individuals captured plus ≥ 30 adults captured for each species, were: American Goldfinch, Indigo Bunting, Ovenbird and Northern Waterthrush. Immature Indigo Buntings and American Goldfinches arrived at the site earlier than adults, while the opposite was true for Ovenbirds and Northern Waterthrushes. Mean body mass of adults was higher than that of immatures for all species except Ovenbird. Only Northern Waterthrush adults had a significantly larger fat score than hatch-year birds. Adults, on average, had a higher rate of weight gain than immatures. There was no significant difference in site preference between the age classes. As competition increases due to a decrease in available habitat, discerning habitat use patterns during migration is important for the long-term conservation of these migratory species.

319279 CONSERVATION EFFORTS BY DEVELOPING SUSTAINABLE LOCAL ECONOMIES AT A RAMSAR SITE IN PAKISTAN

Zulfiqar Ali

Globally recognized sites are heavily influenced by local peoples who are largely dependant on natural resources for fuel, fodder, and their livelihood in developing countries. While these sites are surrounded by historically resource dependant communities, several have villages within their core areas too. The traditional life styles of these communities have become unsustainable because of population growth, the depletion of natural resources and the pressures, direct and indirect, of market forces. The Makran Coastal Wetlands Complex of Pakistan also support highly valuable pools of biodiversity and genetic resources, but unsustainable development is threatening the biowealth, and even causing species extinction. This study is an attempt to augment and present a consolidated assessment of status of the biodiversity of a Ramsar site (Jiwani Coastal Wetlands) in Makran Coastal Wetlands Complex. The functional role of wetland biodiversity is also highlighted and strategies needed for their conservation and wise use will be devised at the end of the study. Socio-economic studies will assess the impact of local human population. This study concludes as the assessment of the potential for the establishment of a conservation economy within the MCWC, which would achieve both sustainable livelihoods for the local people and the protection of the site and adjacent coastal habitats.

315674 CONSERVATION IN HUMAN-DOMINATED LANDSCAPES:RECONCILING AGRICULTURE WITH WILDLIFE CONSERVATION

Malvika Onial, Ben Phalan, Andrew Balmford, Rhys Green

How can we reconcile the need for increased agricultural production with the conservation of wildlife? My study addresses this question through evaluating the two main approaches of wildlife-friendly farming and land sparing that seek to minimize the impact of farming on wildlife. It analyses the responses of wildlife across low to high yielding land-use intensities through an empirical study of the relationship between agricultural yields and population densities of wildlife in an agricultural landscape in India. I quantified the yield gradient through interview-based surveys of farmers and carried out ecological surveys for birds and trees.

Results show that the response of wildlife is species-specific showing different density-yield functions from convex to concave and other complicated shapes. In the case of birds, a higher number of species tend to prefer land sparing as compared to those that prefer wildlife-friendly farming. At least 50% of all species of unmodified forest habitat were absent from farmland. By providing an understanding of the effects of agriculture production on wildlife, this study seeks to evaluate possible land use options that benefit wildlife conservation while also achieving desired agricultural yield targets to meet the needs of a growing human population.

329944 THE KITE FLYING FESTIVAL, MAN MADE DISASTERS FOR THE URBAN WILDLIFE ESPECIALLY IN THE AVIAN COMMUNITY, CONNECTIONS BETWEEN NATURE AND SOCIETY

Kartik B. Shastri

Ahmedabad celebrates religious kite flying festival of Uttarayan every 14th January. During Kite-flying festival thousands of birds fall victim to the sharp glass powder coated maanja with injuries on their wings or just about anywhere, bleeding them to death. This festival is one of the most unfortunate man made disasters for the avian community of our city. More than 850 birds get 'cut' every year. While flying, bird wings are cut and severed by sharp glass string trees are completely covered with kites. The kite strings are so sharp that it sometimes chop off the whole wing!! The festival is round the corner and we prepare ourselves to save as many lives as we can. (Help the Birds) campaign is organized every year in Ahmedabad by many N.G.O. with joint hand with forest department, Wildlife Rescue Center during the Kite-flying festival (Uttarayan) as an effort to save the injured birds from certain death and giving them a survival chance. Our primary focus will be birds of endangered species; especially White-Rumped Vultures *Gyps bengalensis*. Migratory birds visited to our area. So our major goal is organize bird rescue, documentation, education / awareness programs, helping vets in the operation theater, transfer of birds, transportation of injured birds, data collection, we invite avian specialist doctors from all over the world., creating temporary hospital. All of this work is extremely important for the nature conservation.

329523 CONTRASTING LEVELS OF GENE FLOW IN URBAN AND RURAL TREE SPARROW POPULATIONS : IS THERE INFLUENCE OF URBANIZATION?

Shuping Zhang, Guangmei Zheng

As a result of urban expansion, more and more vegetation is reduced and fragmented by modern buildings and highway in metropolis, which is limiting the dispersal of sedentary birds with small home range such as Tree Sparrow (*Passer montanus*). Can these changes influence the dispersal and then the gene flow of urban birds? To test this question, we compared the gene flow and genetic diversity of urban and rural Tree Sparrow populations in Beijing using seven microsatellite DNA loci. Three urban sites and three rural sites with same distance were selected. The results show that Urban populations have lower levels of gene diversity, heterozygosity and allelic richness compared to the rural populations, which is consistent with the finding that more private alleles occur in rural populations. All urban populations have 2-3 loci significantly deviate from Hardy-Weinberg equilibrium while only one loci was found in one rural population, which indicate that urban populations have higher inbreeding possibility. The F_{ST} values among urban populations are higher than rural populations. Gene flow estimates (Nm) values also indicate that a lower level of gene flow occurs among urban populations than rural populations. All of these results indicate that there is a possible trend that the urban environment is inhibiting urban bird dispersions and then decreasing the gene flow among urban populations.

306781 EFFECTS OF ORGANIC AND SOIL CONSERVATION MANAGEMENT ON SPECIALIST BIRD SPECIES**Ondine Filippi-Codaccioni, Vincent Devictor**

Ecologists have questioned if alternative practices like organic farming could enhance species diversity and abundance. However, if many studies focused on those latter aspects of biodiversity, very few address the problem in a functional point of view. In order to do this, bird abundance was assessed on a total of 58 farms across the Seine-et-Marne department, France (12 organic, 19 conservation-tillage and 27 conventional farms). Local abundance variations among the three farming systems were related to two species traits, i.e. habitat specialisation and diet, considering both farmland and non-farmland species. It was found that organic farming favoured specialist birds, either considering the whole community or non-farmland birds only. On the opposite, specialist farmland species were found to be less abundant in conservation-tillage farms than in conventional ones. Invertebrate-feeders were found to benefit from conservation-tillage practices compared to omnivorous species but not compared to granivorous ones. Granivorous species tended to increase with the conservation-tillage duration and in particular specialist birds. Those results shed light on the impacts of organic and conservation-tillage practices on a part of functional diversity which should be more taken into account in comparison studies because of its great importance on ecosystem functioning.

366782 EFFECTS OF WATER ON PATCH-USE BY BIRDS IN A SAVANNAH ECOSYSTEM**Mary Ngozi Molokwu, Jan-Ake Nilsson, Ola Olsson**

Resource depletion resulting from foraging activity can affect plant productivity and composition. This can arise from an improvement in habitat quality through provision of water. Dry foods may be avoided in the absence of water, but when water becomes more available, more of such food may be included in the diet. This could have great consequences on the environment-wide level of seed resources and has implications regarding the conservation of savannah birds. We measured giving-up densities (GUDs; amount of food left after a foraging bout) of birds foraging in artificial food patches in a savannah woodland, in Jos, Nigeria. We investigated the effects of water on patch-use by manipulating the availability of experimentally provided water during three seasons - dry (moderate food availability, no water), early wet (reduced food availability, no water) and late wet seasons (high food and water availability). Results showed that with added water, birds left higher GUDs (decreased depletion rates) during the dry season, but lower GUDs in the early-wet season (increased depletion rates). There was no effect of water in the late-wet season. We present a behavioural tool useful in assessing the impact that birds as predators could have on the seed-bank in savannah ecosystems.

Social Science

314613 COMMUNITY - WILDLIFE INTERACTION AND THEIR LINK TO CONSERVATION IN VILLAGES NEAR UDZUNGWA MOUNTAINS NATIONAL PARK IN TANZANIA

Rose Peter Kicheleri, nsajigwa emmanuel Mbije

This study was carried out on the eastern side of Udzungwa Mountains National Park (UMNP) with the aim of assessing community-wildlife conflicts and their influence on conservation of the park. Random sampling method was used for selecting seventy households for interview. The structured questionnaires were used to get information on which descriptive statistics were derived. Agriculture was found to be very important to the economy of local communities, as it provides food and cash as well as a source of employment. However, encroachment to the Protected Area and subsequent crop raiding by wild animals, especially monkeys, were found to be the main centre for conflicts. Furthermore, shortage of firewood as fuel prompted poaching, resulting in frequent clashes with park authority. The study established further that the community awareness to conservation was very high but the return was very low prompting poaching. The study recommends fencing the park as an effective way of deterring animals from invading farms and lessen dependence on firewoods for fuel. Furthermore, the park should consider stepping up community wildlife conservation education as well as involving them in the park management initiatives for instilling the sense of ownership.

306818 ECOSYSTEM HEALTH IN THE MISSION MOUNTAINS TRIBAL WILDERNESS: A SOCIAL CHALLENGE

Alan Watson, Roian Matt, Steve Carver

Traditionally, the Salish & Kootenai People have placed great emphasis on maintaining harmony with a relatively intact landscape. One of the primary barriers to ecological restoration in the Tribal Wilderness on the Flathead Indian Reservation in Western Montana, is the long term exclusion of fire on adjacent lands. A Buffer Zone was designated as a cushion, to protect the relatively intact wilderness from non-wilderness activities and development. Initially timber within this zone was designated as "unavailable" for harvest and removal. A proposal to change to allow timber extraction created a great deal of controversy and conflict within the Tribal population. A research program, in three phases, first found that meanings attached to this landscape could be described as 1) wildlife and water quality, 2) access and functional attachments, 3) protection of the wilderness, 4) personal and cultural meanings, or 5) recreation and scenic values. In Phase II, a web-based, fuzzy GIS mapping activity further probed not only these meanings and the threats to them, but also the location and intensity of these meanings. When Tribal members could see illustration of the intense threat posed by both logging and fire to the meanings they attached to important places within the "buffer zone," negotiation moved quickly to develop solutions to the tradeoffs obviously necessary.

315515 GENERATIONAL DIFFERENCES IN THE VALUATION OF BUSHMEAT IN CONGO AND SOME RESULTING IMPLICATIONS FOR CONSERVATION

Michelle Wieland

For rural areas in Central Africa bushmeat is not only a socially important food source, but trafficking is often a major economic activity. Although hunting and trading in African societies is not historically new, the high commercialization of bushmeat today has been particularly significant in the lives of rural peoples. To understand the role of bushmeat in rural households, I conducted 3342 surveys over a 12-month period on local food consumption in Conkouati-Douli National Park, Republic of Congo, with concurrent qualitative interviews to understand the importances of food for individuals. Although two of the three study villages are historically hunting-oriented, all consumed significantly more fish (76%) than bushmeat (21%). This phenomenon is mainly explained by economic incentives hunters have to sell in lucrative urban markets. Overall, the results suggest villagers, especially elders, are not happy with the lack of bushmeat and are uncomfortable with the instability of fish supply. But it also reveals generational change and tension: elders and youth maintain different importances of forest foods, and they value fish and bushmeat for different reasons. Further studies of these generational differences are needed to better understand both how these changes affect rural participation with conservation efforts, and also how conservationists can better engage younger generations that harbor strong economic valuations of wildlife to reduce bushmeat hunting.

315496 HEARING VOICES: THE CHALLENGES OF COMMUNITY PARTICIPATION IN BIODIVERSITY DECISION MAKING, THE CASE STUDY OF CO. CLARE, IRELAND

Rachel Kavanagh

Public participation in biodiversity decision making is increasingly the focus of policy and academic attention, heralded as a possible sustainable solution to biodiversity loss. This paper examines public participation in Ireland, a country with a weak tradition of participatory democracy, high levels of local elite involvement in decision making, but strong social local traditions based on the principles of mutualism, voluntarism and philanthropy. By engaging with the communities whose involvement is theoretically sought in biodiversity policy documents this paper provides insights into challenges facing public participation initiatives in biodiversity. The challenges are identified from an analysis of the differing perceptions towards participation. The first issue compares understandings of participation with notions of 'community'. Dynamics of power and politics are seen to follow a pattern of elites 'speaking for the community', constraining open, inclusive dialogue and social learning. The second issue examines current governance frameworks, focusing on the processes of participation and the perceived lack of institutional space for publics to voice biodiversity or conservation values and concerns. It is suggested here, that a situated understanding of community and institutional context can assist central and local government to better hear local voices, address the challenge of participation and provide new opportunities for future participatory processes.

314989 IMPACTS OF A COMMUNITY BASED PAYMENTS FOR ENVIRONMENTAL SERVICES PROGRAM ON ILLEGAL FOREST USE BEHAVIOUR IN MENABE, MADAGASCAR

Matthew M Sommerville, E.J. Milner-Gulland

Few case studies in developing countries have evaluated the success of PES interventions on changing behaviour of individuals or the relative role of payments in influencing behaviours and attitudes. This study examines self-reported changes in legal and illegal forest-use behaviours before and after a PES intervention and investigates the drivers of such changes. Change in illegal behaviours was primarily motivated by fear linked to monitoring. Indeed, monitoring by NGOs and local communities, as well as environmental outreach were the actions that ranked the as having the greatest influence on behaviour change. Despite the fact that payments were ranked as having little impact on behaviour, the payments positively influenced attitudes towards the implementing NGO, while creating a locally accepted justification for the monitoring regime. The results of this study suggest that community-managed PES in tropical low-income countries would benefit from a deeper consideration of the mechanistic role of a variety of incentives in the development of their programs.

315290 EVIDENCE FOR SHIFTING BASELINE SYNDROME IN CONSERVATION

Sarah Kate Papworth, E.J. Milner-Gulland

Shifting baseline syndrome (SBS) is often referred to as a key issue for conservation, yet there is little evidence for its existence. We outline two forms of SBS: generational amnesia, where knowledge extinction occurs because younger generations are not aware of past biological conditions, and personal amnesia, where knowledge extinction occurs as individuals forget their own experience. Two conditions are essential to the identification of SBS; biological change must be present in the system, and any perceived changes must be consistent with the biological data. If age or experience-related differences in perception are then found, generational amnesia may be occurring. Alternately, if individuals believe current conditions also occurred in the past, personal amnesia may be occurring. Previous studies have not fully addressed these conditions, and hence cannot provide indisputable evidence for the existence of SBS. A case study on human perceptions and bird populations in the United Kingdom is presented to demonstrate both forms of SBS, and show that both can occur in the same population. This case demonstrates that shifting baseline syndrome is no longer a cautionary tale, but instead is a real problem for those using human perceptions of change to inform conservation policy-making or management.

365286 BOOK LAUNCH - "RIGHTS BASED APPROACHES: EXPLORING ISSUES AND OPPORTUNITIES FOR CONSERVATION

Yani - Saloh, Terry Sunderland

The links between conservation and human rights are many and complex. The conservation community has been challenged to take stronger measures to respect rights, e.g., in the establishment and management of

protected areas. We also have new opportunities to demonstrate the positive contribution resource management and biodiversity conservation make to realizing human rights. "Rights-based approaches" may present a way to effectively reconcile conservation and rights and realize their positive synergies. However, this innovative and challenging approach requires further discussion and learning within the conservation community and its partners. Even basic questions and concepts remain relatively unexplored, including what IS a rights approach and what are its practical implications for conservation practice? A new book - "Rights Based Approaches: Exploring Issues and Opportunities for Conservation" - combines concept papers, policy reviews, and case studies with the aim of making a substantive contribution to discussion, learning, and action around this important emerging concept. The lead editors of the book, together with other available contributors, will provide a brief overview of the book's rationale, objectives, and content; answer audience questions; and make copies of the book available to interested audience members.

366866 PREDICTING PERSONAL NORMS AND BEHAVIORAL INTENTIONS FOR PROTECTION AND REMOVAL OF NATIVE AQUATIC PLANTS BY MINNESOTA LAKESHORE PROPERTY OWNERS

Susan A. Schroeder, David Fulton

Over 100,000 individuals own lakeshore property on Minnesota lakes, and lakeshore development is increasing. Lakeshore property owners may control/remove aquatic plants if they interfere with recreational activities, but these actions can damage lake ecosystems. Enabling environmentally-friendly management of aquatic plants by private property owners is vital to the health of lake ecosystems. This paper examines how place attachment relates to the protection of native aquatic plants among Minnesota lakeshore property owners. The study uses place attachment as an emotional precursor of awareness of consequences and ascribed responsibility in Schwartz' (1977) norm activation theory, and compares models based on primary- and second-home ownership and recreation participation. Place attachment was related to awareness of consequences and ascribed responsibility for protection of native aquatic plants, but the strength of the relationships was minimal to moderate. Consistent with norm activation theory, awareness of consequences and ascribed responsibility were strongly predictive of personal norms related to aquatic plant management, and personal norms predicted behavioral intentions. Future research could apply other theories of pro-environmental behavior to the protection and removal of native plants, and examine what factors—other than place attachment—relate to awareness of consequences and ascribed responsibility for protecting native aquatic plants.

Environmental geography

315490 SUSTAINABILITY OF A HUNTING SYSTEM IN NORTHERN CONGO

Michael Riddell, Anna Lawrence

This research aimed to understand the social, economic and biological changes in a community's hunting system in the tropical forests of northern Congo since the arrival of a forestry road in 2001. The characteristics of the hunting system were explored using inter-disciplinary methods including; 12 months participatory

monitoring of hunting off-take, analysis of a 12 year off-take data set collected by WCS-Congo, participatory mapping of hunting zones, and informal questionnaires and focus groups. The results highlight a reduction in spatial use of the forest by local populations. Traditional hunting activities such as net and spear hunting are used less while more forest area is used for gun-hunting. The introduction of employment and the new forestry population has led to increased bushmeat demand, while increased accessibility and affordability of cartridges combined with low costs of sending BaAka hunters hunting increased supply. Alternative protein sources are significantly more expensive than bushmeat. Bushmeat off-take has doubled and harvest composition has shifted towards small bodied mammals such as blue duiker (*Philantomba monticola*). A systems approach helps understand and pin-point appropriate conservation management strategies, and a holistic conservation response to this contemporary hunting system would include, among other measures, provision of alternative protein sources and forest zoning for gun-hunting.

367804 WILDLIFE DECLINE IN CAMBODIA, 1953-2005: EXPLORING THE LEGACY OF ARMED CONFLICT

Colby Loucks, Mike Mascia, Andy Maxwell, Keavuth Huy, Kong Duong, Nareth Chea, Barney Long, Nick Cox, Teak Seng

Armed conflict is a social phenomenon often detrimental to wildlife and wildlife habitat, but the legacy of armed conflict for wildlife in post-conflict settings remains unexplored. We explore the effects of armed conflict on wildlife in eastern Cambodia, particularly the relationships among wildlife abundance, habitat loss, technological change, trade, governance, and local livelihood strategies. Based on ordinal-scale measures, both relative wildlife abundance and species richness declined from pre-1953 to 2005, with the sharpest declines occurring during the 1970s. These declines are consistent with three synergistic social processes: proliferation of guns; emergence of wildlife trade for external markets; and government policies mandating hunting by local villagers. Armed conflict officially ceased in 1991, but conflict-induced changes in livelihoods and continuing non-local demand for wildlife have fostered further wildlife declines. Our study demonstrates that the legacy of conflict for wildlife can be profound and destructive. To address post-conflict challenges more effectively, conservation must be integrated within broader peacebuilding processes, including disarmament, demobilization, and reintegration of combatants.

315596 TOURISM AND FISHERIES: A CASE STUDY FROM MOZAMBIQUE

Adaoma Wosu

This paper reviews the effects of tourism development in coastal fishing communities and on the fisheries resources on which they depend. A case study from Ibo Island situated in Cabo Delgado province, northern Mozambique, explores the interface between coastal fishing communities and tourism. The primary researcher used a combination of socio-economic methodologies over three months including semi-structured interviews and focus groups. The main areas of impact of the tourism industry on local communities are financial, providing salaried employment, alternative employment and business opportunities, and local sourcing of goods. Non-financial community level impacts include increased

infrastructure on some islands such as schools and airstrips, and some empowerment impacts such as skill development were also recorded. However, a mismatch between the profile of fisher folk and the profile of actual beneficiaries was observed; the beneficiaries having a higher level of education and livelihoods more applicable to the lodge such as lobster harvesting. In the discussion the question 'what are the ways artisanal fishing communities can benefit from the tourism industry?' is addressed, concluding that the linkages between pro-poor tourism and the fisher folk within these communities need to be strengthened by practitioners, with implications for their livelihoods and the resources they depend on.

305152 EXAMINING TREE SPECIES IDENTIFICATION, SPECIES DISTRIBUTION PATTERNS, AND HABITAT TYPES USING REMOTE SENSING DATA IN THE WESTERN AMAZON

Ophelia Wang, Kenneth R Young, Rodrigo Sierra

Biogeographers have always striven to understand why tropical regions harbor great species diversity. One pitfall that biogeographers often encounter is the lack of tropical tree diversity data in remote areas due to the limited accessibility. Documenting tree species diversity patterns and habitat types in the tropics using remote sensing data provides a more efficient approach. The Ecuadorian Amazon belongs to part of the Amazon that is classified as one of the world's high-biodiversity wilderness areas and important ecoregions, but its remote location hinders detailed large-scale biodiversity inventories. In this study we use high-resolution aerial photographs and medium-resolution ASTER satellite images in the Ecuadorian Amazon to examine 1) palm diversity and distribution based on visual identification, 2) distribution patterns of selected tree species derived from object-oriented feature extraction, and 3) habitat types using supervised classification. More than 11,000 palms have been visually identified and digitized from aerial photographs obtained in a resolution of 5 and 10 cm in order to examine their diversity and distribution patterns. We use the software Feature Analyst to identify tree species with discernible crown characteristics and to extract all individuals from the aerial photographs. Feature Analyst is also used for extracting various habitats from the aerial photographs as references for a supervised habitat classification in the ASTER images.

315099 HUMAN AND ECOLOGICAL RISK FACTORS FOR UNPROVOKED LION ATTACKS ON HUMANS IN SOUTHEASTERN TANZANIA

Hadas Kushnir

A striking example of human-wildlife conflict is occurring in Tanzania where lions have attacked close to 1000 people since 1990. My research seeks to identify human and ecological risk factors that influence the risk of attacks at the village level. I worked in the two districts with the highest number of lion attacks in Tanzania: Rufiji district is located near Selous Game Reserve while Lindi district is far from any protected area. Within each district, I conducted interviews in two villages with a high number of attacks and two neighboring villages that had not suffered any attacks. Logistic regression analysis of 128 questionnaires revealed the following risk factors: ownership of fewer assets, poorly constructed homes/huts, longer walking distances to resources, more nights sleeping outdoors, increased sightings of bush pigs, and fewer sightings of wild prey species. A comparative analysis revealed significant differences between the two districts: while high bush pig

and low prey numbers were universal, hut construction was significant in Rufiji, and walking distances, asset ownership, and sleeping outdoors were significant in Lindi. This analysis suggests that both district-level and village-level environmental factors and human activities influence the risk of conflict. Such information will help relevant authorities develop site-specific methods to prevent lion attacks and can inform research on similar topics to help prevent human-carnivore conflict worldwide.

315582 SMALLHOLDER FOREST CONVERSION AT THE CENTRAL SULAWESI RAINFOREST MARGIN IN INDONESIA - AN INSTITUTIONAL AND DEMOGRAPHIC APPROACH

Sebastian Gerhard Wilhelm Koch, Jan Barkmann, Heiko Faust

To achieve a comprehensive image of the multifaceted proximate causes of small-scale forest conversion, a qualitative-quantitative approach, based on census data (N=898) in three contrasting villages in the vicinity of Lore Lindu National Park was chosen.

The results of the institutional analysis are abstracted from 30 qualitative interviews with key informants from the leading groups of autochthonous and migrant households. In village A, nearly feudal power relationships are exerted by a group of local 'first settler' families that dominate formal village leadership and that restrict deforestation and land transactions. No such institutional restrictions exist in village C. Traditional power relationships are replaced by economic power based on petty capitalist type production of cocoa. Forest Conversion is much higher in village C. In village B, traditional institutions and power structures still appear in place although land transactions are less restricted than in village A, resulting also in high forest conversion rates.

At the household level, we show that life cycle theory accounts well for the extent of self-reported forest conversion. Using census data, two regression models (n=77) reveal that internal demographic variables such as the worker/consumer ratio predict forest conversion much better than external agronomic variables or education. Consumptive demand appears as more important in influencing forest clearing than restrictions in farm labour.

315625 CAN PALEOENVIRONMENTAL STUDIES HELP CONSERVATION ECOLOGISTS RESTORE ECOSYSTEMS AND UNDERSTAND ECOLOGICAL THRESHOLDS?

Marlow Pellatt

Understanding how biotic communities respond to environmental change and what drivers dictate the structure and function of ecosystems are questions commonly addressed by paleoecologists. Applied paleoecological studies provide valuable insight into the understanding of ecosystem resilience, thresholds, disturbance regimes, and rates of change. It is important for conservation ecologists to be aware that paleoenvironmental data are the only empirical information available that allows us to examine ecosystem responses to climate change at the rate and magnitude projected using global climate models. When coupled with bioclimate envelope modelling, conservation practitioners are better able to prepare for future environmental change. This information is underutilised by conservation practitioners, possibly due to lack of familiarity between the disciplines or possibly due to the triage nature of many conservation efforts. This

paper will discuss recent paleoecological research undertaken on the Pacific coast of Canada related to endangered species habitat restoration, long-term pacific salmon abundances, and the interplay among climate, succession, and human alteration of the landscape. Research on terrestrial, lacustrine, and marine ecosystems using multi-proxy indicators is integrated to assess important drivers of ecosystem change and determine ecological thresholds leading to long-term change in the structure of these systems.

Sustainable agriculture

315382 RAPD AND SSR FINGERPRINTING IN WILD *TRITICUM BOEOTICUM* AND *TRITICUM URARTU* ACCESSIONS

Nelli A. Hovhannisyan, Ehsan M. Dulloo, Aleksandr H. Yesayan, Armen M. Danielian

The goals of this study were to assess the level of genetic diversity of three wild relatives of Armenian wheat namely *Triticum boeoticum* and *Triticum urartu* accessions by means of RAPD and SSR markers. 25 *T. boeoticum* and 20 *T. urartu* accessions were analyzed by application of 30 RAPD and 10 SSR markers. On an average, 8 bands per primer were observed in RAPD analysis and 12 bands per primer in SSR analysis. In RAPD analysis 52.4 % and 51.9 % polymorphic bands were observed among wild accessions of *T. boeoticum* and *T. urartu*, respectively. Similarly, 61.27% and 58.75% polymorphic bands were found in SSR analysis.

Using RAPD and SSR fingerprinting the present investigation assessed the amount of polymorphism among *T. boeoticum* and *T. urartu* wild accessions. The SSR analysis clearly indicated that even with 5 polymorphic primers, reliable estimation of genetic diversity could be obtained, while nearly 20 primers are required for RAPD. So, RAPD and SSR analyses can be recommended as cheap options to assess levels of genetic diversity in wild populations of wheat.

The results obtained allowed us to select genetically rich germplasm for sustainable *ex situ* conservation of studied populations. Also these data can be used efficiently in breeding programs for improvement of existing cultivars.

The study was supported by the IFAR Scholarship and UNEP GEF Crop Wild Relatives Project in Armenia.

315336 A LAND USE APPROACH TO MITIGATING HUMAN ELEPHANT CONFLICTS: RECONCILING AGRICULTURE AND ELEPHANT CONSERVATION

Ravi Corea

Agriculture is one of the major drivers of biodiversity loss. The efforts to increase agricultural production in Sri Lanka has impacted on biodiversity, associated ecosystem services as well as increased human elephant conflicts (HEC). Therefore HEC in Sri Lanka is almost entirely central to agricultural crop raiding. While it is a challenge, it is evident that sustainable development requires biodiversity conservation and agriculture production to be reconciled. Conflicts with elephants is mainly driven by socio-economic factors, e.g. population growth, economic development and human settlement programs therefore its resolution must be based on integrating science, agriculture, social sciences, economics and technology. Most current

strategies addressing HEC are focused on mitigation which cannot be applied in certain situations, ineffective in the long term, and expensive to maintain. A mix of mitigatory, adaptive, and pre-emptive strategies based on ecology, biology, land use, livelihoods, supported by the appropriate technology needs to be developed. The Sri Lanka Wildlife Conservation Society has been developing and applying projects to educate and encourage rural farmers to adapt sustainable land uses that are economically profitable, compatible to living with elephants and support biodiversity conservation. These efforts currently are benefiting 14,000 villagers in three administrative provinces in Sri Lanka.

315449 EFFECTS OF HABITAT ISOLATION ON FLOWER-VISITING BEE AT THE SOUTHERN MARGIN OF HALIMUN MOUNTAIN, INDONESIA

Bandung Sahari, Damayanti Buchori, Akhmad Rizali

In tropical landscape, there is an increasing isolation of agricultural patches from the natural habitat. Here we tested the hypothesis that habitat isolation affect the community of flower- visiting bee and. The objective of the research was to evaluate spatial pattern of flower-visiting bee in mustard patches that are situated in different distance from the nearest forest.

We experiementally set up small "habitat islands" of mustard in traditionally managed agricultural landscape that are situated in increasing distances (86-1078 m) from the nearest forest to evaluate the effects of isolation on flower-visiting bee. Each habitat island consisted of approximately 20 pods each with single mustard crop. Increasing isolation of small habitat resulted in increasing number of species of flower-visiting bee. This result contrast with common expectation that increased isolation from the nearest natural habitat are characterized by only loss of species number. Our study also identified that species composition between habitat type has significantly changed and this is expected to affect the ecological functions played by different insect pollinator assemblages. Species succession was also found across different habitat types. Habitat-specific species seems to be a very important factor in shaping the dynamic pattern of insect pollinator community.

329586 RURAL LABOR OUT-MIGRATION, COMMUNITY DEVELOPMENT, AND RURAL ENVIRONMENTAL CONSERVATION IN CHONGQING, SOUTHWEST CHIN

Hua Qin, Courtney G. Flint

There is an increasing demand for understanding the mediating mechanisms between migration and environmental outcomes in recent literature. Common property resource institutions, social capital, and social resilience are identified as important intervening variables in explaining the complex and contextually specific effects of migration on the environment. All these factors are logically related to the concept of community. However, the extant migration and environment literature has not systematically connected them to theories of community development. An opportunity exists for integrating the concept of community as an important mediating factor into the migration and environment framework. This study evaluates the migration-community-environment conceptual line in the setting of circular rural-to-urban labor migration in Chongqing Municipality of Southwest China. The analysis draws on empirical data collected through rural

household surveys from four rural communities in Chongqing. We examine the effects of rural labor out-migration on local communities by analyzing the differences between labor-migrant and non-labor-migrant households regarding community participation and involvement. The analysis found that rural migration presents both detrimental and beneficial potentialities for community development in rural origin areas. These findings provide important implications for subsequent resource management and environmental outcomes of labor migration in rural China.

319287 MAJOR POLICY ISSUES FOR CONSERVATION BIOLOGY IN ASIA

Jeffrey A. McNeely

The Asia Section of the SCB has given particular attention to its work on policy. As the world's most populated region, Asia still has remarkable biodiversity and many outstanding protected areas. Yet this valuable natural heritage is also under remarkable threat from expanding populations, booming economies, increasing populations, and heavy pressure on natural resources. The Asia Section has identified its top policy priorities as the following: developing new sources of funding for forest conservation; identifying potential impacts of energy alternatives on the conservation of biodiversity; curbing the trade in endangered species of plants and animals; a special focus on the conservation of mountain biodiversity; enhancing relevant research; ensuring that conservation biology contributes to major international conventions and funding mechanisms; using conservation biology to build a better understanding of zoonotic diseases; more effectively addressing human-animal conflicts; enhancing community-based conservation; and using conservation biology to help address the pervasive water deficit problems in much of Asia. We propose approaches to dealing with these policy priorities and ways of incorporating the broader membership of SCB in helping to convert policy advice into practical conservation biology practice.

315555 ROLE OF LOCAL WOMEN-GROUPS IN PROMOTING COMMUNITY-BASED CONSERVATION IN KENYA

Esther Bosibori Omosa, PATRICK Munyao Maundu

Local community groups in Kenya play a key role in promoting community-based conservation. In rural Western Kenya, it is women who provide labour in the farms and most times are the house hold heads. Bidii women group collaborated with the National Museums of Kenya to improve conservation status of African traditional food crops that were endangered and at the verge of extinction. A project to promote conservation of traditional foods was carried out in rural Western Kenya in 2005-2007. African traditional foods have been known to have higher health benefits than the exotic ones in terms of nutrient density, fibre content and that some have perceived medicinal value. They are also resistant to pests and better adapted to adverse weather. Traditional foods voucher specimen collected, photos, recipes recorded, Oral interviews and Focus Group Discussions.

Utilization of traditional species promotes dietary diversity and ensures conservation of biodiversity. Benefits of utilizing traditional foods were evident to the community- better nutrition and improved household income from the sold surplus. Neighbouring communities started producing traditional foods. More farmers produced an otherwise group of crops neglected almost lost. Local community groups therefore form an

important part in community-based conservation and should be acknowledged and supported in conservation efforts.

Plant conservation

315662 ASSESSING THE GRAZING IMPACT OF YAKS AND COWS ON ALPINE RANGELANDS IN SOUTHWEST CHINA

Michelle A Haynes, Donald M Waller

The montane western parts of China are biodiversity and cultural hotspots currently undergoing rapid cultural and ecological change. We investigated plant dynamics in response to grazing in the world's most biodiverse temperate region, the mountains of Southwest China. Because disturbance can both enhance and diminish diversity locally and regionally, it is important to assess how grazing affects these forb-dominated alpine communities that serve as summer pastures for Tibetan yak herders. We characterized the plant community in several alpine rangelands in southwest China that vary in grazing intensity to assess how traditional and modern land management practices used by Tibetan yak herders affect these communities. We compared randomly stratified alpine meadow communities with high intensity grazing communities, showing a decrease in species richness along an increase in grazing pressure. Firsthand accounts of yak herders describe the problem of shrub encroachment and voice frustration at shrinking grasslands. As suitable areas for grazing decline, herd sizes have increased over recent decades, intensifying their impact on palatable plants and threatening the rich diversity of the region.

305936 PLANT CONSERVATION: POLITICAL HARMONY FOR NATURE AND SOCIETY

Ablala Alatise

This paper examines the impact of political harmony on nature and society. Although, there is mounting evidence that political parties protect natural resources among Nigerian public. The study was designed to investigate the extent to which political parties were involved in protecting and conserving plant. A total of 120 political leaders were purposively selected which consisted all the political parties in Nigeria. A ten-item questionnaire was used for data collection, using frequency counts, percentages and multiple bar charts for data analysis, the results indicated that a good number of political leaders dishonor invitation from other political parties. It was discovered that vast majority of political parties usually have clash with other opponents which resulted into loss of plants, human lives, properties and natural resources. It was found out that political disharmony is as disastrous as earth-quake. It was ascertained that a large number of political leaders still perform rituals and sacrifices that are detrimental to plant conservation and society. The findings were interpreted in terms of the need to be in harmony with our environment and society irrespective of political party

319286 PLANT CONSERVATION AT RIVER SIDE FOR PROTECTION SOIL AT NORTH IRAN**Ghassem Habibi Bibalani**

The plant roots have a significant character in river side protection. The aim of this research was to decide to provides the height stability by determining the density of roots in soil of river side. To quantify the density of roots along river side, 10 forest sites in Mianrod at Chaboksar town in North Iran were selected. Root length density with depth and aboveground crown cover density were determined for tow genus trees such as Alder and Prunus. Under this forest fine roots (1 mm < diameter < 2.5 mm) were more customary all the river profile, and for Alder forest is about 85% of all roots in the top 45 cm river profile and 75% for Prunus forest. The total Root length density in below 35 cm for Alder had significantly greater concentrations of Prunus. This research has shown river protection has a direct link with Alder root density, and Alder forest site can protect better than seedling sites for river side instability against Prunus.

314480 CONDITION OF POPULATIONS OF RARE ENDEMIC PLANTS OF LAKE BAIKAL AND WAYS OF THEIR CONSERVATION**Denis Sandanov**

One of the main tasks of preserving biodiversity is the study of rare and endangered species. Studies were worked out at the eastern shore of Lake Baikal, a UNESCO World Heritage Site. Results have focused on two species of rare plants endemic to the area (<i>Craniospermum subvillosum</i> and <i>Astragalus sericeocanus</i>), and how the human impacts can affect plants populations. Both species grow only on sandy dunes. These places are popular among tourists and local people during summer. On the experimental plots were studied eco-biological peculiarities of plants, described soil characteristics, and analyzed human impact on the soils. First plot of <i>A. sericeocanus</i> was followed near the main road; second one was followed far away from the main road. The density of population on the first plot was 0.0086 individuals per square meter, age structure factor - 0.556, percent of seed's forming - 25%. On the second plot density of population was 0.086 individuals per square meter, age structure factor - 0.339, percent of seed's forming - 63%. The most part of studied populations of <i>C. subvillosum</i> were quite small. Density of populations was 0.0173 individuals per square meter, age structure factor - 0.427. In conclusion, there are high levels of anthropogenic damage to rare plant's populations. It is therefore necessary to monitor and control these populations. Finally, the fragile sandy dune habitat is clearly very sensitive to human activity and need protection.

318032 CONSERVATION OF ENDEMIC PLANTS OF PAKISTAN: A CASE STUDY OF 9 TAXA FROM CHITRAL VALLEY**Haidar Ali, Muhammad Qaiser**

Chitral is a narrow valley, bound by permanent snow covered high mountains with an area of 14850 km² and altitude variation from c. 900m to 7690m. Flora of Chitral is unique having 25% (101) of the total endemic

flora of Pakistan. Regarding the conservation of endemic plants of Pakistan, nothing has been done previously. 3 years extensive field studies were conducted to document ground realities. Case studies of 9 exclusively endemic plant taxa are discussed here. GIS has been used to investigate their geographic distribution, extent of occurrence and area of occupancy. Conservation status has been categorized according to IUCN 2001. Data analysis shows that 4 taxa are CR, 3 are EN and 2 are VU. Population explosion, unplanned urbanization, deforestation, soil erosion and habitat loss are among the prominent threats. An attempt has also been made for the first time to propagate their germplasm in botanic garden for reintroduction into their actual habitats. Their in situ conservation strategies are also suggested. It has been realized that the challenge of the extinction crisis requires attention and action from the general public, the private sector, Govt. and policy makers to ensure that global biodiversity remains intact for generations to come.

306703 LAND USE IMPACT ON TAMARIND (*TAMARINDUS INDICA* L.) POPULATIONS' CONSERVATION STATUS IN BENIN

Belarmain Adande Fandohan, Achille Ephrem Assogbadjo, Brice Sinsin

The conservation status of many wild fruit tree species that support rural people in Africa remains poorly documented despite its importance for their management. We compared under different human-pressure levels the viability of tamarind (*Tamarindus indica*) populations, a dryland species that has nutritional, medicinal and cultural importance for rural communities. Conservation status of the species' populations and how far it differs according to habitat types have been characterised using dendrometric characterisation and diameter size distributions. Tamarind trees density and regeneration (expressed as stems/hectare) were found to be relatively low, suggesting tamarind populations may not be self-rejuvenating. Nonetheless, significant variation occurred between habitats at $P < 0.001$. Tamarind density in gallery forests was 3-8 times higher than that of savannah woodlands and farmlands. Although diametric structures' coefficients of skewness indicated declining populations however human-pressure levels, median diameter values would suggest the species' populations in farmlands and savannah woodlands to be more vulnerable than those occurring in gallery forests. These findings would suggest that gallery forests are best habitats for tamarind in situ conservation. Observed severe reduction of trees and juveniles in farmlands and woodlands may negatively impact the long-term viability of tamarind populations. Domestication may be needed for *in situ* conservation.

Climate change

315441 PROCESS-BASED DEMOGRAPHIC MODELS FOR THE RANGE DYNAMICS OF PLANTS SPECIES: MODEL FITTING AND APPLICATIONS

Juliano Sarmiento Cabral, Frank Schurr

To better understand how demography shapes range dynamics of plants, we introduce a likelihood framework for fitting process-based distribution models to spatial abundance data and the application of these models to non-equilibrium scenarios. Our mechanistic models have a spatially-explicit demographic submodel (dispersal, reproduction, mortality, local extinction), an observation submodel (observation error)

and are constrained by species-specific bioclimatic envelopes and process-based seed dispersal. Model parameters were varied to find the highest likelihood. We applied it to eight South African Proteaceae and assessed the role of Allee effects and negative density-dependence for range dynamics by doing model selection. We performed forecasts under habitat loss and climate change scenarios. The best model for dioecious species included Allee effects, whereas this was true for only one of four monoecious species. Sprouters (which survive fire) had lower rates of reproduction and population extinction than related nonsprouters. Overcompensation seems important for three nonsprouters. We found quantitative agreement between independent data and most parameter estimates. Forecasts showed occupation decrease due to climate change and local abundance decrease due to habitat loss. Process-based models can quantitatively describe how large-scale abundance distributions arise from the movement and interaction of individuals, also under non-equilibrium with the habitat.

304547 ESTIMATION OF CARBON RESERVES IN THE FORESTS OF SUB-HIMALAYAN WEST BENGAL

Animesh Sarkar

Carbon credit market is growing rapidly in post Kyoto Protocol era. After 2008, the carbon stored in the existing forest areas would be eligible to claim credit from this market. Estimation of carbon pool in the existing forest areas thus becomes significant. To understand the yearly rate of carbon sequestration time series estimation is necessary to get the insights to estimate the annual admissible quantity of carbon emission and help regulate the developmental planning accordingly. Forest is considered to be a natural sink of carbon. Absorption of carbon depends on the age of different plant species. Rate of absorption increases for the first 20 years in the life cycle of any tree species and flattens thereafter. However, in shrub or herb species this is a seasonal phenomenon. Two districts of West Bengal — Darjeeling and Jalpaiguri — contribute 0.61% of the total forest cover in India. This paper looks into the present carbon storage capacity in this forest area ranging from foothills (60 meter) to high altitude forests (3300 meter) and estimated the carbon stock as 82.21 ton/ha, using a cross section analysis that involved tropical, sub-tropical, sub-tropical wet montane, sub-tropical montane and high altitude sub-alpine forests. Assuming a value of \$20/ton, the carbon value of Sub-Himalayan forests is estimated at \$7.6 bn.

369520 LOCAL KNOWLEDGE ABOUT CLIMATE CHANGE IN THE HIMALAYAS

Pashupati Chaudhary, Suresh Kumah Raina, Kamal Bawa

Traditional knowledge can lead science to new discoveries. Except for northwest United States, such knowledge about climate change is not well documented. Climate change is pervasive in the Himalayas. Yet little is known about the impact of climate change on biodiversity. Using a set of indicators (n=18), we interviewed 326 households, conducted focus group discussions, key informant surveys, and made direct observations in 11 villages from the fringes of two protected areas in Darjeeling Hills to document local knowledge about climate change and biodiversity. For 13 indicators, more than 50% of the respondents had observed or experienced changes. Knowledge is strongly consistent across the geographic regions for four indicators, moderately consistent for five indicators, and not consistent for the other four indicators (significant at $p < 0.01$). Perceptions conform to results obtained from modern science. Local knowledge thus

can complement information derived from other knowledge systems and can act as a surrogate for modern scientific knowledge for the design of mitigation or adaptation to climate change. Equally important, such knowledge can accelerate the pace of discovery in climate change research.

315543 RESISTANCE, RESILIENCE OR TRANSFORMATION? TARGETING ADAPTIVE MANAGEMENT STRATEGIES UNDER CLIMATE CHANGE

David Hole, Brian Huntley, Steve Willis, Stuart Butchart, Deborah Pain

In the context of the profound threat to biodiversity posed by projected 21st century climate change, understanding 'what', 'when' and 'where' adaptive management strategies should be deployed is an issue of immediate and substantial conservation concern. How do managers of protected areas, for example, decide between strategies that promote resistance (oppose change), resilience (cope with change) or transformation (respond in the direction of change)? Here we use the sub-Saharan African Important Bird Area (IBA) network as a model system to develop a framework for targeting appropriate adaptive management actions. Based on climate-envelope model projections for the regions entire avifauna, we describe a set of five broad management scenarios that provide simple site-scale prescriptions determined, crucially, within a regional context. We find that the most appropriate scenarios for IBAs show strong spatial patterning across Africa, with, for example, a predominance of the "High Persistence" management scenario amongst IBAs of the Guinea-Congo region and the contrasting predominance of the "High Turnover" scenario in the southern African tropical zone. We also explore identification of key areas in which additions to the network will optimally enhance its future effectiveness. The general principles developed are appropriate for application to any biodiversity conservation network and any species group.

314804 A FRAMEWORK FOR ASSESSING ECOSYSTEM VULNERABILITY TO GLOBAL CHANGE: A CASE STUDY OF CLIMATE AND LAND-USE INTERACTIONS IN THE HENGDUAN MOUNTAINS, CHINA

Benjamin Poulter, Niklaus E Zimmermann, Dominique Bachelet, Barry Baker, Heike Lischke

Impacts to terrestrial ecosystems include a combination of short- and long-term drivers ranging from changing land-use practices to climate change. We present a framework for assessing the vulnerability of mountain systems to multiple dimensions of global change, focusing on a biodiversity hotspot in north-western Yunnan, China; the Hengduan Mountains. The causes of ecosystem change in this region include ongoing climate change, policy changes in the use of fire, and grazing practices. Within this framework we evaluate the spatio-temporal pattern of ecosystem vulnerability using the LPJmL Dynamic Global Vegetation Model (DGVM). The LPJmL DGVM is a comprehensive ecosystem model that also includes a fire and grazing disturbance module. We implement a factorial approach to partition the various drivers of ecosystem change using climate projection data from the IPCC Fourth Assessment Report for 1901-2098 under the SRES A2 scenario. Changes in biogeography (i.e., treeline) and biogeochemistry (i.e., productivity) are ranked according to the various drivers with a series of maps for 2030, 2060, and 2090 illustrating the spatio-temporal pattern of major impacts. We also evaluate the challenges for implementing broad-scale

ecosystem models (DGVMs) to regional impact assessments in non-homogenous terrain. This information is valuable for assessing policy options for conservation, and climate mitigation and adaptation planning.

315148 PEOPLE ADAPTING TO INUNDATION OF ISLANDS - A CASE STUDY IN WEST BENGAL, INDIA

Raiarshi Banerji, Indrila Guha

The IPCC Report, 2007 notes sea levels rising faster than previous forecasts, average 1.8 mm rise between 1961 and 2003 per year, became 3.1 mm between 1993 and 2003. Characteristics of small islands such as limited size, proneness to natural hazards, and external shocks make them particularly vulnerable to the effects of climate change and sea-level rise. Sea-level rise causes inundation, storm surge, erosion and coastal hazards that threaten vital infrastructure and livelihood of island communities. Two islands in Indian Sundarbans are now permanently fully/ partially inundated and disappearance was reported in December 2006 which made 10,000 people homeless. Evacuees from both islets have been rehabilitated on a neighbouring island. People who were originally landed farmers now live in makeshift homes as daily wage earners. This study looks at past/current examples of risks of inundation of islands as a result of natural hazards and external shocks, and responses to adapt to alternative livelihood options. The chosen methodology- focus group discussion and household survey by questionnaires will help in understanding effectiveness of policy measures adopted and institutional barriers for implementation, if any. This paper would also recommend any necessary amendment to the rehabilitation strategy to be adopted by the authorities.

Landscape ecology

365329 ASSESSING THE POPULATION STATUS AND MANAGEMENT OF TIGERS IN THE BATANG HARI LANDSCAPE, WEST SUMATRA, INDONESIA

Yoan Dinata, Jito Sugardjito, Matthew Linkie

Over the past decade, tiger distribution has declined by 41% throughout its range. Whilst, the long-term survival of tigers will be dependent on protected areas, the managers of these areas will require reliable information on tiger occupancy and abundance in order to protect them. The presence of the critically endangered Sumatran tiger in Batang Hari Landscape (BHL) is only confirmed from records of human-tiger conflict. Yet, the 3729 km sq of contiguous forest that comprises the BHL has the potential to play an important role for tiger conservation, but scientific data are lacking. Thus, using camera trap surveys and detection/non-detection indirect sign surveys, the population status of tigers, their prey and their threats were assessed. From 1288 trap-nights, all presumed tiger prey were photographed, as well as 22 tiger photographs of four adult individuals, that yielded a mean density estimate of 1.3 adult tigers/100 km sq (1.31-2.87, 95% C.I.s). From 20 grid cells surveyed with a total effort of 156 km, tiger were detected in 15 cells. Investigating the covariates that influenced tiger occupancy, revealed that elevation was the single most important factor. This final model produced an occupancy of 0.8109 ± 0.0816 or 81.09% of the BHL being occupied by tiger. Where these occur in the eastern side of the BHL, tiger occupancy was lowest. For the BHL,

a spatial management plan defining different land uses and their legal status is urgently required.

366405 FINDING HARMONY BETWEEN GRIZZLY BEARS AND HUMANS USING ACCESS MANAGEMENT

Mark S. Boyce, Cheryl-Lesley Chetkiewicz, Bogdan Cristescu, Scott E. Nielsen, Joseph M. Northrup, Carrie Roeber, Gordon B. Stenhouse

Conservation biologists are challenged to find ways to ensure the persistence of grizzly bears (*Ursus arctos*) on landscapes with ever-increasing levels of industrial development. Timber harvest and extraction of oil and gas has resulted in rapid expansion of the road network in the Rocky Mountains of western Alberta, Canada. Vehicular traffic can displace grizzly bears, reducing the amount of effective habitat. Furthermore, nearly all human-caused grizzly bear mortalities occur within 500m of a road. During the past 10 years we have used GPS radiotelemetry to document grizzly bear habitat selection and movement in areas with varying road density. We characterized habitat selection using resource selection functions (RSF) and we investigated the effects of landscape features on bear movement using step-selection functions (SSF). We also used RSFs and SSFs to identify movement corridors for grizzly bears through roaded landscapes. Restricting vehicular use of roads by gating and/or regulation allows industrial development to be accommodated while reducing bear-human conflicts, thus enhancing grizzly bear population viability.

315320 ARE THRESHOLD ESTIMATES USEFUL FOR SETTING CONSERVATION PLANNING TARGETS?

Jonathan Roger Rhodes, Clive A McAlpine

The use of ecological thresholds for setting conservation planning targets is ubiquitous. For example, a commonly used rule-of-thumb to protect at least 30% of the habitat of a species is based on evidence for the existence of habitat loss thresholds at around 30%. However, habitat thresholds (where they exist) are known to vary substantially among species and even among locations for the same species. Consequently, the use of a simple rule-of-thumb could lead to conservation plans that are inadequate for ensuring the viability of many species. As an alternative we can invest resources in estimating specific thresholds by collecting data. However, this can be expensive and little is known about whether it improves conservation outcomes relative to the use of a rule-of-thumb. We addressed this issue, using the koala (*Phascolarctos cinereus*) as a case study, for setting habitat protection and restoration targets. We show that allocating resources to the estimation of location-specific thresholds substantially improves conservation outcomes. We also show that an appropriate conservation target is not necessarily equivalent to the threshold estimate, but depends critically on the conservation objective and economic budget. We discuss the generality of these results and the implications for conservation planning.

306089 DISTRIBUTION AND CONSERVATION STATUS OF RED PANDA (*AILURUS FULGENS*) IN RARA NATIONAL PARK, NEPAL

Hari prasad Sharma

The project was conducted for six months from October 2007 in Rara National Park (RNP) to confirm the presence, distribution and conservation status of Red Panda. Secondary data were collated from literatures and primary data were collected from field by direct count, indirect observation and questionnaire survey with park officials, local people and herdsman in RNP. The study indicated the presence of red panda in RNP. Altogether three red pandas were noticed. The research showed at least 11 Red Pandas are present in the 31 sq. km of the RNP. The faecal Pellet was found only from 3,100 to 3,600 m of elevation. The faecal pellets density of red panda was higher in the areas, where *Abies*, *Rhododendron*, *Betula*, *Quercus* and *Arundinaria* spp were dominant. *Abies* was important for providing shelter, *Rhododendron* and *Betula* for movement, rest and *Arundinaria* spp as source of food.

Many trees were looped and felled as a mean of timber and agriculture implements after taking the permission from park with minimal charge. The over exploitation was for lighting, stall-feeding, forage, fodder and fuel-wood which create problems to the species for survival. Habitat degradation was mainly caused due to over exploitation of natural resources for daily uses. Adoption of alternative and renewal energy, enhancing eco-tourism, retaining and effective Park management system, and capacity building programs were imperative after discussion for the conservation of red panda in RNP.

320208 THE MULTI-SCALE ECOLOGICAL IMPACTS OF THE ROAD NETWORKS IN LONGTITUDINAL RANGE-GORGE REGION OF YUNNAN PROVINCE, CHINA

Li Xiaowen

Road network has functioned as essential and widespread socioeconomic infrastructure, although road ecology has emerged as a hot topic in the past decade, the ecological impacts of road network and its scaling effects have poorly been studied. LRGR is characterized with its rich biodiversity, high ecological vulnerability and rapid road network construction. Aiming at exploring multi-scaled impacts of road network and topography on the regional ecosystem in LRGR, the independent effects of road network density and their interactive effects with topographic factors (i.e., elevation, slop & aspect) on the ecosystem were analyzed by using spatial correlation and ANOVA with scaling from 2km×2km to 20km×20km. The results showed that the correlation between the road network density and the ecosystem transformation is much determined by the road network categories, the correlation values decreased with upgrading of the road system. In addition, the topographic factors showed their scaling independent impacts, and their interactive effects with topography occurred at most scales. Further, the independent effects of higher-grade road network categories were much distinct, while the topographically interactive effects of those lower-grade road network categories are notable in most scales, indicating their extensive ecological impacts prone to be topographically altered.

315641 CONSERVING LARGE-SCALE POPULATION DYNAMICS: MERGING GENETIC AND DEMOGRAPHIC DATA TO UNDERSTAND SPATIAL SYNCHRONY IN SNOWSHOE HARES

Ellen Cheng, L. Scott Mills, Karen E. Hodges

Spatial synchrony is a widespread phenomenon occurring in many taxa. Identifying patterns and mechanisms of synchrony is fundamental to understanding factors that influence animal numbers and large-scale dynamics, with broad implications for conserving ecological systems.

Collecting the long-term, geographically extensive data required to study large-scale dynamics is often beyond the means of any single research program. We present an opportunistic approach to empirical synchrony analysis. We combine time series and genetic data provided by hunters and trappers, government agencies, and disparate research efforts conducted over varying time and geographic scales, to evaluate one commonly proposed mechanism—dispersal—for the legendary synchrony of snowshoe hare cycles across much of Canada and Alaska.

We compiled snowshoe hare time series data from almost 100 sources and genetic data from over 50 sources distributed across 11 of the 13 Canadian provinces/territories and 16 of the 26 U.S. states where snowshoe hares occur. We used simulation modeling to evaluate effects of data quality, sampling method and synchrony metric on estimates of synchrony. From this analysis, we identified a subset of time series data and the most appropriate metric for a range-wide analysis of hare synchrony patterns. We combined these results with an analysis of hare genetic connectivity to assess how landscape processes influence dispersal and large-scale dynamics of snowshoe hares.

366419 ELK TRANSLOCATIONS INTO RISKY LANDSCAPES: WHAT MATTERS FOR RETENTION AND SURVIVAL?

Jacqueline L. Frair, Evelyn H. Merrill, Mark S. Boyce, James R. Allen

Keeping harmony with nature may require species reintroduction or translocation to augment local populations. We experimentally evaluated factors influencing success of elk (*Cervus elaphus*) translocations to the central east slopes of the Rocky Mountains of Alberta from 4 source populations during winters of 2000-2005. Translocated elk originated from Banff and Jasper (where elk had habituated to humans), from an agricultural fringe area SW of Calgary (where elk had experience with hunters but not wolves), and Elk Island National Park (where elk were protected from both hunters and wolves). Release sites covered a range of habitat quality, human-access levels, and wolf predation, and resident elk served as controls. We related the survival and retention in release areas to exposure to environmental variability in these areas in a competing risks framework. Forage availability was not related to survival or retention. Although wolf predation was the largest initial source of mortality, humans were the largest cause of death overall, and relative risk varied by source population. Areas adjacent to roads remained risky for both translocated and resident elk. We identify potential release areas across the landscape for each population source by mapping areas of high joint probability of survival and retention.

366457 HABITAT CHARACTERISTICS AND STATUS OF TWO WILDLIFE CORRIDORS FOR TIGER CONSERVATION IN TERAJ ARC LANDSCAPE, INDIA

Meraj Anwar, Surendra P. Goyal, Qamar Qureshi

Terai Arc Landscape (TAL) harbors only source population of tiger in north western India. Increasing human population, exploitation of natural resources and other infrastructure developmental activities have led to fragmentation of the biologically rich and contiguous habitat in the TAL. Corridors help in conserving the tiger at metapopulation level. This study aims to assess the status of corridors with reference to tiger identified in previous study carried out by Wildlife Institute of India and Save the Tiger Fund, USA. Present talk will be on the status and habitat characteristics of Rajaji-Corbett (RCC) and Gola river corridor (GRC). A total of 463 plots were sampled over 51 transects in RCC. Concentric nested plots of 10m radius for trees, 5m radius for shrubs and 1m² quadrats for ground cover and 2*20m² for ungulate pellet group counts were laid at every 250 meter on each transect. Similarly, 193 plots over 22 transect were laid in GRC. In RCC, 10 vegetation communities were identified from cluster analysis IVI values. Likewise in GRC, 6 vegetation communities were segregated. In each community, density of tree, shrub, sapling and ungulate pellet group/dung were estimated. Species richness (2-10.2) and diversity (0.9-3.5) of trees were calculated. Sign survey (72.2 km in RCC and 51.5 km in GRC) was also carried out to assess the functional status of the corridors. Tiger signs were encountered more frequently in RCC than that in GRC.

Communications, outreach and education

315513 INSPIRING A CONSERVATION AND STEWARDSHIP ETHIC IN ELEMENTARY SCHOOL CHILDREN

Harriet Rankin Huber, Lisa Hiruki-Raring

Teaching school children about conservation and stewardship through a local story is a powerful method to reach students, their teachers, and their families. In 2006, we developed a curriculum for third graders that tells the story of an orphaned Killer Whale found in Seattle, Washington, U.S.A. It uncovers the mystery of who she is, where she belongs, and how to get her 400 miles back to her home in British Columbia, Canada. The curriculum includes information on Killer Whale natural history, management, and research through the story of successful cooperation among government wildlife agencies in the U.S. and Canada, First Nation Tribal leaders, non-governmental organizations, and the general public to bring the orphaned Orca home. It stresses the need for stewardship, the importance of cooperation to reach conservation goals, and emphasizes that everyone, even children, can contribute and make a difference. The curriculum was tested for two years in urban Seattle public schools, with an effort to reach low income schools with high ethnic diversity. Two different curricula are now used in grades 2-3 and 4-6 and incorporate partnerships with the Seattle Aquarium and a small non-profit organization, Killer Whale Tales, to provide free enrichment for low income students.

365891 UNDERSTANDING THE CONSERVATION OF LAKESHORE BUFFERS IN MINNESOTA, USA

Edgar Atwood Rudberg, David Fulton

In the United States the Clean Water Act (1972) was created to address point sources of pollution. Through this policy waters are assessed for degradation and the total maximum daily loads (TMDL's) of pollutants are set with the intent to decrease identified impairments. One shortcoming of this approach is how to address non-point source pollution, which largely stems from citizens' cumulative individual behaviors. This study evaluated littoral landowner's behaviors, attitudes and beliefs towards managing and restoring native vegetative buffers in four distinct eco-regions in Minnesota. Recent research in healthcare communications concerning normative was used as a conceptual framework in study design. We collected data through focus groups and a mail survey of a stratified random sample (n = 2400) of households owning lakeshore properties. We verified self-reported behaviors through field surveys of each study lake. Results assess the relative role of attitudes and norms in influencing lakeshore conservation and development behaviors and identify barriers to conservation behaviors and potential incentives and actions to overcome barriers. Based on the results of this research we are working with the Minnesota Department of Natural Resources (DNR) to identify programs to encourage conservation and restoration of lakeshore habitat and evaluate the effectiveness of these programs.

329227 PROMOTING PROTECTION THROUGH PRIDE

Shiyang LI

Some of the world's brightest minds and investments go toward selling products like soda, toilet video games. So why not environmental conservation? Future of our global environment will ultimately depend attitudes and behaviors, but tools for creating social in short supply. Rare has designed a program to conservationists managing outreach efforts around flagship program for constituency building centers called a Pride campaign and our methods are now contracted by large conservation organizations who social marketing techniques for local conservation including TNC, CI, WCS, and more. Campaigns charismatic flagship species, like the Saint Lucia Parrot Philippine Cockatoo, which becomes a symbol of local as a messenger to build support for habitat and protection. Marketing tools - such as billboards, posters, videos, sermons, comic books, and puppet shows conservation messages positive, compelling, relevant, the community. Targeted awareness-raising initiatives dramatically build momentum for conservation by creating constituencies necessary for initiating policy changes, reform, and new protected areas; by catalyzing in-and public sector funding; by shifting public behavior more sustainable practices; and by focusing public critically threatened ecosystems and species. Rare has trained 158 local leaders in the developing world, whose campaigns have influenced more than 6.8 Million people living in over 2,400 remote communities, including in China.

315403 EVALUATION OF THE EFFECTIVENESS OF EDUCATION AS A TOOL FOR ENVIRONMENTAL CONSERVATION

Caroline Howe, E.J. Milner-Gulland

We explore educational policies through an analysis of the role of educational activities in projects funded by the UK DEFRA Darwin Initiative. The scheme promotes biodiversity conservation and sustainable resource use worldwide and emphasises the importance of education within its remit. It therefore offers a range of education initiatives in terms of scale and strategy providing the variance required for such a meta-analysis. The study involved a combination of quantitative statistical and cost-benefit analyses alongside qualitative in-depth interviews with project leaders and entailed developing measures of success for analysing large datasets. We demonstrate that at the larger scale, consistent measures of success can be developed which can be used to analyse large datasets in a quantitative manner. We have used these measures to successfully establish education as a practical tool for environmental conservation and sustainable development and to reveal important distinctions in cost-effectiveness of different educational strategies. This may be one of the few studies on environmental conservation success in which intervention effectiveness has been properly quantified and robustly examined. It is hoped that this comprehensive, quantitative and critical assessment of the effectiveness and success of education interventions will be used in future to ensure that sustainable development and environmental conservation strategies are both cost-effective and successful.

315067 ARENAS PROJECT: SCHOOLTEACHERS AND SCIENTISTS' ROLES FOR ATTITUDE CHANGES IN COASTAL COMMUNITIES

Mariana Rios, Micaela Trimble, María Szephegyi, Cecilia Passadore, Mariana Nin, Paula Laporta, César Fagúndez, Elena Castiñeira

The conservation of our environment will be only assured when a significant portion of the population acquire an ecological knowledge about the different environments and its importance. Environmental Education Programs (EEP) are important tools to arise awareness, as they contribute to get a better perception of the environment, leading to a sustainable interrelation among ecosystems and local communities. The aim of Arenas EEP is to create a critical mass of people aware of environmental issues, and contribute to a sustainable development of the coastal area of Uruguay. For this, we worked with schoolteachers in guidelines to rediscover the environment and the power of field trips to introduce and study natural science topics. Why schoolteachers? Because their commitment with education and social community reality make them essential agents for the continuous and systematic spreading of knowledge. We worked with 65 teachers and over 1300 kids from all over Uruguayan cost. We got involved in many different environmental activities and field trips, most of them planned by teachers and kids. We found outstanding the commitment and responsibility from schools. We believe that rediscovering our local environment can be an easy, cheap and powerful way of learning. The exchange among schools and biologists was rich and encouraging. We builded up a relationship based on trust and conviction and we reached a better understanding of coastal communities.

315210 FROM THE ONGE TRIBAL'S TO THE LESSER FLORICAN: ROLE OF COMMUNICATION DESIGN FOR CONSERVATION OF CULTURES, KNOWLEDGE SYSTEMS AND ENDANGERED SPECIES

Anirban Dutta Gupta

Communication Design is an important tool for education, empowerment and archiving. Used sensitively it can lead to a successful conservation strategy.

India's biodiversity and protected areas face immense human pressure. To conserve this biodiversity, direct or indirect support of stakeholder communities is necessary. Low rural literacy level, poverty and mistrust of government policies makes this task difficult. Communication design is a way of garnering this popular support. Two case studies demonstrate this approach.

Onge Tribal Community shelter design showcase how designed communication has been used for the conservation of culture and knowledge system. It has empowering the Onge community to build and maintain their traditional ethno-architectural shelter. This has instilled a sense of pride and understanding of traditional methods, knowledge and culture, leading to a continuation of their unique social structure.

The Lesser Florican Community Leadership Programme demonstrates the use of communication design for the conservation of a widely distributed species. Involvement of communities is necessary for Lesser Florican conservation. To counter low-literacy levels, context-specific audio-visual products are being used for conservation education and capacity building.

The projects show the role of communication design for conservation and preservation of endangered species, cultures and knowledge systems in a shrinking world.

315283 CONSERVATION EDUCATION FOR BIODIVERSITY PRESERVATION AT THE CHENGDU RESEARCH BASE OF GIANT PANDA BREEDING, SICHUAN PROVINCE, CHINA

Sarah Marie Bexell, Zhang Zhihe, Zhang Anju, Fei Lisong, Wu Xianzhi, Xu Ping, Feng Ruixi, Tang Yafe

Conservation, even of iconic species such as giant pandas, cannot be achieved without participation by global citizens. Southwest China is a top biodiversity hotspot. The Chinese government established the Chengdu Research Base of Giant Panda Breeding in 1987, to help establish a viable captive population of giant pandas. With success in breeding came the need for public participation in biodiversity preservation. In 2000, we created the first functioning education department in a zoological facility in China. Dedicated educators have been identified and trained, programs and materials created, and collaborative networks established. Through partnerships with international universities, governmental and non-governmental organizations and zoos, we now assist other education sources. We work with local schools and our international visitors and public. We work with nature reserve staff and educators surrounding reserves to increase local pride, knowledge, and biodiversity preservation. Critical keys to success are staff that care about animals and nature, on-going training, intimate understanding of animals, and exposure to knowledgeable peers and mentors who care about them, animals and nature. A critical aspect of our programs is target behaviors for biodiversity protection. We hope to inspire future generations to protect biodiversity and provide training and mentoring

for educators throughout China.

320182 POTENTIAL OF PEOPLE'S BIODIVERSITY REGISTERS FOR THE CONSERVATION EDUCATION & ACTION

Pramod Padmanabhan Nair

Biodiversity Act (2002) of India directs the establishment of Biodiversity Management Committees (BMC) in all local bodies, village, taluk and district levels. The act stipulates that 'the main function of the BMC is to prepare People's Biodiversity register (PBR) in consultation with the local people. The register shall contain comprehensive information on availability and knowledge of local biological resources, their medical or any other use or any other traditional knowledge associated with them'. In India, the task is huge and it cannot be done by one agency. After a lot of discussions, meetings and field level experiments many methods and operational modalities are suggested. All the strategies converged in certain basic principles 1) involvement of local people, scientists, government and nongovernmental institutions together with a same goal in the same platform 2) bringing out important information out through participatory rural appraisal techniques 3) giving due recognition to the knowledge and efforts for conservation by the local communities and recognize them with legal validity after due verification and 4) a decentralised plan of action. This process (PBR methodology) is providing a unique opportunity for taking conservation education and action as a mass movement. This paper narrates a few case stories from India highlighting the potential of this law and the process in the conservation of biodiversity of the people, for the people and by the people.

Conservation genetics

315481 ACCURACY, PRECISION, AND COST-EFFECTIVENESS OF CONVENTIONAL DUNG COUNT BASED AND NONINVASIVE GENETIC METHODS TO ESTIMATE ELEPHANT POPULATION SIZE

Simon Hedges, Lori Eggert, Arlyne Johnson, Marissa Ahlering, Martin Tyson

Noninvasive DNA-based methods have been developed to estimate population size and are advantageous as samples can be collected relatively easily. However, no one has compared the results of such methods to estimates from simultaneously-conducted non-genetic methods. We compared the results of a dung count based survey of an elephant population in Laos with a simultaneous fecal DNA based capture-mark-recapture (CMR) survey of the same population. In Feb-May 2006, we found 545 dung-piles along 183 km of line transects. We converted the dung-pile density estimate to elephant density using dung decay rates for 1051 dung-piles monitored from Sept 2004 to Feb 2006 as well as data on defecation rates. Our analyses gave an estimate of 141 (95% CI=[95, 208]) elephants. We also analyzed 267 DNA samples, collected during 3 CMR sampling occasions as well as extra-study sessions, to estimate population size and sex ratio. Our analyses gave an estimate of 132 (95% CI=[120,149]) elephants. From these results and a literature review, we conclude that DNA-based methods provide more precise estimates, provide more data about population parameters (e.g. effective population size), require less time in the field, and can be used when dung counting is not feasible. Finally, we show that fecal DNA based methods are cheaper than conventional dung counting

methods if transect survey costs are approximately equal to CMR survey costs and decay rate monitoring costs are greater than laboratory costs.

309072 DEMOGRAPHY AND GENETICS OF REINTRODUCED PLANT POPULATIONS: A CASE STUDY OF *ARENARIA GRANDIFLORA* L., AN ENDANGERED SPECIES IN THE LOWLANDS OF FRANCE.

Monika Zavodna, Nathalie Machon

The goal of re-establishment of the populations is to recover declining species, and to restore their evolutionary potential in a long-term self-sustained manner. *Arenaria grandiflora* L. (Caryophyllaceae) is common in southern and central European mountains. In France, it also appears in two locations of lowland regions (Fontainebleau forest and Loire valley) that are about 150 km apart. The populations of *A. grandiflora* in Fontainebleau forest have however, declined rapidly in the last two decades and it has been suggested that they might have suffered from inbreeding depression and/or fixation of deleterious alleles by drift. To preserve and restore *A. grandiflora* in the Fontainebleau forest, a reintroduction experiment was conducted in 1999 when six populations consisting of individuals originating from both the Loire valley and from the Fontainebleau forest were created. Since 1999, the reintroduced populations have been monitored for individuals' survival and reproduction success annually. In 2007, out of six reintroduced populations four were sustained and their genetic composition was assessed using microsatellite markers. In all four populations the individuals of both origins as well as 'hybrids' were detected. Interestingly, significantly higher number of 'hybrids' than expected under random mating was observed. Our experiment highlights the benefit of mixing the origins for population restorations.

314852 EFFECTS OF GROWTH HORMONES, ROOTING MEDIA AND LEAF SIZE ON JUVENILE STEM CUTTINGS OF *BUCHHOLZIA CORIACEA*

Adejoke Olukemi Akinyele

Effects of growth hormones, rooting media and leaf size on stem cuttings of *Buchholzia coriacea* were investigated. Single node cuttings were obtained from two-month old seedlings. Some cuttings retained whole leaves while others had half leaf. Cuttings were treated with IBA, NAA and IBA/NAA at 0, 50, 100 and 150 mg/l concentration and planted in 3 rooting media- topsoil, riversand and decomposed sawdust. The experiment was a 3x4x3x2 factorial design set up in the green house under a high humidity propagator. Cuttings were assessed for Percentage survival, Number of roots per cutting, Length of longest root per cutting and Total root length. Data was analysed using ANOVA and significantly different means were separated with the use of LSD.

Macropropagation of the seedlings using single node cuttings had a survival percentage of 96.3%. The highest mean values, 3.8cm and 12.5 cm in root length and total root length were recorded in topsoil. Fifty percent of the dead cuttings were recorded in rooting medium of riversand. Control had the highest number of roots (4.8). The ability of this species to root without any hormone creates a far reaching impact in the conservation of the species.

315485 EVALUATION OF NON-INVASIVE GENETIC SAMPLING METHODS FOR ESTIMATING TIGER POPULATION SIZE

Samrat Mondol

It is difficult, but necessary to estimate population abundances of elusive, wide-ranging carnivores. Because of limited resources, researchers often employ non-invasive 'captures' that may involve 'genetic' or 'photographic' sampling of individual animals. In this context, well-founded capture-recapture models offer a powerful analytic tool. We developed a rigorous combination of captive, laboratory and field-based protocols for identifying individual tigers (*Panthera tigris*) from fecal DNA in the context of capture-recapture modeling and estimation. Our field survey, designed for capture-recapture analyses, enabled us to test for population closure and generate estimates of tiger abundance, which resulted in similar estimates from a rigorous 'photographic' study of the same population at the same time. The results under both the heterogeneity model (Mh), and the Null model (M0) ($N(SE)=66$ (12.98) and $N(SE)=47$ (11.21), respectively), were reasonable in comparisons to those obtained from a photographic survey ($N(SE)=66$ (13.8) and $N(SE)=81$ (27.7)), respectively. Similar estimates were obtained with a common genetic population estimate approach CAPWIRE ($N = 65$). These results highlight the benefits of rigorous integration of ecological and genetic methods to estimate animal abundance, a parameter of critical importance to species conservation. Furthermore, preliminary results from a large tiger landscape reveal the benefits of such methods for carnivore conservation.

366627 GENETIC DISTINCTIVENESS AND DECLINE OF A SMALL POPULATION OF HUMPBACK WHALES (MEGAPTERA NOVAEANGLIAE) IN THE ARABIAN SEA

Cristina Pomilla, Tim Collins, Gianna Minton, Ken P. Findlay, Matthew S. Leslie, Louisa Ponnampalam, Howard C. Rosenbaum, Robert Baldwin

Humpback whales in the Arabian Sea present a possibly unique exception to the seasonal migrations typical of this species. Early sightings were thought to be Southern Hemisphere whales extending their migration north of the equator. Several sources of evidence have questioned this hypothesis, suggesting that at least some whales may be year-round residents. Genetic analyses based on 11 microsatellite markers and mitochondrial DNA sequences (485bp) revealed significant differentiation between whales sampled off the coast of Oman ($n=47$), in the Arabian Sea, and whales sampled in four Southern Hemisphere and one North Pacific regions (microsatellites, smallest $F_{ST}=0.0387$, $p<0.000$; mtDNA, smallest $F_{ST}=0.112$, $p<0.000$). These results combined with Bayesian estimates of gene flow and divergence times, as well as clustering analyses, suggest that the Arabian Sea population originated from the Southern Indian Ocean, but is currently isolated. Genetic diversity (microsatellites, $k=7$, $H_o=0.7011$; mtDNA, $h=0.6873$, $p=0.01734$) was significantly reduced, when contrasted with values obtained for Southern Hemisphere populations. Multiple tests showed a consistent signature of recent bottleneck, current lack of recovery, and possibly ongoing decline. Based on surveys that suggested a very small population size and our genetic findings, the Arabian Sea population has been recently listed as Endangered in the IUCN Red List.

315549 THE ILLEGAL IVORY TRADE AND ORGANIZED CRIME: WHAT WAS CITES THINKING?

Samuel K Wasser, Celia Mailand, Cathy C Laurie, William Joseph Clark

The illegal ivory trade has undergone a massive increase since 2005, with very significant involvement of organized crime. China is currently the principal market for this contraband, followed closely by the United States and Japan. The alarming rise is indicated by 25 metric tons of ivory seized between 2005 and 2006, exceeding that of the prior 3 years combined. Four of those seizures totaled 11 metric tons and were all shipped from Tanzania within a two-month period in 2006, making this the largest string of successive seizures shipped from a single locale on record. Penalties have been miniscule at best. Only one conviction of these 4 cases has been made to date; the defendant received a suspended jail sentence and a fine that was less than 1% of the ivory's \$10 million USD retail "street value" estimated by Customs. We used DNA-based assignment methods to ascertain whether these 4 seizures had a common origin, and if so, where? We discuss implications of results for CITES decisions to promote the legal ivory trade as well as how results are being leveraged to encourage new approaches to combat the illegal wildlife trade.

315578 BEHAVIORAL CORRELATES OF LOW RELATEDNESS IN AFRICAN ELEPHANT GROUPS IN A POACHED POPULATION

Kathleen Schuyler Gobush, Samuel K Wasser

Poaching created a natural experiment in many matrifocal African elephant populations (*Loxodonta africana*) by removing adult females from a social system centered on kin support and philopatry. We examine the hypothesis that groups lacking kin display less cohesion, and cooperate and compete with elephants outside of their group more frequently than more discriminating and stable intact groups. We collected behavioral data on 77 known elephant groups in Mikumi National Park, Tanzania across three dry seasons (2003-2005) via focal group and scan sampling during transect and waterhole surveys. Females were genotyped at 10 microsatellite loci and pair-wise relatedness derived. Groups were categorized as disrupted if their relatedness fell below a simulation-generated threshold value; otherwise they were considered intact. Indices of cohesion, tolerance, affiliation and agonism were analyzed to determine the influence of group composition on these behaviors. Cohesion, measured as a proximity index, was greater in groups with an old matriarch, primarily driven by the actions of young adult females. Genetically disrupted groups displayed a higher frequency of affiliation, as well as agonism, with others than intact groups. Thus, solitary foraging and its risks may be avoided by individuals lacking kin. However, less discriminating social behavior is also associated with increased agonism, potentially leading to negative consequences for these elephants.

315418 GENETIC VARIABILITY OF KELP GULL IN THE BRAZILIAN COAST AND ITS CONSEQUENCE FOR SEABIRDS CONSERVATION

Gisele Pires de Mendonça Dantas, Fernanda Almeida Santos, Joao Stenghel Morgante, Nuno Ferrand, Raquel Godinho

Several species of Gulls have become a plague in some regions, harming anthropogenic activities and displacing others seabirds from its breeding sites. In Brazil, the Kelp Gull (*Larus dominicanus*) is a species that becomes a considerable problem, due to its growing population. To create an effective management plan for seabirds in the Brazilian coast it is necessary to know the historic factors that affected the genetic diversity of Gulls and shaped its current geographic structure in the coast. For this, we used mitochondrial and nuclear markers. We observed that this species showed a low genetic variability in mitochondrial DNA: only one haplotype in cytochrome b and three haplotypes in ATPase 8 and 6. In contrast, the nuclear intron analysis (13 loci) show large diversity values, but did not show sign of population expansion. These markers also revealed that Kelp Gull has a recent origin (200.000 years). Additionally, the microsatellites showed low genetic variability and confirmed that this species did not show demographic fluctuations. Several studies have attributed low population genetic differentiation at wide geographic scales to high vagility or to bottleneck events. However, we concluded that this species did not suffer bottleneck events and has recent origin in the Brazilian coast. Additionally, we propose a management plan considering the differentiation among breeding sites for Kelp Gull.

Mammal conservation

366711 SOME CONSIDERATIONS ABOUT PORPOISE-WATCHING IN POYANG LAKE, CHINA

Kexiong Wang, Ding Wang, Songhai Li, Xiujiang Zhao, Xinqiao Zhang

China's Poyang Lake is an important habitat of Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*), in which there are about 400 individuals inhabiting. The decline of fishery resources resulted from local fishermen's over-fishing is great threat to the porpoises. Porpoise-watching is proposed in this study as the substitution for fishing, with an aim of reducing and even ceasing fishermen's over-fishing by providing them with alternative jobs relating with the ecological tourism. Economical and ecological benefits and costs of whale-watching were widely discussed, but both environmental conditions in the lake and population status of the species are different with those of whale-watching tours in the sea, and therefore, the feasibility of porpoise-watching should be assessed. Firstly, the potential effects of boats on porpoises should be assessed quantitatively by observing behavioural and acoustic responses; Secondly, porpoise-watching trials should be highly regulated by local fisheries administrations, and the local fishermen should be encouraged to be involved in the trials; Thirdly, whether the tourism will be sustainable, and will bring economic benefits to fishermen with less negative effects to porpoises and environments should be considered with highest priority in assessing feasibility of porpoise-watching.

306790 A CAUSE FOR OPTIMISM: THE POTENTIAL CONTRIBUTION OF SELECTIVELY LOGGED FORESTS FOR TIGER CONSERVATION IN MALAYSIA

Mark Rayan Darmaraj

Apart from a single study conducted in a primary dipterocarp forest, robust density estimates of tigers (*Panthera tigris*) are not available for other habitat types in Malaysia. To provide such information for a selectively logged dipterocarp forest, a 9-month camera-trapping survey was conducted in Gunung Basor Forest Reserve (GBFR), Malaysia. Analysis generated following a capture-recapture framework resulted in a density estimate of 2.59 adult tigers/100 km² with a standard error of 0.71. After the survey had ended, subsequent camera-trapping in the study area provided photographic evidence of breeding success. These results indicate that selectively logged forests such as GBFR have the potential to not only accommodate a high population density of tigers but are also able to support breeding populations, and may thus serve as important core tiger habitats. The potential contribution of selectively logged forests for tigers is further enlightened by the fact that 85 percent of confirmed tiger habitats in Malaysia are located within forest reserves such as GBFR. Thus, to create an enabling condition to significantly contribute towards the long term survival of tigers, conservationists should strive to develop tiger-friendly management guidelines to be applied in sustainable forest management so that managed selectively logged forests, can be used as a viable option to conserve tigers and its prey in Malaysia.

315340 DISTRIBUTION AND CONSERVATION STATUS OF MARSH DEER (BLASTOCERUS DICHOTOMUS) ON POOR KNOWN WETLANDS OF PARAGUAY-PARANA RIVER BASIN, ARGENTINA

Bernardo Lartigau, Pablo Herrera, Santiago Dalessio, Leandro Antoniazzi, Hector Ball, Daniela Cano, Horacio Cardozo, Patricio Cowper Coles, Alejandro Di Giacomo, María Ayelen Eberhardt, Carlos Figuerero, Natalia Meyer, Anibal Parera, Gabriela Ramirez

Marsh deer (*Blastocerus dichotomus*), the largest deer of South America, is a globally threatened species. It is found in Brazil, Paraguay, Bolivia, Peru and Argentina. Two main populations are well-known in Argentina, in the Ibera Wetlands and in the Parana River Delta. In the rest of the country, there is scarce or non-existent knowledge of this species. We carried out a survey on 67.500 square kilometres of poor known wetlands, along the Paraguay-Parana river basin, in the provinces of Santa Fe, Corrientes, Formosa and Chaco. The purpose was to localize new populations and increase our knowledge on non-well known ones. Each surveyed region was divided in quadrants of 30x30 kilometres, where presence or absence of the species was determined by using interview and field assessment. New populations in critical danger were localized and others poor-known were confirmed by 239 interviews to rural workers. Main threats in each area were determined, and conservation strategies for each area were discussed. The work was done with strong participation of local groups, so as to assure long-term conservation efforts. This information is considered as a fundamental input for developing a National Plan for the conservation of this species.

377879 MULTIPLE GENEALOGIES REVEAL SIGNIFICANT INDOCHINESE-SUNDAIC FAUNAL TRANSITION AT THE ISTHMUS OF KRA: EVIDENCE FROM SIX ASIAN FELID SPECIES**Shu-Jin Luo**

The dynamic geological history of Southeast Asia has resulted in a complex array of ecosystems including the contemporary climatic differences and floral transitions between the Indochinese and Sunda regions on the boundary of the Isthmus of Kra. This region is considered one of the most important biodiversity hotspots in the world and is home to 12 of the 37 recognized wild cat species most of which have been poorly studied. To examine the pattern of regional fauna diversification, this study compared intraspecific phylogeographic patterns in six sympatric Asian wild felid species. A total of 587 samples were examined using a multi-locus approach that included the paternal, maternal, and biparental molecular genetic markers. Concordant mtDNA and nuclear DNA genealogies suggest an ancient Indochinese-Sundaic vicariant divergence (> 1 My) in both *P. bengalensis* and *P. marmorata*. A modern secondary contact zone of the two lineages in *P. bengalensis* exists on the Malay Peninsula. Divergence between the Indochinese and Malay lineages within *P. tigris* and *P. temmincki* were relatively recent and likely reflected genetic drift and reduced gene flow since 72,000 to 108,000 y ago in *P. tigris*, and 180,000 to 440,000 y ago in *P. temmincki*. Overall the results suggest past vicariant divergences and highly structured phylogeographical patterns, and may be of conservation utility such as to assist in tracing the origins of illegally traded wildlife from the region.

314935 FAILURE OF DISEASE SUPPRESSION VIA REMOVAL OF INFECTED INDIVIDUALS TO CONTROL DEVIL FACIAL TUMOUR DISEASE IN A TASMANIAN DEVIL POPULATION**Shelly Lachish, Hamish McCallum, Dydee Mann, Chrissy Pukk, Menna E. Jones**

There are few sustainable strategies for the management of infectious diseases in threatened wildlife. Selective culling of infected individuals is often the most feasible and acceptable option to control a novel infectious disease in a threatened wildlife host, but has seldom been evaluated as a management tool. In this study we assess a trial involving the selective culling of infected individuals to control Devil Facial Tumour Disease (DFTD), an emerging infectious cancer threatening populations of Tasmanian devils. We compared demographic and epidemiological parameters indicative of disease progression and impact between a management site and an unmanaged control site. We found no evidence that selective culling of infected individuals either slowed the rate of disease progression or reduced the population level impacts of this debilitating disease. Failure of selective culling to impede the progress of DFTD or decrease its impacts in the managed population may be due to the frequency-dependent nature of DFTD transmission, a long latent period and/or high degree of infectivity of DFTD, the presence of a cryptic hidden disease reservoir or immigration of diseased individuals. Our results suggest that increasing the removal effort at Forestier for a period of time would be a worthwhile option to pursue. We advocate multi-faceted disease management programs based on adaptive management principles to effectively manage infectious diseases in species of conservation concern.

366216 HIGH-LEVEL MAMMALIAN PHYLOGENOMICS BENEFIT FROM NUCLEAR INTRONS: INTERFAMILIAL RELATIONSHIPS WITHIN CANIFORMIA (ORDER CARNIVORA) AS A CASE STUDY**Li Yu, Ya-Ping Zhang, Peng-tao Luan**

Tracing evolutionary relationships among organisms is vital in evolutionary biology. Phylogeny of Mammalian order Carnivora, an intriguing animal group with evolutionarily theoretic significance and conservation values, has received especial attention. Here, the resolution of the most intractable issues in high-level Caniformia phylogeny has prevailed with a data set consisting of more than 22kb from 22 intron loci using supermatrix and supertree analyses. Caniformia was divided into two clades. Clade 1 unites Ursidae and Pinnipeds, and Clade 2 comprises Procyonidae, Mustelidae, Ailuridae, and Mephitidae. Procyonidae and Mustelidae are most closely related. The red panda falls beside Musteloidea sensu stricto, with Mephitidae as their sister taxon. The present study not only showed that selectively neutral intron genes offer powerful complementary data indispensable for advancing understanding of ambiguous phylogenies, but allows for the development of new molecular markers in nonmodel species as well. In addition, our work was the first to report such large numbers of intra-individual allele heterozygotes (115 cases) that the incorporation of them in the analyses provides insight into their effect on the phylogenetic intron studies. Another intriguing finding was that Musteloidea showed sequence variations at a substantially higher rate than the remaining carnivores for the majority of intron genes, supporting both the body size and lineage effect hypotheses.

320346 HUMAN-BEAR CONFLICT: A REVIEW OF CONCEPTS AND GLOBAL TRENDS**Neil Clive D'Cruze, Ozgun Emre Can, John Beecham, Iris Mazurek**

Human bear conflict is an international problem involving all eight bear species that can cause severe economic losses, injuries and even human fatalities and have serious consequences for bear welfare and conservation. We reviewed the scientific literature focused on human bear conflict and identified the types of conflicts that have emerged between the period 1972 to 2007. We demonstrate that human bear conflict is becoming popular among the scientific community and that the amount of research effort spent on it has almost tripled in the last seven years despite associated time, personnel, and financial constraints. However, the work published to date has not been equally divided in terms of species or geographical region. Our study indicates that North America is the most prominent human bear conflict continent before Europe and that the Brown bear is the top problematic species. Scientifically informed holistic mitigation strategies can reduce the severity of human bear conflict and are required to ensure the effectiveness of any conflict resolution program. We recommend that researchers should look to work in regions and with species that have been traditionally overlooked and utilize approaches that will speed up information and experience sharing related with conflict resolution.

306636 WINTER HABITAT SELECTION BY MACACA MULATTA IN A TEMPERATE FOREST, JIYUAN, CHINA

Lu Ji-Qi, XIE Dong-Ming, GUO Xiang-Bao, LÜ Jiu-Quan

We know little about of winter habitat selection of *Macaca mulatta tcheliensis*, an endemic subspecies of *Macaca* to China. These macaques was distributed mainly in the south part of Taihangshan Mountains area. The climate belongs to continental monsoon climate. There are four distinct seasons with the variation of sunlight, heat and precipitation simultaneously.

The long winter with poor food supply in this area lasted from November to March of the next year, this period is pivotal for Taihangshan macaque in their life history. We conducted a preliminary survey on the winter habitat selection by Rhesus macaque in Taihangshan mountains area, Jiyuan, China. The result show that the characteristics of those habitat macaques selected are as follows: 1) well-developed forest environment; 2) sunny and semi-slope; 3) near to water resources; 4) far away from predators such as Leopard (*Pantera pardus*), Golden Eagle (*Aquila chrysaetos*); 5) relative near to residential area. Once the water became freeze, macaque will eat snow, or suck the dew from little grass in the morning. During late winter, especially the snow covered days, we would provide additional food for macaque to survive the food-short period.

Bird conservation

310302 ENHANCING POPULATION MONITORING THROUGH INTEGRATED MODELING

Justine Sulawa, jean-dominique lebreton, oliver krone

A common problem in conservation biology is the sparseness of data and the lack of sufficient long-time series to obtain robust estimates of key biological parameters. It can lead to difficulties or the impossibility for providing management guidelines for rare and/or endangered species. Integrated population modeling, by combining the several available sources of information, makes it possible to improve the precision of estimates of demographic parameters and the general quality of demographic inference. We assessed the efficiency of this approach by applying it to the German population of the white-tailed eagle (*Haliaeetus albicilla*). Using a state-space model for census data in combination with multinomial-based models for ring-recovery data, we produced a combined likelihood for estimating demographic parameters. We compared the estimates obtained using integrated population modeling to those obtained using ring-recovery data alone over the period 1991-2005. We found confidence intervals 2.4, 2.2 and 5.2 times smaller for pre-adults, young adults and old adults, respectively. By combining both sources of information, we got over shorter periods estimates for demographic parameters with similar or narrower confidence level than using ring-recovery data only. We conclude that the integrated population modeling is a powerful tool for conservation biology and provides an important benefit in time and precision for demographic inference.

306596 GENETIC DIVERSITY AND MATING SYSTEM OF AN INTRODUCED ISLAND POPULATION OF NORTH ISLAND BROWN KIWI (*APTERYX MANTELLI*)

Birgit Zieseemann, Dianne Brunton

North Island brown kiwi populations are seriously declining due to habitat loss and predation and require intensive conservation management. The translocation of kiwi to predator-free islands has become an important tool in kiwi conservation. However, an understanding of their population structure and mating system is crucial if those populations are to persist long-term. Here, we examined the genetic diversity and mating system of an introduced island population of NI kiwi using microsatellite profiling. This population originated from a small founder population sourced from three sites in New Zealand over four decades ago and has thrived since then. Additional life history data on the founder population are unknown. Genetic diversity was higher than expected, with high levels of heterozygosity and allelic diversity. These results highlight that founders sourced from genetically diverse populations may have contributed to maintain genetic diversity and minimise genetic drift. Previous studies suggest that NI kiwi are monogamous, despite possessing some characteristics of reproductive biology associated with polyandry. Preliminary results indicate that the genetic mating system may be monogamy in accordance to previous behavioural studies. This study will aid in effective kiwi management by providing an understanding of their mating system and the genetic relationship between individuals to prevent this species from losing viability due to the loss of genetic diversity.

365076 IMPORTANCE OF APPROPRIATE SPATIAL RESOLUTION WHEN TRACKING FOR CONSERVATION

Tiana Jayne Preston, Andre Chiaradia, Richard Reina

Understanding fine scale movements of central place foragers is important when assessing the potential impact of disturbances within their foraging area. We used two methods to describe habitat use of breeding little penguins (*Eudyptula minor*) in Melbourne, Australia potentially threatened by a major ship channel dredging project. In 2006 we collected satellite location and diving data from separate individuals, and then in 2008 we simultaneously collected both global positioning system (GPS) location and diving data from the same individuals. Both years had similar values for mean maximum distance travelled (13.8 km 2006 and 2008), estimate of time in shipping channels (2006 10.8 %, 2008 9.1 %) and estimate of demersal diving (2006 44.3%, 2008 36.2%). In the first study we were unable to conclusively demonstrate that penguins were foraging within the shipping channels because the location of the diving penguins was unknown, and the satellite positions were infrequent (10 per day) and imprecise (best accuracy 150 m). Thus, our findings were of limited value in assessing the potential impact of dredging. In the second study, miniaturized GPS devices combined with dive recorders allowed us to obtain frequent (1 s) and accurate (within 6 m) three-dimensional location data, which confirmed that penguins do forage within the shipping channels. Our experience demonstrates that high resolution tracking data is crucial for conservation and management application over small scales.

315694 UNRAVELING DISTRIBUTIONAL PATTERNS OF THE WORLD'S MOST REMOTE FLAMINGOS

Maria Adela Davison, Mery Sonia Villalobos, Carmen Quiroga

Today's conservation crisis requires ecological research that is conducted across multiple temporal scales. However, obtaining broad temporal data is notoriously problematic for organisms whose population dynamics are difficult to assess. We combined an experimental approach and an innovative observational technique to track distributional patterns of foraging Andean and James flamingos (*Phoenicoparrus andinus*, *P. jamesi*, respectively) within a lake in the Bolivian Andes. Elusive and often inaccessible, high Andes flamingos are virtually impossible to monitor over extended time periods. We experimentally excluded flamingos from portions of the lake to assess their influence on algal biomass and deployed a remotely operated digital camera to follow flamingo distribution patterns over a five-month period. Experimental results indicate that flamingos significantly reduce the biomass of algae over short and long time periods (days-months); remote photography of flamingo distributions showed regular diel patterns and associations between location, composition, and size of foraging groups and various food patch characteristics. These findings suggest that within-lake distributions of high Andes flamingos are influenced by temporally dependent factors, including the foraging activity of flamingos themselves. Ultimately, greater understanding of such factors will inform time-integrated conservation initiatives for these waterbirds of conservation concern.

315309 TRANSEMISSPHERIC IMPACTS ON SHOREBIRD POPULATIONS OF THE SAEMANGEUM TIDAL RECLAMATION IN SOUTH KOREA

Danny Rogers, Moores Nial, Phil Battley, Chris Hassell, Ken Gosbell

The estuaries of the Dongjin and Mangyeung Rivers in South Korea are traditionally recognised as one of, if not the most, important sites in Asia for migrating shorebirds. In 2006 the South Korean government completed construction of a 33-km seawall that encloses the 41,000 ha of mudflat and shallows of these estuaries (collectively known as Saemangeum), which are earmarked for reclamation. From 2006-2008 we assessed shorebird numbers during northward migration in April and May at Saemangeum and adjacent estuaries, and in 2008 conducted a national survey in May. Peak numbers of shorebirds at Saemangeum declined from 177,000 in 2006 to 46,000 in 2008. There was limited evidence of displacement to the Geum Estuary and Gomso Bay, and overall numbers across these sites declined by 100,000 birds. These numbers could not be accounted for elsewhere in South Korea. Especially hard-hit was the Great Knot, which declined from 116,000 in 2006 (~30% of the world population) to 26,000 in 2008. Over the same period, surveys in NW Australia detected a decline in Great Knots that suggests the large majority of those displaced from Saemangeum have died. This is the first demonstration that reclamation of tidal flats in Asia affects shorebird populations over a vast geographical area.

366284 THE PERILS OF YOUTH: FACTORS AFFECTING PIPING PLOVER CHICK SURVIVAL IN THE NORTH AMERICAN GREAT LAKES

Lauren J Brudney, Todd Arnold, Francesca Cuthbert

The Great Lakes Piping Plover (*Charadrius melodus*) is federally endangered in the USA; only 63 pairs nested in 2007. Recovery efforts are diverse, but a major management focus is reduction of egg and chick predation. Predator exclosures have increased hatching success but do not protect mobile chicks. We evaluate the causes and variability in chick mortality from 1992-2007 and characterize potential avian and mammalian predators at breeding sites. We used remote digital videography and passive track surveys to identify predators and other disturbances at breeding sites. We detected canids, corvids, raccoons, striped skunks, herring and ring-billed gulls, and humans at the breeding sites. We analyzed nesting records to elucidate the relationship between chick age, breeding location, year, and brood-specific covariates on chick survival. These data demonstrated that chick age, breeding locality, brood year, hatch date, and the number of days above 32°C during chick rearing significantly effect chick survival. Track surveys and remote digital videography identified sites that were at high risk for predation. These results should be used to design more effective predator management strategies in the Great Lakes region. Nesting records identified factors that put plover chicks at greater risk for mortality and may be used to design more efficient monitoring strategies.

305511 THE DAMAGE OF AVIAN IN "SNOW DISASTER 2008" IN NANLING MTS., GUANGDONG, CHINA

Jianxin Zhang

At the beginning of 2008, a rare and heavy snow storm stroke ("Snow Disaster2008") the south China, and caused a great ecological impact to the forest and wildlife. We investigated the six sites in Nanling Mts. Guangdong province to explore the impact of the snow disaster on the wildlife. We found that: 1) The direct and indirect physical hurt caused by the cracked tree, and the lack of food caused were the main reasons which caused the death of avian. 2) We estimated that order of magnitude of dead avian individuals should be 0.74 -1.37 million. 3) The impact of the snow disaster was positively correlated with the altitude significantly, and the impact above the altitude 500 m was more serious than the area below altitude 500 m ($P < 0.01$). 4) The species which lack of the shield from the snow disaster, prey from the ground and weak ability of the migrant suffered most in the snow disaster. 5) Most local residents thought that the number of avian decreased about 20%-50%.

We concluded that the snow disaster caused great damage to the wildlife resource, and the impact of the extreme weather on the wildlife should be more cared in wildlife protection and restoration in South China.

305166 HOPE FOR THREATENED TROPICAL FOREST PREDATORS: LESSONS FROM THE PHILIPPINE EAGLE CONSERVATION PROGRAM

Jayson Carungay Ibanez, Dennis Salvador, Angelito Cereno, Anna Mae Sumaya, Elsa Delima

The Philippine Eagle *Pithecophaga jefferyi* is an IUCN critically endangered species that is found only in the Philippine archipelago where it is country's national bird. Because of the massive decimation of its primary forest habitat and continuing persecution of adult and young birds by Filipinos, the species remains at the verge of extinction. Is the Philippine's top forest predator doomed to extinction? We review four decades of conservation efforts, focusing on the results in conservation breeding, wild population monitoring, habitat protection, community-based conservation, public education, test releases, policy formulation and law enforcement. Remarkably, not all hope is lost. Although the status of the Philippine Eagle remains precarious, we conclude that the breadth of success indicators in the four major islands where it is historically found are promising and that the efforts to save the Philippine Eagle from extinction as a flagship for forest biodiversity conservation in the Philippines is not a lost cause.

Student Award Session:

314589 THE SHRINKING ARK: LARGE MAMMAL EXTINCTIONS IN INDIA

Krithi K Karanth

Large terrestrial mammals are among the most threatened taxa in the world, with 25% of species facing extinction. We examine the extinction vulnerability of 25 mammals in India. We compiled 30,000+ natural history and museum records to reconstruct mammal historic occurrence. Current mammal occurrence was determined by interviews and mapping with >100 acknowledged wildlife experts. We applied occupancy modeling to examine extinction vulnerability in relation to time, presence and proportion of protected areas, landscape features, human factors (densities and cultural tolerance), and species biology. We find that all 25 species are extinction prone (probabilities ranged between 0.20 and 0.96). Protected areas (presence and proportion of land they occupy) are critical to the survival of 22 species. We find proportion of forest cover to support persistence of 16 species. Human population density negatively influences survival of 14 species. Human cultural tolerance positively affected persistence of 12 species. Conservation initiatives (hunting bans, formal protected areas) over the last four decades have allowed some species to re-colonize some areas. Future conservation efforts will need to create and connect protected areas, and integrate factors such as land use, human population densities, and regionally rooted cultural-religious factors to ensure persistence of Indian mammals.

314619 LARGE VERTEBRATE POPULATION DECLINES IN AFRICA'S PROTECTED AREAS

Ian Craigie

Protected Areas (PAs) are the cornerstone of the global conservation effort. However the ecological

performance of PAs in terms of the long term persistence of their key biodiversity features remains poorly understood. Here, we use a new database of time series population data of large vertebrates from within African PAs to create population trends. The data collected consist of 540 population time series of 65 species from 84 protected areas. The population trends are aggregated to form an index showing the overall change of abundance. The index shows a decline in population abundances of over 50% between 1970 and 2004. Indices for different regions of Africa demonstrate that there are large regional variations. Southern Africa is maintaining its' populations and Western Africa is suffering severe declines, Eastern Africa shows an intermediate decline. These results indicate that in general PAs in Africa are currently struggling to mitigate the human-induced threats challenging them, but that in some cases parks are functioning well. This African protected area population index has the potential to contribute toward the assessment of the Convention on Biological Diversity's 2010 target to reduce the rate of biodiversity loss.

366635 EFFECTS OF URBANIZATION ON HOST-SPECIFIC WEEVIL SPECIES (COLEOPTERA: CURCULIONOIDEA) IN BEIJING

Dingcheng Huang, Zhimin Su, Runzhi Zhang

Urbanization is ranked to be a main driver of native biodiversity loss. A better understanding of the relationships between habitat characteristics, landscape structure and biodiversity is helpful for developing reasonable urban planning to mitigate its potential detrimental impacts. *Dorytomus occalescens* and *D. roelofsi* are newly recorded species from China, *D. setosus* and *D. alternans* from Beijing. *Dorytomus* are known host-specific, associated with the species of *Salix* and *Populus* which are common in this city. We detected their distribution pattern by band-shelter trapping along an urbanization gradient in Beijing in 2007 and 2008. The results showed that species richness and abundance of *Dorytomus* weevils were significantly lower in urban zones within the 3rd ring roads than those outside and decreased significantly when built-up ratio within 1 km was over 75%. They were not significantly predicted by abundance and density of host plant, but distance to urban center and built-up ratio within 1 km. These results indicated that determinants of *Dorytomus* weevils' persistence in urban habitats were not resource availability but might be fragmentation and openness of the surrounding matrix. Connectivity between urban and natural landscape is critical for mitigating urbanization impacts on those host-specific species. (Financial support by CAS Program KSCX2-YW-N-42.)

314997 ENSEMBLE MODELS PREDICT IMPORTANT BIRD AREAS TO BE LESS EFFECTIVE FOR CONSERVING ENDEMIC BIRDS UNDER CLIMATE CHANGE

Bernard Coetsee

Our aim was to examine climate change impacts on endemic birds, and specifically assess projected range changes in terms of the Important Bird Areas (IBAs) network in South Africa, Lesotho and Swaziland. The newly emerging ensemble modelling approach was used with 50 species, four climate change models for the period 2070-2100 and eight bioclimatic niche models in the statistical package BIOMOD. A consensus forecast is created with a Principal Components Analysis (PCA) and interpreted in terms of the IBA network. An

irreplaceability analysis was used to highlight priority IBAs for conservation attention in terms of climate change. The majority of species (62%) lose climatically suitable space. Five species lose at least 85% of their climatically suitable space. Many IBAs lose species (41%; 47 IBAs) and show high rates of species turnover of more than 50% (77%; 95 IBAs). The South African IBAs network is likely to be less effective for conserving endemic birds under climate change. The irreplaceability analysis identified key refugia for endemic species under climate change, but many of these areas are not currently IBAs. In addition, many of these high priority IBAs fall outside of the current formal protected areas network.

315092 PREDICTING POPULATION RESPONSE TO CHANGING LAND-USE: DO GENERAL RULES IN LANDSCAPE ECOLOGY WORK?

Danielle Shanahan, Hugh P. Possingham

Recent landscape ecology research has focussed on creating general rules for balancing human land-use with wildlife persistence to aid inexpensive decision making; rules that ensure sufficient habitat and connectivity remains to preserve basic population processes. These generalisations are rarely, if ever, directly tested. We take an a priori approach to testing some of these rules, using them to predict population presence or absence of species in remnant habitat patches. We create a simple 'skeleton' model which can be applied to any landscape, designed to balance predicted species-specific responses to habitat fragmentation with general landscape theory. We tested our model using presence-absence data for 17 bird species in South East Queensland, Australia. We achieved remarkably high predictive success, generally above 60% and often between 80-100% accuracy, though this was compromised for habitat specialists. In applying and assessing the accuracy of this a priori model we gained specific knowledge of the system in question, and also a greater understanding of the application of some theoretical generalisations. Our work provides hope that some generalisations could be extremely useful for cost-effective decision-making in landscape planning – the key is finding a balance between species-specific responses to habitat fragmentation and broader theoretical generalisations.

315335 ASSESSING THE IMPACT OF CLIMATE CHANGE ON BIRDS OF CONSERVATION CONCERN IN COLOMBIA

Jorge I Velasquez-Tibata, Catherine H. Graham, Paul G.W. Salaman

Climate change is expected to cause shifts in species distributions worldwide, threatening their viability due to potential range reductions and movement to unprotected areas. In this study, we assessed the extent of those effects on 214 threatened and range-restricted birds of Colombia, using species distribution models. Current and future distributions were modeled via MAXENT using point localities gathered from museums worldwide, literature and ornithologists' accounts, and climate surfaces for the present and for the year 2050 under two climate scenarios. Species were predicted to lose on average (\pm SE) $45.3 \pm 4.4\%$ of their total range under future climate scenario A2, with 19 species expected to have no suitable climate conditions in Colombia for the year 2050. Twelve species are expected to have no suitable climate conditions under the B2 scenario. Using the IUCN B1 criteria our models predicted a 10-11% increase in threatened species for both

climate scenarios considered. Currently, the mean percent of range representation for all species evaluated is $19.45 \pm 1.94\%$ in protected areas. In the future, range representation for all species in protected areas will decline considerably, to $8.46 \pm 1.52\%$ under A2 and $11.12 \pm 2.17\%$ under B2. Addition of reserves to the existing protected area network can help to mitigate some of the consequences of climate change, but careful monitoring and in-situ or ex-situ management may be necessary for those species predicted to be most affected.

315670 USING INVASIVE SNAILS AS BIOCONTROL AGENTS: GUARDIANS OF HUMAN HEALTH OR THREAT TO NUTRIENT CYCLING IN TROPICAL STREAMS?

Jennifer M Moslemi, Sunny B. Snider, Alex S Flecker, James F Gilliam

The introduction of invasive species to outcompete disease-harboring native species is an atypical and relatively high-risk approach to biological control. Although unintended impacts on ecosystem processes are likely, monitoring of ecosystem-scale response to introduction is not often conducted. In Trinidad, West Indies, we examined impacts of the aquatic snail *Tarebia granifera*—introduced throughout the Caribbean to outcompete native schistosoma-carrying snails—on aquatic nitrogen cycling. In addition, we assessed the influence of riparian vegetation removal on *T. granifera* impacts. We collected *T. granifera* abundance, biomass, and nitrogen excretion data in three streams to determine snail nitrogen excretion per (1) area of streambed and (2) snail biomass. Where riparian vegetation had been removed and direct sunlight reached the streambed, both area- and biomass-specific nitrogen excretion was significantly greater than in closed-canopy conditions. Analyses of food resources reveal that increased food quantity, but not quality, was the likely driver of observed differences. Measurements of whole-stream demand for nitrogen indicated that snail nitrogen excretion supplied 9% and 2% of demand in open and closed canopy habitats, respectively. Our findings suggest that intentional introduction of non-native snails can impact nitrogen cycles in tropical streams, and these impacts are augmented by destruction of riparian vegetation.

315347 PRIORITIZING INVESTMENTS IN ISLAND CONSERVATION USING GLOBAL DATA ON BIODIVERSITY, BUSINESS, AND CORRUPTION

Erin McCreless, Chris Wilcox, Don Croll, Bernie Tershy, Sarah Horwath

Marine islands make up 2% of the earth's land area, yet 64% of extinctions have occurred on islands and they contain 45% of critically endangered species. Invasive animals are a leading threat to island species, and their eradication is a powerful restoration tool. We used a return-on-investment (ROI) approach to prioritize global island regions for invasive animal eradication. Our model integrates geographic, biological, economic, and socio-political data, and includes NGO operating costs, hidden costs such as permitting to meet regulatory needs, and potential costs arising from project failures due to corruption and political instability. Developed countries with high island biodiversity dropped lower on the priority list due to costly permitting and labor costs, while some biodiverse developing countries fell due to corruption and poor business climate. Countries with moderate to high levels of island biodiversity, and low to moderate operating costs, corruption, and business climate (e.g. India, Vietnam, Brazil, Mexico), are higher priority. Our ROI approach: 1) includes a

novel use of widely available, international economic and political data, 2) is applicable to a variety of conservation problems at many scales, and 3) is a useful means to maximize the impact of limited conservation funding. Our results add to research showing that conservation planning incorporating both biodiversity benefits and economic costs results in more efficient use of conservation resources.

329563 PERMEABILITY OF COMMON URBAN FEATURES TO THE MOVEMENTS OF FOREST SONGBIRDS

Marie Anne Tremblay, Colleen Cassady St. Clair

Urbanization is widely regarded as a major threat to biological diversity worldwide. As cities expand, naturally productive habitats are permanently lost and fragmented leading to smaller, more isolated wildlife populations that are at greater risk of extinction. Using a taped recording of an avian mobbing call as a lure, we tested the willingness of forest birds to cross four types of common urban features: 1) roads of varying widths and traffic volumes, 2) railway lines, 3) transportation bridges across riparian corridors, and 4) rivers. In 591 experiments involving 2241 birds, we found that the size of the gap in vegetation was a more important determinant of movement than either traffic or noise. For roads and bridges, as the gap in vegetation approached 30 m, the likelihood of movement sharply decreased. The birds in our study also showed a marked preference for flying over, rather than under, bridges and their choice of route was largely dependent on surrounding vegetation. Our results suggest that urban landscapes present a number of impediments to the movements of forest songbirds and point to the importance of vegetation management as a potentially effective strategy for mitigating the barrier effects caused by human infrastructure in cities and other fragmented landscapes.

365301 DRIVERS AND IMPACTS OF LAND-USE CHANGE IN THE MAASAI-STEPPE, TANZANIA

Fortunata Urban Msoffe, Shem C Kifugo, Mohammed Yahya Said, Moses Ole Neselle, Paul van Gardingen, Robin Reid, Joseph O. Ogutu, Mario Herero,

In this paper, we discuss the drivers and impacts of land-use change in the Tarangire-Simanjiro ecosystem, part of the Maasai-Steppe, Northern Tanzania. An ecological-social-political analysis approach was adapted to unfold and synthesize the causes of land-use change emanating from historical, political and livelihood needs. Remote sensing data was used to analyze land use change and GIS was used to link-up with wildlife population dynamics and livestock distribution data derived from aerial censuses.

Results indicated that agriculture increased five-folds within the study period, while human population increased exponentially from 3.8% pa in 1988 to 5.2 % pa in 2002. On the other hand, wildlife migratory routes used by key species declined from 9 in 1964 to 5 in 2000, out of which 3 were seriously threatened for blockage by the extensive cultivation spreading in the study area. Recurrent droughts and diseases have contributed to the declining livestock economy over the years due to livestock loss and the unpredictable and erratic rainfall has limited their recovery. We recommend that efforts to reverse the on-going trends should include community-based wildlife ventures supported by proper land-use plans in order to generate direct tangible benefits from wildlife to communities while maintaining the ecosystem viability

314853 CONSERVING BIODIVERSITY THROUGH GLOBAL EFFORTS TO REDUCE CARBON EMISSIONS FROM DEFORESTATION

Oscar Venter, Wilson A. Kerrie, Takuya Iwamura, Richard Fuller, Hugh P. Possingham

Initiatives to reduce emissions from deforestation in developing countries (REDD) seem poised to protect threatened forests. It is widely hoped that this will also contribute to the conservation of biodiversity. In this article, we use decision theory and information about carbon, threat and cost to develop a cost-effective schedule for REDD investment. We use data on three groups of vertebrates to estimate the biodiversity outcomes of these investments. We find that spending funds to protect forest carbon protects biodiversity better than random spending, but not nearly as well as spending to maximize biodiversity outcomes. However, an anticipated benefit of REDD is that it will pay for forest protection at the national level and thereby stop normal within-country 'leakage'- where protecting forests simply causes nearby forests to be cleared instead. If REDD can stop within country leakage, we discover that REDD could provide even greater benefits for biodiversity than site based conservation spending that is directed at biodiversity. Finally, we find that if biodiversity is considered when allocating funds, the biodiversity outcomes of can be doubled while only reducing the carbon protected by only 8%. The REDD mechanism may soon become a powerful funder of forest conservation. We show that REDD has the potential to deliver benefits for forest conservation, and if these benefits are incorporated into the REDD mechanism, they could be increased very cost-effectively.

315666 COEXTINCTION DYNAMICS IN CARNIVORE PARASITES

Nyeema Harris, Rob Dunn

Coextinction refers to the loss of an affiliate species due to the extinction of the host. It is presumed that this phenomenon is occurring, but few estimates are available. Here, we present a simple, probabilistic model of coextinction between terrestrial North American carnivores and their parasites to determine how species loss alters parasite community composition and dynamics. We systematically compiled a list of parasites for each carnivore, broadly defining parasites to include microparasites (viruses, bacteria, protozoa), macroparasites (nematodes, platyhelminthes), and ectoparasites (fleas, ticks). Our literature search yielded over 500 parasite species and about 1,200 host-parasite combinations. We found that the predicted number of parasite extinctions is more than an order of magnitude greater than the number for endangered carnivore hosts. As a consequence to host extinctions, the parasite biota also shifted toward a composition more dominated by species from generalist parasite clades such as ticks and viruses. Our findings confirm the high possibility of coextinction in carnivore parasites, which can have very real consequences to the persistence of rare species; given that generalist parasites often have higher fitness costs for their hosts. Our findings also indicate that maintaining diverse parasite communities can help promote species coexistence and sustain biodiversity.

Disturbance ecology

315673 AMPHIBIAN AND REPTILE RESPONSE TO THINNING AND BURNING IN PINE-HARDWOOD FORESTS OF ALABAMA, U.S.A.

William Bradley Sutton, Yong Wang, Callie Schweitzer

Amphibians and reptiles are essential components of forest ecosystems. Increasing evidence suggests that many of these species are declining due to anthropogenic disturbances, such as habitat destruction and alteration. We examined amphibian and reptile response to forest thinning and prescribed burning in 18 pine-hardwood forest stands of the William B. Bankhead National Forest, Alabama, U.S.A from 2005-2008. Experimental design consisted of a two by three factorial design with three replications. Forest treatments consisted of three thinning levels (no thin, 11 m² residual basal area (BA), and 17 m² residual BA) and two burn levels (no burn and burn). Using drift-fence trap arrays, we captured approximately 3600 individual amphibians and reptiles representing 42 species during one-year of pre-treatment surveys and three years of post-treatment surveys. Most reptile species (e.g. Green Anole, Black Racer, and Black Kingsnake) responded positively to thin and thin/burn treatments and were highly correlated with increased downed woody debris and decreased canopy cover. An amphibian species, the Slimy Salamander was not affected by thinning treatments, but declined in some burn and thin/burn treatments. Findings suggest that forest thinning is a viable conservation strategy to improve forest growing conditions without negatively affecting amphibian and reptile species inhabiting southeastern forests.

315321 ANTHROPOGENIC CHANGE IN THE TERRESTRIAL HABITATS OF THE GALAPAGOS ARCHIPELAGO

James Edward Maxwell Watson

Surprisingly, little effort has been made to quantify the 'footprint' of human disturbance that compromises the Galapagos Archipelago's ecological integrity. Here I provide a quantitative assessment of the impact of anthropogenic activity on the archipelago. I defined anthropogenic change as either transformed by direct human activity or an area that has been heavily invaded by four of the most prevalent and aggressive alien plant species (*Psidium guajava*, *Rubus niveus*, *Cinchona pubescens* and *Syzygium jambos*). I found that 37,833 ha (5.5%) of the archipelago have been completely transformed by human activities, concentrated on the four main inhabited islands. The most impacted islands (13,000-14,000 ha each) are Santa Cruz (the most populous) and Isabela (the largest). When vegetation type was considered, the humid and very humid vegetation zones have been most affected (29% and 45% respectively). On San Cristóbal and Santa Cruz, 100% and 76% of the very humid zone and 94% and 88% of the humid zone has been transformed. This research points to an urgent need to prioritise restoration efforts in humid and very humid vegetation zones and to improve spatial mapping across the archipelago to get a better understanding of the direct and indirect impacts of humans.

369069 CRAYFISH, COMPETITION AND COEXISTENCE: EXPLORING AGGRESSION AND SHELTER COMPETITION IN A NATIVE-INVASIVE CRAYFISH ASSEMBLAGE

Brett Alan Hanshew

The Red Swamp crayfish (*Procambarus clarkii*) is one of the IUCN's 100 Worst Invasive Species. It is present in Oregon's Willamette Valley along with the native Signal Crayfish (*Pacifastacus leniusculus*). Both crayfish species are aggressive habitat and dietary generalists, and largely rely on shelter: they are prey items for many aquatic and terrestrial predators. We hypothesized that the successful invasion of Red Swamp crayfish into Signal crayfish streams may be due to interactions between aggression, shelter availability, and interspecific competition.

We used a multi-scale approach addressing both abiotic (habitat) and biotic (competition) mechanisms of invasion by using field survey and experimental techniques. We used an epicenter survey design that focused on areas of coexistence for both species of crayfish. We sampled water bodies at points intersecting concentric circles with radii of 500m, 1km, and 1.5km at two regional field sites. Within both epicenter surveys, invasive *P. clarkii* were the dominant species.

We performed a 2x3 factorial mesocosm experiment with treatments for shelter density (high, low) and species composition (both species alone, both species together). We discovered significant differences in occupancy patterns between treatments, and that shelter availability alters these patterns in mixed species treatments. Notably, invasive Red Swamp crayfish mimic Signal Crayfish shelter occupancy patterns in mixed species treatments.

309955 SYNERGISTIC IMPACTS OF LAND-USE, CLIMATE CHANGE AND RESOURCE AVAILABILITY ON ANDEAN BIODIVERSITY: A CASE STUDY OF DUNG BEETLES

Trond Larsen

The synergistic impacts of land-use and climate change on biodiversity are poorly understood. These impacts are predicted to be strongest on montane ectotherms, for which few data exist. I assessed dung beetle community structure along intact and disturbed altitudinal gradients from 250 - 3500 m ASL in Peru. Species richness and abundance declined strongly in response to all types of land-use. The most simplified, open habitats supported the lowest beetle diversity and abundance despite ample food availability. Most species showed highly restricted altitudinal ranges of less than 500 m. Congeners displayed strong altitudinal segregation in intact habitat, but not in disturbed landscapes. Several forest species shifted their distribution upwards in response to habitat loss, while a few high elevation grassland species moved downwards into modified habitats. Climate change is likely to exacerbate the influence of habitat loss in the region by making conditions hotter and drier. Dung beetles may face further extinctions due to resource limitation, since ectotherms are predicted to shift more rapidly with climate change than the mammals they depend on for food. Maintaining intact elevational gradients from the lowlands is essential for providing corridors that allow species redistribution in response to climate change. Mid-elevation habitats, such as cloud forest, merit high conservation priority for their future role in harboring species from the lowlands.

315115 HUMAN-LEOPARD CONFLICT IN THE DECCAN REGION OF KOPPAL, CENTRAL KARNATAKA, INDIA

Usham Somarendro Singh, Kartick Satyanarayan, Geeta Seshamani, Samad Kottur, Haobijam

Meitei

Humans and leopards co-exist in and around the forested areas of the Deccan region of Koppal, Central Karnataka. The study aims in finding the solutions for the human-leopard conflict. The investigation was carried out during 2007 and 2008 and recorded 105 animals attacked by leopards. It predated on four species; goat *Capra hircus* (n=49) and sheep *Ovis aries* (n=29) were the primary preys. 98 individuals were consumed and 7 livestock survived the attack. Kills occurred more ($p < 0.001$) in the forest habitat. Evening (42.5 %) and afternoon (31.5 %) durations recorded highest attacks. The investigation found mortality of two leopards; one caused by humans and the other due to the retaliatory attack of cattle's. Two humans attacked by leopards were recorded. Shepherd are both local (53 %) and migratory (47 %) and largely depend on forest ecosystem during the cropping season in the valleys. Awareness among the locals was poor and 96.3 % didn't know the forest department; none applied for compensation. The locals (56 %) wanted to eliminate the leopard. Keeping livestock guarding dogs was the only traditional technique used to prevent leopard's attack. We felt the need for extensive education programme and protection of some critical habitats.

315726 THE EFFECTS OF LONG-TERM BURNING REGIMES ON SAVANNA SPIDER ASSEMBLAGES

Bradley Neil Reynolds

Fire is a key ecological process shaping African savannas. Due to the lack of information on the role of fire in preserving fauna and flora, a long-term fire experiment was initiated in Kruger National Park, South Africa, in 1954. So far this study has mainly focussed on the response of vegetation to long-term burning regimes (LBRs) with little work done on animals. This lack of studies on the effects of LBRs on fauna, especially invertebrates, is a global problem and is alarming as fire-driven biomes possess an enormous number and diversity of invertebrates, all of which have pivotal roles to play in ecosystem functioning. This study aims to investigate the effects of LBRs on spider assemblages along a rainfall gradient in order to better understand the effect that managed burning regimes may have on invertebrate assemblages. We propose that spider diversity will be greatest in less frequently burned areas and areas subjected to less intense fires, as the vegetation complexity in these areas is greatest. Furthermore, we propose that greater differences in spider assemblage composition between different burning regimes will exist in higher rainfall areas than in lower rainfall areas because of lower resilience of the vegetation to disturbance in wetter areas than in drier ones. Results of this study will shed more light on the responses of invertebrates to LBRs and improve our understanding of how best to use fire as a tool for successfully managing biodiversity.

367922 THE IMPACT OF OIL EXPLORATION ACTIVITIES ON CARNIVORE AND PRIMATE POPULATIONS IN THE NORTHERN PERUVIAN AMAZON

Joseph Mark Kolowski, Alfonso Alonso

The western Amazon is experiencing unprecedented levels of oil exploration, a trend of particular concern given the high levels of biodiversity found in this relatively pristine and unstudied region. Despite the widespread use of seismic reflection technology for oil exploration, no studies have investigated its impact on tropical wildlife populations. We conducted trail camera and line-transect surveys inside a large oil concession (Block 39, operated by Repsol Exploración Peru) in the northern Peruvian Amazon with ongoing 2D seismic explorations to investigate its effects on carnivore and primate populations with particular focus on the ocelot (*Leopardus pardalis*). Ocelot activity and estimated population size before and during exploration operations indicated a lack of spatial or temporal avoidance of this disturbance. Group encounter rates for the three most common primate species were also unaffected by seismic exploration activity. Our ocelot density (#/ 100 km²) estimates from before (75.2) and during (94.7) seismic operations include the highest reported for the species, and represent the first ocelot density estimates from this region. We also report high densities of *Ateles belzebuth* and *Lagothrix poeppigii*, both species of conservation concern in Peru. Based on these data, it appears that when using environmental best practices, these exploration operations can be conducted with minimal short-term impact on large mammal populations.

364906 AMPHIBIAN MICROCLIMATES, MASS AND ENERGY EXCHANGES IN FORESTRY TREATED HABITAT

Annette Sieg, James Robert Spotila, Michael O'Connor

Amphibians are declining worldwide at a faster rate than any other vertebrate group and habitat loss is a major cause of this decline. A study of forestry impacts on amphibians created logged habitat surrounding breeding ponds in Missouri. We estimate mass and energy exchanges for native wood frog (*Lithobates sylvaticus*) over hourly, daily, and yearly time frames in the heterogeneous landscape created both experimentally and by existing topography, forest floor leaf litter, and climate variables. We measure metabolic rates at varying combinations of body temperature and hydration to assess the energetic consequences of inhabiting different forestry treatments. Estimates of evaporative water loss (EWL) rates and body temperatures experienced by native amphibians are based on measured climate variables in each treatment, and with physical models of frogs cut from sponges or plaster cast. Occupancy of logged sites increases EWL rates, body temperatures and energetic costs, but the magnitude depends on the treatment type, prevailing weather, and pre-existing site characteristics. Biophysical projections reveal that critically low hydration is reached in 2-3 weeks in clearcuts and only after many months without rainfall in the control. This approach emphasizes the primacy of water as a resource in amphibian physiological ecology and delineates precisely under which spatial and temporal scales logging impacts amphibians. These are concepts often missing in amphibian conservation.

Conservation in hotspots

314770 ADVANCES IN WILD ORCHID CONSERVATION IN GUANGXI CHINA, A GLOBAL ORCHID HOTSPOT

Hong Liu, Yi-Bo Luo, Dun Luo

Orchid conservation issues are acute in China. The tremendous cultural, horticultural and ethnobotanical demands on Chinese wild orchids, coupled with shrinking wild habitats and the primitive horticultural techniques, have subjected wild populations of many Chinese orchids to destructive collection and local extinction. In 2005, soon after the discovery of its rich orchid flora, the first Chinese orchid nature preserve was established in Yachang, a former state forestry reserve in a remote area of Guangxi, southwestern China. The most extraordinary feature about Yachang is the existence of extremely large populations of many terrestrial and lithophytic orchids, which include species of great horticultural importance that have been poached to near extinction elsewhere. The Preserve was recently elevated to a National Nature Preserve, a status that would bring national level of funding for protection and management. Currently a proposal is being evaluated by the provincial government of Guangxi to promote international collaborative conservation research to develop science based conservation of orchids in Yachang. In order to reduce the human pressure on wild orchids, development of affordable and sustainable orchid cultivation and viable orchid markets to improve local residents' livelihood is essential to the long-term success of orchid conservation in the region.

314934 ALL HUMAN-WILDLIFE CONFLICTS OCCUR DUE TO WILDLIFE OVERABUNDANCE-A MISUNDERSTANDING IN HWC AREAS IN CHINA

Yufang Gao

Human-wildlife Conflict (HWC) is an important issue in conservation. Considering the dense human populations in close proximity to nature reserves, HWC in China is reported to be increasing in the past five years, especially the human-wild boar conflict, due to overabundance. Since 2008, several awareness-raising campaigns have been conducted to address the human-bear conflict (in Tibet, West China), human-tiger conflict (in Jilin, Northeast China), and human-alligator conflict (in Anhui, East China) for the Wildlife Conservation Society China Program. The author finds that a misunderstanding emerges among those living in HWC areas that the increase of HWC is an indicator of wildlife population recovery as a result of effective conservation efforts. Village surveys including questionnaires and semi-structured interviews were carried out and the attitudes of the local residents towards wildlife were assessed in the three conflict areas. The author concluded that: 1) Increasing wildlife population is not the only factor contributing to escalation of HWC in China. For these three HWC areas, species habitat loss, degradation and fragmentation are still the main problem; 2) Gaps in knowledge, attitude and behavior still exist in these three HWC areas; 3) Conservation education as a long-term strategy to foster community-based conservation and finally achieve the harmony for nature and society is by all means necessary.

367424 AN AMPHIBIAN HOTSPOT REVISITED - DOES A FINER SCALE GIVE NEW ANSWERS?**Johannes Penner, Annika Hillers, Matthias Herkt, Jakob Fahr, Mark-Oliver Rödel**

One third of the world's known amphibians are listed as threatened. Detailed information on the distribution of these species are required for the design and implementation of efficient conservation plans. Current information for most areas is only available at a coarse scale using expert opinion. Several were identified as global hotspots due to their importance for threatened species and the current anthropogenic pressure. A finer gridded resolution is necessary to estimate the distributions of data deficient species and to identify previously unknown hotspots or areas in urgent need for protection.

Employing niche modelling we predicted the distribution of 179 amphibian species in West Africa on 1 km² scale. Important ecological drivers for the distribution of species have been identified from a set of selected environmental variables. Precipitation and land cover had a strong impact on the models, but there was no single outstanding variable. Potential fine scaled hotspots were identified and compared to existing protected areas through a gap analysis. Finally, the modelled hotspots were compared to potential historical refugia detected via genetic analyses.

Several areas of high diversity and endemism have been identified, mainly in SW Ghana and along the borders between Liberia, Côte d'Ivoire and Guinea and between Liberia and Sierra Leone. We conclude that our fine scale does give new insights and that the existing framework might be sufficient only in some areas.

315149 EFFECTS OF HABITAT DISTURBANCE ON THE DIVERSITY OF AMPHIBIANS AND BUTTERFLIES IN THE LOWLAND FOREST OF SINHARAJA MAB RESERVE, SRI LANKA**Enoka Priyadarshani Kudavidanage, Chamitha D. de Alwis, Sarath S. Rajapakse, Sarath W.****Kotagama**

The Western Ghats - Sri Lanka region is a global biodiversity hotspot which has lost more than 70% of its original forest habitats over the past two centuries. To investigate the effects of habitat disturbance in lowland rain forests, butterflies and amphibians were surveyed in the primary and secondary forests the Sinharaja reserve, peripheral home garden and Pinus plantations. Selected habitat variables were measured to characterize the abiotic environment. A total of 32 species of amphibians and 120 species of butterflies were recorded. Estimators of forest species richness and population densities for both taxa were not significantly different between the two forest types, but showed different patterns in the other habitats. The species richness and abundance declined from forest to non forest habitats in amphibians while it increased in butterflies. Community composition of amphibians in forests was clearly distinct from those in modified habitats. Both taxa were affected by anthropogenic disturbance but may respond to different components in the habitat (i.e., structure and resources), thus butterflies and amphibians may not surrogate each other. More research is required to improve the understanding of the altered diversity and community structure resulting from forest habitat degradation in Sri Lanka.

315556 FACILITATING THE PARTICIPATION OF INDIGENOUS PEOPLES IN PROTECTED AREA MANAGEMENT: THE AGTA IN THE NORTHERN SIERRA MADRE NATURAL PARK, THE PHILIPPINES

Tessa Minter, Jan van der Ploeg

In the Philippines protected areas are by law managed by multi-stakeholder bodies in which indigenous peoples participate. The Northern Sierra Madre Natural Park is the largest protected area of the archipelago. The Agta, the indigenous people of the Sierra Madre, are formally represented in the Protected Area Management Board. But the participation of the Agta in the management of the Northern Sierra Madre Natural Park remains largely rhetoric. Their functioning is hampered by logistic, communicative, financial and educational barriers. The co-management body fails to address illegal logging, encroachment and the use of destructive hunting and fishing methods, which threaten the livelihoods of Agta communities in the park. In its current functioning the Protected Area Management Board legitimizes existing power structures, masks corruption and organized crime, and maintains racial prejudice. It is essential to strengthen law enforcement by devolving authority over natural resources to local governments, enhancing the capacity of the park service, and supporting civil society organizations that hold local governments accountable.

315314 EPOLAR BEAR HEARING SENSITIVITY: FUNDAMENTAL DATA ON PERCEPTION MAY ENHANCE ESTIMATES OF NOISE-DISTURBANCE

Megan Owen, Ann E. Bowles, Samuel L Denes, Jennifer L Keating, Stefanie K Graves, JoAnne Simerson, William Winhall

About 50% of maternal dens excavated by pregnant female polar bears on Alaska's North Slope occur on land or land-fast ice. Overlap between maternal dens and industrial activity is possible as these areas hold some of the largest, and most hotly-contested, petroleum reserves in North America. Noise from human activities may adversely affect polar bears by disrupting intra-specific communication, prompting altered habitat use, or causing behavioral and physiological stress. However, an understanding of species-specific audition is essential to assessing noise disturbance from industrial activities. We used behavioral psychoacoustic methods to test hearing sensitivity at frequencies between 125 Hz and 31.5 kHz. Results from 4 females and 1 male show best sensitivity between 8 and 14 kHz. Sensitivity rolled off sharply between 14 and 20kHz, suggesting a narrower bandwidth than that of small carnivores. Our results also suggest that low frequency hearing is at least as sensitive as that of small carnivores, and potentially more sensitive. Although North Slope industrial activities are managed to prevent disturbance of denning females, uncontrolled human activities are still possible. The negative ramifications of disturbance may be intensified due to anticipated reductions in body weight associated with changes in the sea ice and concomitant loss of feeding opportunities.

306098 CAVES - THE FORGOTTEN CONSERVATION HOTSPOTS OF ASIA**Tony Whitten**

Caves are arguably the hottest of the biodiversity hot spots as measured by area, endemism and threat, yet receive very little attention or appropriate management. Some recent investigations in China have found that up to 90 percent of the invertebrates collected in caves are new to science, yet environmental assessments for development projects in karst areas rarely if ever give attention to cave fauna. Disturbance by limestone quarrying, visitors, tourism infrastructure, and changes in water flow through or from above the cave can have devastating effects on the highly-adapted and range-restricted fauna. Moreover, there is no government agency responsible for - or conservation NGO especially interested in - caves in China or many other countries, and current national protected area systems and processes fail to address the needs of cave faunas. Some examples of World Bank-financed development projects in China and SE Asia which have led to cave conservation are described, and suggestions on how to raise the profile and conservation status of caves are given.

319299 PLANT ENDEMICITY ON HAINAN ISLAND: CONSERVATION CHALLENGES**Javier Francisco-Ortega, Zhong-Sheng Wang, Fu-Wu Xing, Faguo Wang, Hong Liu, Han Xu, Weixiang Xu, Yi-Bo Luo, David Boufford, Mike Maunder, Shuqing An**

Hainan Island, the second largest island of China has a rich flora with a relatively large proportion of endemic species. Hainan is part of the Indo-Burma Biodiversity hotspot and therefore a major priority for international conservation. The island has an environment with major geological and topographical differences; they have been a major force for evolution and speciation. Our studies shown that several of these endemics are confined to limestone areas. We are producing the first check-list of seed-plants endemic to Hainan; this project is providing an initial framework to establish future plant conservation strategies. Our initial results show that many of the species that were previously considered as Hainan endemics are also found in the mainland or have been merged to taxa with a widespread distribution. All of the endemic genera are monotypic, and none of the more widespread genera have more than 15 endemic species on Hainan. Our study includes a review on phylogenetic patterns and identifies major challenges for conservation. Challenges include developing a comprehensive red list, understanding phytogeographical patterns of endemism in areas with different kind of soils, investigating the placement of endemics on the tree of life, outreach and environmental education, identification of local biodiversity hotspots, and documenting to what extent environmental changes induced by humans affect the conservation of this unique natural heritage from China.

Protected area planning and design

308128 AQUATIC TOURISM PROMOTION AS AN ARSENAL IN CONSERVATION OF NIGERIAN PROTECTED AREAS: A CASE STUDY OF OLD OYO NATIONAL PARK, NIGERIA

Samson Oluwagbemiga Ojo

The study aimed at determining composition, abundance and distribution of some aquatic resources for sustainable recreational development and management.

The study was based on typical wet and dry seasons and river stratification. Fish sampling of Ogun River in the park done with monofilament gillnets of 38mm to 127mm and graded hooks. Physico-chemical properties of the river also determined.

12 fish families and 30 species were identified, 5 families classified as fishes of ecotourism importance. Optimal fish catches achieved with mesh sizes 51mm and 76mm. Highest species diversity found in upstream and decreased downward with Sex ratio 6.48 female: 3.52male. Effect of seasons and mesh sizes were significant for total catches, however significant difference observed in number and weight of fishes among mesh sizes ($P < 0.05$). Significant correlation ($P < 0.05$) observed between length and weight of fishes during the seasons with r values of 0.774 and 0.894 and mean condition factor ranged from 0.55 ± 0.11 to 2.34 ± 0.29 . Mean physico-chemical values are within tropical ranges. Socio-economic status of fisher folks was also determined.

Ogun River has high ecotourism potentials based on fishes identified.

314953 POTENTIAL CHEMOSIGNALS IN THE ANOGENITAL GLAND SECRETION OF GIANT PANDAS, *AILUROPODA MELANOLEUCA*, ASSOCIATED WITH SEX AND INDIVIDUAL IDENTITY

Dingzhen Liu, Jian-Xu Zhang, Sun Lixin, Rongping Wei, Guiquan Zhang, Honglin Wu, Hemin Zhang, Chenghua Zhao

With a combination of dichloromethane extraction and analysis by gas chromatography-mass spectrometry (GC-MS), we found 39 compounds in the anogenital gland secretion (AGS) of captive adult giant pandas, *Ailuropoda melanoleuca*, during the non-mating season. In addition to indole, squalene, and some of the straight-chain fatty acids that had been characterized previously from the AGS of giant pandas, we identified several new compounds such as decenal, two isomers of decadienal, phenylacetic acid, 5-methylhydantoin, hydroquinone, phenylpropanoic acid, and erucic acid. Quantitative comparison of the relative abundances of the 20 main GC peaks revealed that 5-methylhydantoin, indole, and erucic acid are putative female pheromones, whereas squalene and hydroquinone are putative male pheromones. In addition to the presence of a few individual-specific compounds, the relative abundances of most of the 21 constituents varied more between individuals than within individuals. This suggests that individual identity might be coded in both digital and analog form. The chemical composition of different AGS samples from the same pandas consistently displayed a minimum cluster distance, much smaller than that between samples from different individuals in a hierarchical linkage cluster (average linkage) dendrogram. Our results indicate that the AGS might contain an "odor fingerprint." And synthetic chemosignals might be useful in modulating the behavior and physiology of giant pandas.

315185 CONSERVING KARST LANDSCAPES: EMPHASISING CULTURAL VALUES, BUILDING LOCAL SUPPORT FOR CONSERVATION WHILE STRENGTHENING CULTURAL CONSTRUCTIONS OF NATURE

Mark Infield, QUANG NGOC NGUYEN

The karst limestone landscapes of southern China and northern Vietnam are recognised as areas of high biodiversity, both within terrestrial forests and subterranean environments, and of outstanding scenic beauty. Both values are threatened by the conversion of karst landscapes that are deforested by unsustainable resource use, removed wholesale to provide raw material for construction, and fragmented by land use changes. Efforts to gain support for their conservation emphasise the special values of karst in terms of biodiversity, their potential for tourism and their hydrological importance. However, these landscapes are closely linked to the culture of local communities through myth, poetry and painting, the assigning of names, and association with religious practices. Initiatives being undertaken by Fauna and Flora International in Uganda are demonstrating that integrating local values into conservation policy and practice stimulates interest in and support for protected areas and helps revitalize traditional values and practices. Application of values-based conservation can help build support for karst conservation amongst communities living within karst landscapes. Reference will be made to constructions of nature amongst local peoples and related cultural practices to propose practical steps for conservation managers to integrate these values and practices into the design, management and representation of karst conservation areas.

377867 PRELIMINARY STUDY ON EDGE EFFECT OF FOREST ROAD IN DINGHUSHAN

Ting Zhou, Shao-lin Peng

Edge effect on forest community caused by road was studied in Dinghushan Natural Reserve, Guangdong Province. In this paper, two roads with different wide were selected, 6m and 2m. We sampled four transects on both sides (upgrade and downgrade) of a winding mountain road with 6m wide. Each transect was 30m long and 5m wide, and was isolated by a 5m belt respectively, which means the distance from road is 0, 10, 20 and 30m. When it comes to 2m road within forest, some transects without intervals with 30m long and 2m wide were set. The distance from road is 0, 2, 4, 6 and 8m. The vegetation and understory surface soil were investigated. Several conclusions can be made from the present study. When the road is wider (6m), the total biomass showed positive effect, while soil acidity and total nitrogen content showed negative effect in downgrade transects. Neither species diversity nor soil water content exhibited obvious edge effect. However, the edge effect induced from the road with narrower (2m) is not dominant. Conclusively, roads divided the forest ecosystem with artificial linear gaps, which generated different edge effects in the characteristics of vegetation and soil. Edge effect caused by forest roads should be considered in the management of natural reserve.

315337 PHYLOGENETIC DIVERSITY ASSESSMENT OF AUSTRALIAN MARSUPIALS**Mayra Pereira de Melo Amboni, Shawn Laffan, Gerry Cassis**

In a world where there is a general lack of financial support for environmental issues, some areas must have priority on conservation among others. It is essential, therefore, to allocate resources in the most efficient manner, so that the areas that best represent the overall biodiversity have the greatest priority in conservation efforts. Strategies for biodiversity conservation have been proposed that not only protect the biodiversity itself, but also the evolutionary processes that maintain it. The phylogenetic diversity approach for conservation of biodiversity allows us not only to recognize degrees of species distinctiveness, but as well enables us to elucidate some evolutionary history and therefore infer some of their evolutionary process. In this study we analyzed the phylogenetic diversity of Australian marsupials to identify areas within Australia where there is higher phylogenetic diversity and which should, therefore, receive more attention for conservation purposes. We used spatial location available in the Online Zoological Collection of Australian Museums and the Biodiverse software to run the analysis. Little is known about the continental scale diversity of mammals across Australia, and this study therefore contributes to a better understanding of Australian marsupials' distribution pattern and enables more effective application of management and conservation actions.

Population dynamics**315422 CONSERVATION IMPLICATIONS OF HABITAT USE BY THE HONG KONG NEWT, PARAMESOTRITON HONGKONGENSIS****Wing Kan Fu, David Dudgeon, Nancy E Karraker**

Paramesotriton hongkongensis has a highly restricted distribution in southern China, and is mainly confined to hillstreams in Hong Kong where most of the few known populations appear isolated from each other. Although much of the life cycle is spent on land, newt behaviour during this stage has not been studied, and critical habitat requirements for foraging and breeding are unknown. We censused breeding populations in four streams every three weeks, and used stomach flushing to characterise diets. Two streams were impounded by dam or river channel. We also characterized terrestrial habitat surrounding breeding sites and conducted surveys to determine distance that newts traveled from streams. Densities in streams ranged from 1.0/m² to 3.5/m², and peaked during the cool dry northeast monsoon. Most newts were terrestrial during the wet southwest monsoon when they could travel 200m from streams. The diet of aquatic adults included shrimps, snails and aquatic insects. There was no systematic difference in diet or adult body condition (size-weight relationships) between streams, but a higher frequency of injuries and deformities was noted in impounded streams (32.3-66.7%) relative to free-flowing streams (1.6-6.9%). The extensive terrestrial habitat use by *P. hongkongensis* mandates protection of substantial areas of forest around newt breeding sites, while further investigation of the relationship between stream conditions and newt health is needed to inform conservation efforts.

314979 EFFECTS OF HABITAT FRAGMENTATION ON PLANT DIVERSITY AND DYNAMICS IN THE SUBTROPICAL EVERGREEN BROAD-LEAVED FORESTS OF YUNNAN, SW CHINA

Cindy Q. Tang

A wide-ranging study of the subtropical forests (23°6'-27°44' N, 105°57'-98°36'E) of Yunnan, leads to recommendations for conservation of subtropical evergreen broad-leaved forests (EBLFs) affected by habitat fragmentation. Sampling was conducted in 130 plots including natural forests, secondary stands and fast-growing *Eucalyptus* and *Pinus* plantations. Diversity indices showed the natural EBLFs to be more diverse than the secondary and planted forests. The secondary and abandoned planted forests had gradually been entered by native species, and would eventually succeed toward the composition of the natural forests were there no further human intervention or natural catastrophes. The mid-successional stage had higher species diversity than the early and late stages.

Reestablishment of the original forest composition will not be complete in all environments, as exemplified by the fate of the endangered tree *Michelia coriacea*, endemic to southeastern Yunnan. *M. coriacea* had a poor seedling/sapling bank due to its fragmented distribution. The population was declining, with a growth rate λ of 0.814. The invasive *Eupatorium adenophorum* has aggressively invaded the damaged and fragmented sites, limiting the tree's regeneration.

Strict protection of the natural forests, limitation of plantations of fast-growing species, and control of invasive plants are crucial for conservation of the natural EBLFs.

315016 GROWTH PARAMETERS OF ICELAND SCALLOP (*CHLAMYS ISLANDICA*) IN GILBERT BAY LABRADOR, A MARINE PROTECTED AREA

Shanshan Liu, Joseph Wroblewski, Raymond Thompson

The Marine Protected Area (MPA) is a potential tool for marine conservation and fishery management. The sustainability of the Iceland scallop stock is a major conservation issue in Gilbert Bay, the first MPA in eastern Canada's subarctic coastal zone. Scallops in Gilbert Bay were smaller than scallops in the Strait of Belle Isle, Gulf of St. Lawrence. Three methods were used to determine the age of individual scallops: external, ligament and internal growth increments. We investigated the growth parameters of Iceland scallops in Gilbert Bay using the von Bertalanffy growth function, and compared them with scallops in the Strait of Belle Isle and the Nuuk area of West Greenland. We found considerable variation in scallop growth within the bay ($p < 0.001$), but growth rates of scallops from the inner and outer bay were similar ($p = 0.06$). Scallop growth in Gilbert Bay was similar to scallop growth in the Strait of Belle Isle ($p = 0.19$) and scallop growth in the Nuuk area of West Greenland ($p = 0.69$). Scallops in Gilbert Bay were smaller, perhaps due to intensive commercial fishing in the past. Suitable harvesting regulations may improve the sustainability of Iceland scallop populations in Gilbert Bay.

308145 COMPETITION AND COEXISTENCE OF SYMPATRIC PRZEWALSKI'S GAZELLE AND TIBETAN GAZELLE

Zhongqiu Li, Zhigang Jiang

Przewalski's gazelle and Tibetan gazelle are two endemic endangered ungulates on the Qinghai-Tibetan Plateau. We found both gazelles coexist in Shengge Area upon Upper Buha River, northwest of the Qinghai Lake Watershed. Shengge Area is the only one where the two gazelles live in the same ecosystem. We also found the mix-species groups of the two gazelles, why do they coexist in the same ecosystem? To explore the competition and coexistence mechanisms of the two gazelles, we studied the social structure, dietary composition, habitat utilization and activity patterns of the gazelles from 2003 to 2007.

In results, Przewalski's gazelle and Tibetan gazelle have similar social structure, dietary composition and activity budgets; however, they differ in the utilization of core home ranges and some habitat factors. Formation of mixed-species groups could reduce individual vigilance and probability of being predated; however, it also implies the crossbreeding between Przewalski's gazelle and Tibetan gazelle might have taken place in the study area.

319465 ESTIMATING SNOW LEOPARD (UNCIA UNCIA) POPULATIONS IN THE NEPAL HIMALAYA

Rinjan Shrestha, Eric Wikramanayake, Kamal Thapa, Gokarna Jung Thapa, Narendra Man Babu Pradhan

Snow leopards (*Uncia uncia*) are sparsely distributed in the mountain ranges of Central Asia. Reliable population estimates of snow leopards are hard to obtain because of their inaccessible habitat and elusive behavior, thus constraining conservation action. We present a model to estimate populations inferred from relationships among sign surveys, genetic analyses, and extent of potential habitat for the Nepal Himalaya. We regressed snow leopard numbers assessed through genetic analysis with scrape density ($\beta_1 = 0.015$, $r = 0.89$, $P < 0.05$). We used the coefficient of this relationship to predict snow leopard density based on scrape data in five major habitat complexes. Our density estimates ranged from 0.9- 3.3 animals/100 sqkm in the five habitat complexes for an overall population estimate of 363 animals. Density variations are attributed to habitat suitability. Because large carnivores are cryptic and tend to be sparsely distributed, various constraints prevent reliable field data from being collected to estimate population parameters and develop appropriate conservation strategies. We suggest that this model is useful for providing relatively good estimates of populations for such species when conservation actions are urgently needed.

366858 SYNCHRONY BETWEEN MINK AND MUSKRAT FUR RETURNS IN CANADA

Catherine J. Shier, Mark S. Boyce

Fur return data from the Hudson's Bay Company are assumed to be an index of population size, and

fluctuations in the harvests of muskrats and mink are thought to track a predator-prey interaction. We have documented an east-west gradient in the synchrony of fur-return data for muskrats and mink. In western Canada we see lagged oscillations as expected from predator-prey dynamics, but in eastern Canada mink and muskrat harvests are synchronous. Longitudinal data analysis revealed that synchronizing perturbations in harvests of these two species in eastern Canada is driven by the North Atlantic Oscillation (NAO). Synchrony by the NAO is caused by periodic early onset of winter that causes reduced trapping opportunity for both mink and muskrats.

Therefore we attribute the synchrony to factors influencing trapping success and not the abundance of the animals.

315681 LONG-TERM AVIFAUNA CHANGES: FIRE OR CLIMATE CHANGE?

Eduardo Gallo Cajiao, Graham H. Pyke, Culum Brown

Individual effects of co-occurring threats to biodiversity must be understood to inform conservation policy. Two threats to avifauna operate in Australian heathlands, inappropriate fire regimes and climate change. The former are the product of high fire frequency leading to population decline. The latter causes a shift in species distribution towards higher latitudes/altitudes, with populations decreasing at lower latitudes/altitudes and increasing at higher latitudes/altitudes. Using a long-term data set of bird counts from two plots with different fire histories within a National Park on the East Coast of Australia, we assessed three questions: 1) does high fire frequency lead to species decline and loss? 2) does time since last fire result in different trophic structure? and 3) is bird abundance change consistent with the predictions under climate change? Abundance changes were analyzed using a general linear model. Patterns of trophic structure were estimated using a G test. When the first two questions were examined, no evidence was found of species decline and loss, or differences in trophic structure. Conversely, the third question presented consistent results according to the predictions. Most species showing an increase in abundance at regional scale were southerly distributed. Our results suggest that climate change may have a stronger effect on birds in heathlands than inappropriate fire regimes.

315584 CLIMATE CHANGE IMPACTS ON THE ELK-ASPEN INTERACTION IN YELLOWSTONE, AND WHAT WE CAN DO ABOUT THEM

Jedediah Brodie

In order to comprehend and ameliorate the effects of climate change we must understand the impacts, not just on single species, but on ecological interactions. My field work in Yellowstone National Park (YNP) suggests that climate change has altered the interaction between elk (*Cervus elaphus*) and aspen (*Populus tremuloides*) to the point where aspen recruitment is completely curtailed. The decline of aspen, a very widespread and ecologically important tree, in the northern Rocky Mountains has long been noted but its causes remain debated. My research shows that elk herbivory is driving the recruitment failure. Yet elk movement is largely determined by snow depth, and deep snow protects aspen shoots from herbivory. Historical snow levels in YNP were substantially higher and have been declining since the end of the nineteenth century. Deeper snow in the past corresponds with peaks in aspen recruitment; recruitment has

subsequently declined throughout the twentieth century along with winter precipitation. I use population models to demonstrate how we can adapt our management policies to reduce the on-the-ground impacts of climate change. While declines in winter precipitation are beyond our control, elk abundance is not. By adjusting elk harvest levels, we can offset the total impact of elk on aspen, allowing the continued persistence of this critical species.

Forest conservation

314966 ATTRACTING EFFECTIVENESS OF ARTIFICIAL NEST-CAVITY TO DENDROCOPOS MAJOR IN POPLAR SHELTER PLANTATION AND ITS IMPLICATION FOR WOOD BORERS MANAGEMENT

Tao Wan, Junbao Wen

Artificial nests have often been established to conserve hollow-dependent birds. The main aim of this paper was to construct a highly effective artificial nest-cavity for great spotted woodpecker *Dendrocopos major* in poplar shelter plantation. From 2003 to 2006, the traditional heart-rot nest-wood (or cleft-hollowed nest-wood, *Salix matsudana*) were installed in poplar shelter plantation of Urad Qianqi, Inner Mongolia Autonomous Region, China. In 2006 summer, we designed 13 types' of artificial nest-cavities made of *S. matsudana* or *Populus popularis* using orthogonal design with 3 main factors: heartwood-rot, protuberance and roughness, which were constructed based on the characteristics of natural nest-cavities. We used occupancy by *D. major* to evaluate the effectiveness of nest-cavities. The drill-hollowed artificial nest-cavities had better attracting effectiveness than the traditional heartwood-rot nest-wood. The optimum conditions to construct poplar artificial nest-cavities were drill-hollowed, obvious natural protuberance and natural bark roughness. An appropriate increase in placing height of artificial nest-cavities and distance among artificial nest-cavities was helpful for great spotted woodpecker to occupy. In addition, the optimal orientation of artificial nest-cavities was northward. Finally, the significance of artificial nest-cavities by protecting the great spotted woodpecker in large-scale shelter plantations for forest pest management was discussed.

310119 CONSERVING LEOPARDS IN GIR LION SANCTUARY, INDIA

Usham Somarendro Singh, Jamal Ahmad Khan, Sharad Kumar, Bharat J. Pathak, B P Singh

Agro-settlement complex outside Gir Lion Sanctuary supports established population of leopards *Panthera pardus*, causing human-leopard conflict. A female leopard was rescued from a well located outside Gir PA, collared and released in Central Gir to understand its movement, survival and use of habitat. It was monitored from 2002 to 2005. After the release, it moved out in 62 hours to the agro-ecosystem. Her range covered 17 settlements and the home range was 76 km² at 95 % MCP. 46 kills were examined and the leopard was found to consume on 8 prey items, mainly dog *Canis familiaris* (47.8 %) and cattle *Bos spp.* (13 %). Habitat use differed significantly ($p < 0.001$). Sugarcane *Saccharum officinarum* farm (81 %) and bajra *Pennisetum glaucum* farm (10 %) were the major sheltering place. She partly used coastal forest during harvesting period of May and June. She gave birth twice at a span of 19 months and extensively used sugarcane farm for rearing her cubs. The average litter size was 2.5. Leopard was recaptured three times.

Twice, she was released back in the Gir forest and moved out to reach its range. Finally, she was captivated. We recommended for monitoring the released leopards and education programme. Suggestions were given for changing sugarcane cultivation and managing dog's population.

306100 HUMAN PRESSURE ON THE DISTRIBUTION AND CONSERVATION OF RED PANDA (AILURUS FULGENS) IN DHORPATAN HUNTING RESERVE, NEPAL

Ram Nath kandel

The study revealed the presence of red panda in three blocks: Surtibang, Barse and Fagune of Dhorpatan Hunting Reserve. The most favorable habitat for red panda is from 3,200 to 3,500 m elevation. Altogether 27 species of tree and 18 species of shrubs were recorded in the study area. The preferred habitat of red panda was dominated by *Abies spectabilis*, *Rhododendron campanulatum*, *Betula utilis* *Juniperus indica*, and *Arundinaria* sp which provide ample food value and habitat for red pandas. But human interferences, live stock grazing and poaching have threatened the existence of the species in the study area. Due to political conflicts and other factors, government authority was virtually absent and thus the rules and regulations of the Reserve were not implemented properly. The reserve has appeared as grazing land rather than a protected area. Therefore, it is necessary to initiate the implementation of alternative natural resources to the local people and enhance their income source for the conservation of red panda in DHR.

305770 MOVEMENTS OF NEOTROPICAL UNDERSTORY PASSERINES IN FRAGMENTED FORESTS OF THE BRAZILIAN ATLANTIC RAINFOREST

Miriam Melanie Hansbauer

The Atlantic Rainforest of Brazil is one of the world's 25 biodiversity hotspots. It holds a high biodiversity, including endemic and threatened species, but the primary forest has widely (88%) disappeared. The objective of our study was to assess how landscape features affect movements of forest birds, as this is one of the keys to understanding the ecology of animal populations in fragmented landscapes. In this context, edges of forest patches are crucial. They are characterized by abiotic factors and ecological processes distinctly different from those in the original forest. We radio-tracked Blue Manakins (*Chiroxiphia caudata*), White-shouldered Fire-eyes (*Pyriglena leucoptera*) and Rufous-breasted Leaf-tossers (*Sclerurus scansor*) in five forest fragments (3 ha - 53 ha) and in an adjacent natural reserve (10,000 ha) to document daily movements during 3-5 weeks. *C. caudata* and *S. scansor* avoided forest edges, but *P. leucoptera* showed affinities to the edge. Both sensitive species moved faster and further in the fragmented than in the contiguous forest. Our results suggest that forest fragmentation influences significantly movement behaviour of sensitive forest understory birds. By comparing our data with other studies on *P. leucoptera*, we concluded that movement behaviour of resident birds differs from that of dispersing birds and might not allow to infer functional connectivity to fragmentation; this should be taken into consideration when suggesting conservation strategies.

365285 HABITAT PREFERENCE, REGENERATION PATTERN AND REPRODUCTIVE STRATEGY OF RELICT PLANT EMMENOPTERYS HENRYI OLIV. ON MT. TIANMU, EAST CHINA

Shang kankan, Song kun, Kang minming, Da Liangjun

The Mt. Tianmu is one of the most important refugia of Tertiary relict plant taxa in East China. The community structure, habitat characters, demographic structure, spatial distribution and productive modes in relict populations of *Emmenopterys henryi*, an endangered deciduous tree endemic to China, were studied to evaluate its ecological performance and regeneration potential. The population structure is typical sporadic type and the spatial pattern is clumped distribution at local habitat. The seeds dispersed and colonized at unstable habitats of the steep slope with shallow soil, much gravel and a certain disturbance dominated their and formed the topographic climax community. It can be regarded as a non-differentiated climax pioneering species of the canopy with "R-strategy". Vegetative reproduction by root sucker compensate for the low opportunity of seedlings establishment at habitats impeding the seed germination. We discussed conservation strategies for relict deciduous trees that account for the peculiarity of their habitat and population in China's subtropical montane.

314929 LONG-TERM EFFECTS OF FRAGMENTATION AND FRAGMENT SIZE ON BIRD SPECIES RICHNESS IN HAWAIIAN FORESTS NATURALLY FRAGMENTED BY LAVA FLOWS

David Flaspohler

We examined patterns of native and exotic bird species use of and exotic rodent presence in remnant mid-elevation forest patches isolated by volcanic activity 150 years ago in Hawaii. The total number of bird species increased rapidly with forest patch size, with most of the native species pool found in patches < 3 ha. Smaller forest patches were dominated by native bird species with several exotic bird species found only in the largest forests. The species-area slope rose more rapidly for exotic bird species, suggesting that many of exotic birds in this landscape show greater area sensitivity than the native birds. Track-plate surveys for rodents suggested that exotic rats were present in all forest fragments, while mice were restricted to the surrounding lava matrix; mongoose were detected only in large contiguous forest. We used airborne scanning light detection and ranging (LiDAR) to assess how well traditional measures of forest fragment quality (e.g., fragment area) correlated with newly available estimates of vegetation volume, an important predictor of bird species richness and abundance. Forest patch area was strongly correlated with vegetation volume but showed a weak correlation with mean tree height. This work demonstrates the value of conserving small remnant mid-elevation forest patches for endemic birds in Hawaii and suggests that restored forests of this type need not be enormous to provide habitat for this unique and threatened assemblage of birds.

317768 CONSERVATION STATUS OF OKAPI IN VIRUNGA NATIONAL PARK, DEMOCRATIC REPUBLIC OF CONGO**Stuart C Nixon, Thierry Lusenge, Noelle Francesca Kumpel**

Until recently, whether okapi (*Okapia johnstoni*) still persisted in Virunga National Park, eastern Democratic Republic of Congo, following over a decade of war, was uncertain. In 2006 signs were found confirming their presence in the northern sector's Watalinga forest, but partly due to insecurity surveys since have been limited and their conservation status is unknown. We estimated distribution and relative abundance of okapi in the park and assessed threats to their survival using 216km of reconnaissance surveys, camera trapping and participatory evaluation of bushmeat, timber and charcoal trade with local communities. Okapi are more widely distributed inside the park than previously documented, with sign recorded on both sides of the Semliki river over a total area of 300km². However, they are divided into four isolated populations by the Semliki and a newly-rehabilitated road crossing the park. Okapi dung and camera trap encounter rates were both low, and we estimate that no more than 50-100 okapi are likely to be found in the survey area. Okapi populations in the Watalinga forest are suffering from high levels of hunting and habitat loss and this, coupled with their small population size, means they should be considered highly threatened. Unless immediate measures are taken to increase protection and monitor this population, we believe that at the current rate of hunting this newly rediscovered population in Virunga National Park could be extinct within a few years.

314983 COMMUNITY-WIDE PATTERNS OF SEED DISPERSAL IN A DRY TROPICAL FOREST AT MUDUMALAI, SOUTHERN INDIA**Soumya Prasad, Raman Sukumar**

Plants depend upon various vectors for dispersal unlike animals that can move in response to changing climates. Dispersal modes need to be characterized to understand plant responses to rapidly changing environments in fragmented landscapes. Most conservation planning has focussed on patterns, while processes such as seed dispersal are rarely considered. We characterized dispersal modes for a tropical dry forest community at Mudumalai, southern India which harbors high densities of several endangered large mammals. The disperser assemblage was studied using tree watches and camera traps. Fruit color, size and mass were noted. Mudumalai had more mechanically-dispersed (38%) and mammal-dispersed (37%) species compared to wet forest sites in south Asia which are predominantly bird-dispersed (~ 50%). There were strong associations between fruit traits and dispersal modes. Large-seeded fruits (> 8 mm) were only dispersed by mammals. Ruminants, bears, civets and elephants were important dispersers, while primates and rodents were largely neutral or seed predators. Large mammals (> 50 kg) dispersed 32% of Mudumalai's woody plants; 15% solely by large herbivores (ruminants and elephants). Such plant species could be disperser-limited in sites where large herbivores are rare or extinct, and have limited ability to migrate in response to changing climates. These species should be prioritized for restoration programs in this region.

Ecology restoration

315430 HOW TO SUCCEED IN THE RESTORATION OF PLANT POPULATIONS THREATENED WITH EXTINCTION ?

Nathalie Machon, Monika Zavodna, Matamoro Alexis, Olivier Gargominy

The ecological success of a restoration plan depends primarily on three factors: addressing environmental constraints, determining the minimum viable population, and taking into consideration genetic composition. The first priority is to successfully match the ecological characteristics of the restoration site to the ecological needs of the plants. An assessment of site suitability can be based on studies of other taxonomic groups (e.g. snail assemblages). If the composition of these surrogate taxonomic groups corresponds with that found at natural sites for these species, we can assume the site has good restoration potential for the target species. The second issue is to define the size of the minimum viable population in order to insure the introduction of a sufficient number of individuals to minimize stochastic demography and Allee effects. The third factor relates to determining the genetic composition of restored populations. In the case of inbreeding depression, the mixing of populations should be considered. The importance of these three factors in restoration success will be assessed in a detailed case study of *Arenaria grandiflora*, a nearly extinct plant species from the Parisian region of France, whose restoration was initiated in 1999. In addition, a broader assessment of these factors in the success of restoration plans will be presented for several other species using examples taken from the published literature.

315703 COMMUNITY-BASED CONSERVATION, ECOLOGICAL RESTORATION AND ECOTOURISM AT KUYUCUK LAKE, EASTERN TURKEY

Cagan H Sekercioglu, Sean Anderson, Mehmet A Kirpik, Emrah Coban, Onder Cirik, Sedat Inak, Yakup Sasmaz

Turkey is the only country in the world that is mostly covered by three biodiversity hotspots, but also entirely covered by "crisis ecoregions". Northeastern Turkey has low population density, traditional agro-ecosystems, and an important migratory flyway, but overgrazing, erosion, and illegal hunting are widespread. KuzeyDoga Society works with local people, students, volunteers, and scientists to conserve and promote the region's biocultural diversity by integrating community-based conservation, monitoring, ecological restoration, environmental education, and ecotourism. Kuyucuk Lake is a globally important bird area surrounded by steppe rangeland and wheat fields. We have documented over 35,000 birds of 195 species, but extensive overgrazing and unsustainable agricultural practices have led to erosion, water reduction, and the disappearance of most vegetation. Cattle enclosure experiments led to the rapid recovery of shoreline vegetation in one growing season. We work with the local villages to restore the shoreline vegetation while monitoring birds, amphibians, plants and insects. With the help of volunteers from Turkey and a dozen other countries, Kuyucuk Lake has become a major environmental research, education and ecotourism center and the local attitudes towards conservation have improved greatly. The first of its kind in Turkey, the Kuyucuk Lake community-based conservation project provides valuable lessons for other conservation projects in the developing world.

315130 OPRAH: OPTIMAL RESTORATION OF ALTERED HABITATS**Mark R. Lethbridge, Nicholas J. Souter, Michael I Westphal, Hugh P. Possingham**

'Optimal Restoration of Altered Habitats' (OPRAH) is a conservation decision support tool for restoration of fragmented habitats. OPRAH's strength is that it specifically accounts for target species habitat requirements. OPRAH combines species habitat quality information and measures of landscape configuration to optimally select habitat restoration priorities for single or multiple species. It uses a simulated annealing algorithm and information about extant native vegetation, land use and economic data, to find solutions to non-linear landscape-scale problems. The landscape is divided into planning units, some of which represent native vegetation, while others can be restored for a given cost. A case study from the Mt Lofty Ranges in South Australia demonstrates how OPRAH spatially defines the most efficient multiple-species habitat restoration network. Data for eight declining woodland bird species was used to identify the optimal reconstruction network. OPRAH found that each of the eight target species required contrasting priority restoration patches in the optimal reconstruction network. In demonstrating the diversity of species requirements, OPRAH has highlighted the need to consider as large a range of species as possible when undertaking conservation planning.

366505 POPULATION STATUS AND DISTRIBUTION OF GHARIAL (GAVIALIS GANGETICUS) IN NEPAL**Madhav Khadka, Hemanta Kafley**

Gharial, biological treasure of the Indian subcontinent now restricts its existence in few big river systems of India and Nepal only. The objective of the study was to update existing status and distribution pattern of gharial and assess threats in gharial conservation in Nepal. The study employed opportunistic search method for census based on direct observation. GIS technique was used to visualize distribution pattern of gharial population in Nepal. The study revealed minimum population estimation of 81 individuals surviving in four river systems of Nepal. Narayani and Rapti Rivers in central part of Southern Nepal harbor 34 and 24 individuals respectively. Whereas, Babai and Karnali Rivers in the mid-western Nepal supported ten and six gharials respectively. The observed sex ratio was found to be 1 male : 6 Female. Twenty seven percent of the individuals were categorized under adult breeding animals. Till date, 691 captive bred gharials have been released in different river systems of Nepal since 1970s. The alarming condition in gharial conservation as revealed by this study prompted us to release gharials and monitor intensively to better understand problems in gharial conservation. As a result, 13 gharials have been released recently attaching VHF radio transmitters on them.

365295 PHOTOSYNTHESIS, GROWTH AND FOLIAR HERBIVORY OF FOUR ARDISIA SPECIES (MYRSINACEAE): AN INTERPRETATIVE ANALYSIS OF INVASION BY *A. ELLIPTICA*

Jin Zhao, Jin Chen

Introduction: *Ardisia elliptica* is an understory shrub endemic to Southeast Asia and has become a notorious invasive plant in Florida. And the reason why some species become invasive remains intensively debated. Four *Ardisia* species from their native habitats were studied in order to understand how these species perform differently in response to different light treatments and herbivores.

Methods: We collected the seeds and planted them with four light treatments (100%, 75%, 40%, 5%). LSPT, LCPT, Pmax, Rd, RGR, carbon content and nitrogen content were determined after six months grown in the greenhouse. The consumption of herbivore, carbon content, nitrogen content and leaf toughness of the four species grown in the field were also estimated.

Results: RGR of *A. elliptica* was the highest among the four species, which could be attributed to its high Pmax and relatively low Rd. It also showed high phenotypic plasticity in response to different light treatments. In the field, herbivore preferred *A. elliptica* to the congeners because of its soft leaves (3325.11 ± 127.70 a mN).

Discussion: Overall, *A. elliptica* appear to be better suited than congeners to capturing and utilizing light resources, particularly in high-light environments such as those characterized by relatively high levels of disturbance. Furthermore, escaping from natural enemy may also have contributed its invasion.

315116 SURVIVAL AND BREEDING SUCCESS OF THE CRITICALLY ENDANGERED MALHERB'S PARAKEET (*CYANORAMPHUS MALHERBI*) ON MAUD ISLAND, NEW ZEALAND

Luis Ortiz-Catedral, Dianne Brunton, Mark E. Hauber

The captive breeding of Psittaciformes is a common conservation tool worldwide. However, most attempts to re-introduce captive-bred parrots into the wild have shown limited success due to high predation rates. In New Zealand, captive breeding for translocation to pest-free offshore islands is a key element in the recovery of the critically endangered orange-fronted parakeet. Two insular populations have been established on Chalky and Maud Islands. We closely monitored the Maud Island population for one season immediately after release to determine survival, to locate nesting sites, and to document breeding success. Parakeets were monitored via radio-telemetry for the first two months and by playback of calls along transects thereafter. Of 14 individuals originally released (eight females/six males) seven survived (four females/three males) for at least six months. Death was confirmed for one individual and the status of the remaining six individuals is unknown. Three pairs formed and nested within the first month after release. Only two nests (clutch size: 5 and 6 eggs) were confirmed, both in Mamaku ferns stump (*Cyathea medullaris*). One nest failed and the other produced three fledglings, two of which have survived for 2 months. This is the first record of the species nesting in Mamaku ferns and to our knowledge the earliest record worldwide of successful breeding following translocation for a captive-bred psittaciform.

364682 RESTORING WILD SOUTH CHINA TIGERS: IMPLICATIONS FOR LARGE CARNIVORE CONSERVATION IN ASIA

Philip Nyhus, Ron Tilson, Jeff Robert Muntifering, Tom Dahmer, Lu Jun, Qing Cao, Courtney Larson, Jeff Carroll

Tigers (*Panthera tigris*) and other large carnivores are threatened or have disappeared across their historic range in Asia. South China tigers (*P.t. amoyensis*) are extinct in the wild and captive populations are genetically impoverished. For five years we investigated whether and where South China tigers could be restored. We completed rapid evaluations of 11 locations recommended by Chinese officials. The largest potential reintroduction site, with a surface area of approximately 1,250 km², includes two adjacent National Nature Reserves, Hupingshan in Hunan Province and Houhe in Hubei Province. A preliminary tiger habitat suitability analysis suggest approximately 450 - 695 km² currently are suitable and an additional 52 - 105 km² potentially could be suitable for tigers following habitat restoration. Major constraints to tiger reintroduction include rugged topography, depleted prey base including absence of large cervids, households, and agriculture. Opportunities include the presence of core wilderness areas and strong government commitment. We conclude the constraints are daunting but a small population of tigers could be reintroduced following habitat restoration. Importantly, a reintroduced wild tiger population could serve as a symbol and catalyst for conservation of biodiversity in China, and provide a needed stimulus for tiger and felid conservation throughout Asia.

365682 RESTORATION OF A DEGRADED RAIN FOREST USING THE RED-RUFFED LEMUR (VARECIARUBRA)

Barbara Martinez, Onja Razafindratsima

In 1997 Masoala National Park, northern Madagascar, launched a habitat restoration project for a forest corridor that connects the park's two major tracts. The corridor was severely degraded by agricultural encroachment. As part of this ongoing project, staff members plant food trees commonly found in the diets of the region's two frugivorous lemurs (*Eulemur albifrons* and *Varecia rubra*). During the hot-rainy season in both 2006 and 2007, we investigated the seed-dispersal ability of the larger species, the red-ruffed lemur (*V. rubra*), using data collected on three habituated sub-groups. *V. rubra* consumed fruit species from 52 native forest trees and one non-native pioneer shrub. Germination rates were determined by collecting consumed and non-consumed seeds and planting both in a nursery at our study site. Seeds that passed through the gut of *V. rubra* had higher germination rates than seeds from non-consumed fruits. The diversity, germination success, and spatial distribution of passed seeds suggest that a combination of tree planting by Masoala staff and seed dispersal by *V. rubra* can help restore the park's degraded forest corridor. Our results are useful for the Masoala and future restoration efforts in Madagascar, as we provide evidence that frugivorous lemurs play an important role in the restoration of their own habitat.

Freshwater conservation

315426 A SPATIAL ASSESSMENT OF FRESHWATER ECOSYSTEMS AND WATER SUPPLY IN A SEMI-ARID ENVIRONMENT

Lindie Babara Smith-Adao, Jeanne Nel, David le Maitre, Ashton Maherry, Ernst Swartz

A spatial assessment was conducted in the semi-arid area of South Africa, to: (1) identify priority areas for the conservation of river and groundwater ecosystems; (2) examine surface and groundwater quality; and (3) investigate the rehabilitation of degraded areas to highlight 'win-win' situations for both environmental and human use. A systematic conservation plan was produced, highlighting river conservation areas (river types, fish species and connectivity areas), moderate-impact management areas (groundwater discharge and recharge areas) and river rehabilitation areas. The proposed river selections would achieve the biodiversity targets of 33 (66 %) of the 50 river types; feasible rehabilitation would increase this to 92 %. The greatest groundwater discharge and recharge (30 to > 50 mm⁻¹) values are concentrated around the mountainous regions of the Little Karoo. This is because the main aquifers in the mountains (Table Mountain Group) yield good quality water. Naturally poor quality groundwater is found in the Bokkeveld shales. The naturally poor quality groundwater has a limited and localised impact because these formations typically have low yields. River reaches of unacceptable surface water quality were classified as degraded water resource delivery areas where the poor water quality was primarily due to saline return flows. Only the middle reaches of the Gouritz and Groot Rivers represent a possible win-win situation for both the environment and human use.

314694 EVALUATING RECREATIONAL FISHERIES FOR AN ENDANGERED SPECIES: A CASE STUDY OF TAIMEN, HUCHO TAIMEN, IN MONGOLIA

Olaf Jensen, David Gilroy, Zeb Hogan, Brant Allen, Tom Hrabik, Brian Weidel, Sudeep Chandra, Jake Vander Zanden

Growing recreational fisheries have added to the pressures faced by many fish stocks. At the same time, recreational fisheries provide economic benefits and incentives to conserve fish populations and the ecosystems on which they depend. Understanding this tradeoff is difficult, even in developed countries. In a developing country, where the target species is endangered, the stakes are higher and management resources are fewer. Here we demonstrate how a short-term (5 year) mark-recapture experiment, life history invariants, and meta-analysis can be combined to parameterize a delay-difference population model for a population of the endangered giant Eurasian trout (taimen, *Hucho taimen*) in the Eg-Uur watershed of northern Mongolia. The model allowed us to evaluate the impacts of a recreational fishery for taimen based on a suite of population characteristics including: equilibrium abundance, biomass, and mean weight. The Bayesian framework and Monte Carlo simulations combine disparate sources of information while keeping track of uncertainty. Results suggest that the existing catch-release recreational fishery has likely reduced taimen abundance, biomass, and mean weight by less than 8% compared to unfished levels. In comparison, if all taimen caught in this fishery were retained, there is a 56% chance that such harvest levels would lead to the eventual extirpation of the population. The modeling approach is flexible and can be used to evaluate other data-limited fisheries.

315247 INFORMING CONSERVATION AND RECOVERY STRATEGIES FOR ENDANGERED LARGE RIVER FISHES; THE RAZORBACK SUCKER *Xyrauchen texanus* IN LAKE MEAD, USA**Jon C Sjoberg, Brandon Albrecht, Ron Kegerries, Paul B Holden**

The razorback sucker *Xyrauchen texanus* is a large (up to 91cm) catostomid endemic to the Colorado River system of the southwestern USA. Once common in 3800 km of the main-stem river and large tributaries, this species is now restricted to small relic populations primarily maintained by stocking of cultured fish due to altered and fragmented habitats from reservoir construction and widespread introduced predators. Lake Mead, a very large (65800 hectare) reservoir contains the only population of the species which has clearly demonstrated successful reproduction and adult recruitment in the wild despite a significant predator load of nonnative sport fishes. Studies conducted since 1996 suggest that unique conditions in Lake Mead including near-shore turbidity and submerged cover may facilitate the observed recruitment success despite the reservoir's high fluctuation zone, exceeding 10 m in most years, and recent reservoir elevation declines of 35 m from ongoing drought which require adult spawning aggregations to constantly seek new areas for reproduction. Turbidity during periods of reservoir decline and submerged cover during periods of stable or rising elevation appear to work in concert to replicate conditions for successful recruitment similar to pre-impoundment habitats. These findings provide significant new information to guide development of recovery and conservation strategies for endangered fishes in the Colorado River and other large river systems.

315728 REQUIEM FOR THE YANGTZE RIVER DOLPHIN: SHIFTING BASELINES, FLAGSHIP SPECIES AND ECOSYSTEM SERVICES IN THE YANGTZE**Samuel Turvey, Leigh Barrett, Yujiang Hao, Kaiya Zhou, Ding Wang**

The Yangtze River dolphin or baiji (*Lipotes vexillifer*), China's only endemic cetacean species, has been the focus of international conservation concern since the 1980s but is now highly likely to be extinct. A range-wide survey interviewed over 600 fishermen in the mid-lower Yangtze and its major appended lakes in 2008 to investigate the possible extinction of the baiji and to gather associated data on the status of other threatened Yangtze species. Awareness of decline and possible extinction of the Yangtze megafauna varies with informant age in riverside fishing communities; younger fishermen are not only less likely to have caught or seen baiji or the seven-metre Yangtze paddlefish (*Psephurus gladius*), but are less likely to have heard of either species, even though both animals definitely survived until only a few years ago. Analysis of last-sighting data indicates that the baiji and commercially important fish stocks experienced similar patterns of decline, suggesting that charismatic megafaunal flagship species can act as useful indicators of the status of ecosystem services in some systems. Spatial analysis of baiji last-sighting records also challenges previous assumptions about population fragmentation of this species, providing important new insights into the dynamics of large mammal range collapse immediately prior to an extinction event. However, little new evidence was found to suggest continued survival of the baiji.

315521 COFFEE, CONSERVATION AND COMMUNITY DEVELOPMENT: RESULTS AND LESSONS LEARNED FROM IMPLEMENTING ENVIRONMENTAL AND SOCIAL STANDARDS FOR COFFEE PURCHASING

Bambi Semroc, Elizabeth Ann Baer

Coffee production in the tropics, depending on the production practices used, can act as a threat to or a strategy for conserving biodiversity while allowing for the sustainable development of local communities dependent on coffee for their livelihood. A number of certification programs and procurement initiatives have emerged to promote the adoption of environmental and social best practices among coffee producers and allow for coffee produced in accordance with these practices to be distinguished within the marketplace. In 2004, Starbucks Coffee Company launched the Coffee and Farmer Equity (C.A.F.E.) Practices sourcing guidelines, a third-party verification program that monitors supplier performance in accordance with a set of standards, and this program has been used to guide coffee purchasing decisions over the past four years. Between 2004 and 2008, farms and mills in 20 countries participated in the program. To better understand the impact of the program over time, an analysis of the verification reports was conducted to identify compliance rates with key social and environmental indicators and trends in these rates over a three-year period by region, country and farm size. The results are discussed and recommendations are made for improving the analysis as well as the program based on these findings.

Biogeography

320513 COMPARATIVE ECOLOGY OF TWO DAHOMEY GAP FOREST RELICS IN BENIN (WEST-AFRICA) AND IMPLICATION FOR CONSERVATION

Méryas Dègbémabou Kouton, Emeline Sessi Pelagie Assede, Brice Sinsin

Dahomey gap phenomenon occurred last Holocene and had modified the ecology of a mesoscale forest zone in west-Africa. This work aims to access and compare some ecological factors (local climate, flora, fauna, human action) in two different forests in the zone. Braun-Blanquet methods, point and line transects and rural rapid appraisal are the main used methods. Lama reserve is a tropical humid zone. There are plantations with an undergrowth of *Chromolaena odorata* and of *Sterculia tragacanta* dense forest of *Mimusops andongensis* and old fallows. The sampling revealed 287 plant species in 216 genera, 73 families. 9 mammalian species in 6 genera and 4 families was reported. Lama forest is an example of co-management between administration and riparian populations. Soil infertility around the reserve is a threat because residents poach to increase their few incomes.

At Niaouli, there are 256 plant species distributed in 155 genera and 74 families. Swampy forest of *Pentacletra macrophylla*, dense forest of *Antiaris toxicaria* in full deterioration and robber tree forest. 4 mammalian species in 3 genera and 3 families had been countered. This reserve is strictly protected but is often under threat and reparians always claim their land. There is less than 50% of community for the vegetation, same for the animals. Thus, lama forest is unique in dahomey gap with guineo-congolian species and some secondary climax won't access that endemic level.

315626 ECO-FLORISTIC REGIONS AND DEFORESTATION THREATS IN SUMATRA: A NEW APPROACH TO IDENTIFY CONSERVATION NETWORK PRIORITIES

Yves Laumonier, Yumiko Uryu, Michael Stüwe, Arif Budiman, Setiabudi, Oki Hadian

Biogeographical studies are a necessary step in the establishment of conservation area networks. Determining the ecological factors influencing vegetation and plant distribution is also a basic principle for hierarchical ecological classifications, a necessary prerequisite for ecosystem-based land use planning and natural resource management. Thirty-eight Eco-Floristic Regions (EFR) had been identified for the Indonesian island of Sumatra combining both approaches in the mid 1980s. We have now determined the impact of deforestation on these EFRs between 1985 and 2007. Based on the percentage of forest lost up to 2007, we determined each EFR's "closeness to extinction" by defining five degrees of threat. Some "critically endangered" EFRs lost over 90% of their 1985 forest cover. Priorities for conservation and restoration management of Sumatra ecosystems can be formulated to be integrated into new Sumatra's land use plans at EFR level instead of only the crude, small-scale schemes presently applied in Indonesia.

315293 GLOBAL PATTERNS IN MARINE MAMMAL DISTRIBUTIONS: HOTSPOTS, COLDSPOTS, AND THE IMPLICATIONS FOR CONSERVATION

Sandra Pompa Mansilla, Gerardo Ceballos González

The loss of biological diversity is a severe global environmental problem. Determining global patterns of species distribution is a fundamental method to mitigate anthropogenic impacts by determining conservation priorities and management strategies especially for threatened, range-limited and commercially valuable species. Marine ecosystems have been highly impacted, and populations and species have been decimated and even became extinct. The number of endangered taxa is rapidly increasing due to climate change, fisheries overexploitation, and the whaling industry. In this work we present a global analysis of distribution patterns for marine mammals, focusing on i) assess species richness and composition, ii) describe global distribution patterns, and (iii) determine hotspots, coldspots, and irreplaceable sites for conservation. We digitized geographic range maps for all 128 marine mammals and created a GIS for geographic analysis. We identified 9 hotspots which include 74% of the 128 marine mammal species, including five endemic taxa. We also identified 11 coldspots, 16 endemic species, i.e. those restricted to a single country or small geographic range, and 11 endangered species. Our results are striking and interesting, because they indicate complex patterns of species distribution. A conservation strategy exclusively focusing in hotspots will miss several species found in coldspots.

315369 TOWARD A BIOREGIONAL STATE: GREEN CONSTITUTIONAL ENGINEERING IDEAS, POLITICALLY INSTITUTIONALIZING CONSERVATION BIOLOGY (BOOK TALK)

Mark Whitaker

Environmental sociologist Mark D. Whitaker is a comparative historical researcher on the politics of environmental degradation and sustainability. *Toward A Bioregional State* is his novel approach to development and to sustainability. He proposes that instead of sustainability being an issue of population scale, managerial economics, or technocratic planning, an overhaul of formal democratic institutions is required. This is because environmental degradation has more to do with the biased interactions of formal institutions and informal corruption. Because of corruption, we have environmental degradation. Current formal democratic institutions of states are forms of informal gatekeeping, and as such, intentionally maintain democracy as ecologically out of sync. We are unable to reach sustainability without additional ecological checks and balances to demote corrupt uses of formal institutions by removing capacities for gatekeeping against democratic feedback. Sustainability is a politics that is already here--only waiting to be formally organized. Whereas we are aware increasingly of ecological tyranny, we require adapting our institutions of democratic politics to integrate environment into formal institutional deliberations permanently for the long term. Discussed are: (1) principles; (2) charismatic institutional suggestions to aid conservation biology in being a principle of state government; (3) polls showing global super-majority support. biostate.blogspot.com.

315424 UNRESOLVED DISCREPANCIES IN BIRD RICHNESS PATTERNS IN THE AMAZON

Mariana Moncassim Vale, Maria Lucia Lorini

With the recent availability of comprehensive digital distribution maps for bird species in the Americas, researchers have been using overlays or "pile-ups" of these maps to create species richness maps, which in turn are used to determine conservation priorities. For the Amazon, this exercise reveals higher bird richness in varzea (seasonally flooded riverine forest) than in terra firme (upland forest). Bird inventories, however, consistently show the opposite pattern. This discrepancy could be explained by poor resolution of the digital distribution maps. In the Amazon, river banks often delimit species distributions. Poor map resolution might cause a false overlay at the limits of these species' distribution ranges, artificially increasing bird richness along rivers.

We examined the digital distribution maps of 515 species occurring in Manaus, central Amazon. Most species known to be limited to one side of the Amazon River had a "spill over" of a couple hundred meters to the other side. These cases, however, added to 49 species only. They cannot explain the difference in richness maps of ca. 100 species in a 1 km belt between varzea and nearby terra firme. The discrepancy, therefore, is not only due to poor resolution of the distribution maps. Further research is needed to explain why spatial patterns from digital richness maps do not match observations on the ground. As it is, strong caution is advised in using these maps for conservation prioritization in the Amazon.

315507 WHY INDIA HOLDS THE KEY TO TIGER RECOVERY**Uma Ramakrishnan, Samrat Mondol, Ullas Karanth**

With about 3000 surviving wild individuals that are now restricted to only 7% of their historical range, wild tigers are now globally threatened. Conservation efforts must now prioritize geographical regions that hold more individuals as well as possess higher degree of genetic variation and habitat diversity to ensure species recovery and retain evolutionary flexibility in the face of ongoing global changes. Although some understanding has been gained on ecological and demographic aspects of extant wild tiger populations, little is known about their genetic composition and variability. We sampled fecal DNA from 43 individual tigers in 27 reserves spread across a diversity of habitats through India to obtain 1263bp of mitochondrial DNA and 10 microsatellite loci. Our study reveals that that Indian tigers retain more than half of the genetic diversity in the species. Coalescent simulations attribute this high genetic diversity to a historically large population size of ~25,000-50,000 tigers for the Indian subcontinent. Furthermore, our analyses indicate a precipitous, possibly human-induced, population crash ~500 years ago. Our results suggest that only 2% of tiger numbers in historical times persist now in India. Yet, when viewed in the context of ecological and demographic data our results confirm that the Indian subcontinent holds the key to the global survival of wild tigers and offer some hope for their future recovery.

315214 NEW RECORD OF CHINESE BAT, HARRISON'S TUBE-NOSED BAT *MURINA HARRISONI* (CHIROPTERA) AND ITS KARYOLOGY**Yi Wu**

As a new species, only one adult female specimen of the harrison's tube-nosed bat (*Murina harrisoni*) has been reported from Cambodia by Csorba and Bates in 2005. The authors collected an adult female specimen of tube-nosed bat from a tropical rain forest in Jianfengling National Forest Park at southwest of Hainan Island at an altitude of 808m using harp trap on 17 September 2008, and confirmed it as the second specimen of the *Murina harrisoni* and a new record of this species in China. This is a medium sized tube-nosed bat, external measurements (in g, mm) are as follows: Weight 5.1; HB 51.1; TL 40.7; HF 9.2; E 15.7; FA 36. The skull has a condylo-basal length of 16.64 mm and is comparable to those of 16.73 mm for holotype given by Csorba and Bates (2005). The karyotype of *Murina harrisoni* is first reported in the world. The karyotype is $2n=44$ and $FN=50$, with three large metacentric and one small submetacentric, 17 medium to small-sized pairs of acrocentric chromosomes of gradual decrease in size; because no male was available, the Y chromosome could not be directly determined; based on the description by McBee et al. , (1986) the X chromosomes were identified as a pair of medium-sized metacentric chromosomes. The G-band and C-band karyotypes have also been studied.

320504 ENDEMICITY OF BIRDS IN CHINA BY PARSIMONY ANALYSIS

Fumin Lei

The study aims to determine areas of endemism (AOEs) in the avian subregional level and avian diversity conservation priority by using Parsimony Analysis of Endemicity (PAE) method. PAE was used to obtain avian subregion based cladograms. AOEs were identified by PAE based on a distribution database with 105 endemic species in 18 avifaunal subregions as the operating geographic units (OGUs). Four AOEs were determined. They are the Hainan Subregion, the Taiwan Subregion, the Qinghai-Zangnan Subregion and the Southwest Mountainous Subregion. The cladogram of subregions generally reflects the Palearctic and the Oriental Realms division pattern in China. AOEs were also suggested alternatively useful for inferring avian diversity conservation hotspots which are mostly congruent with the previous studies.

Alien and invasive species

315084 DRY WEATHER INDUCES HUMAN WEST NILE VIRUS OUTBREAKS

Guiming Wang, Jerrold L. Belant

West Nile virus (WNV) is an invasive species in North America. Since its introduction to New York City in 1999, WNV has spread rapidly across the continental United States (US) and has become a major public health concern throughout North America. Therefore, it is crucial to predict human WNV risks for cost-effective controls of the disease and optimal allocations of limited resources. Droughts of previous years induce mosquito outbreaks by reducing their predators or competitors. Consequently, droughts increase human WNV risks 1-2 years post-drought. The state of Mississippi had the highest human incidence rate during the 2002 WNV outbreak in the US. We analyzed data on human WNV incidences in the 81 counties of Mississippi in 2002, using standard morbidity ratio (SMR) and Bayesian hierarchical models, to estimate relationships between annual precipitation and human WNV risks. We also evaluated spatial autocorrelations of human WNV risks with conditional autocorrelative (CAR) models. The human WNV risk of 2002 was inversely correlated with annual precipitation during 2001. Annual precipitation was a predictor of spatial variation of WNV risk. Therefore, precipitation patterns and ultimately, climate change, can influence WNV risk by altering trophic interactions between mosquitoes and their predators.

365324 FIELD EVALUATION OF GONACON FOR REDUCING FECUNDITY IN GRAY SQUIRRELS IN URBAN AREAS

Murali Pai, Greg Keith Yarrow

The eastern gray squirrel (*Sciurus carolinensis* Gmelin) is known to be overabundant in its native range in the USA, and as an invasive species in Great Britain. Gnawing and stripping of tree bark by gray squirrels is a serious problem in areas of high squirrel densities. We conducted a three season study of immunocontraception on Clemson University campus (565 ha), located in northwestern South Carolina. The

objectives of this study were to identify and quantify the metrics of success which determine the efficacy of a GnRH vaccine, GonaCon™, in reducing fecundity in gray squirrels. We administered GonaCon™ by injection to 33, 23 and 11 squirrels during the three respective trapping seasons and released them. As a control, we administered by injection a sham vaccine consisted of 0.4 mL saline-AdjuVac™ intramuscularly in the thigh to 32, 20 and 8 squirrels during the same three seasons. There were no significant differences in the handling time, body weight, sex, age and breeding status of treated and control squirrels. However, there were significant differences in scrotal size of treated and control squirrels with a reduction in scrotal size being observed in treated males. This finding is one of the metrics of success for the vaccine and will be corroborated with hormone profile, antibody titers and histological evidence.

320536 INVASIVE PLANTS DISTRIBUTION PATTERN AND ASSOCIATION IN THE SOUTHERN U.S.

Songlin Fei, Ningning Kong

Invasion of exotic plants has increasingly deteriorated ecosystem health. Early detection and treatment are the keys to best defense against these invasive plants. In order to identify areas with high invasion possibilities for constant surveillance, we investigated the regional scale distribution patterns of invasive plants in forest ecosystems, and analyzed factors that influence the distribution of invasive plants in southern U.S. Exotic invasive plants data including 33 invasive species from the USDA Forest Inventory and Analysis (FIA) for the 13 southern states in U.S. were used in this study. We analyzed the association between county level percentage of infested forest plots and its related environmental and disturbance factors, which included road density, population interaction index, land cover diversity, forest connectivity, forest cover percentage, average elevation, and slope. The results show that road density, land cover diversity, forest connectivity, and elevation in the forested area, and forest cover percentage in the county have significant influences on exotic invasive plants distribution. For all of the significant variables, invasive plants have the highest occurrence in the middle ranges, which indicates that the invasion of exotic plants is most likely to occur in areas with medium level disturbances. In addition, spatial scan statistics revealed that there are three major invasive species hotspots in the southern U.S.

368274 RESOURCE OVERLAP AND POTENTIAL COMPETITION BETWEEN INVASIVE RED-EARED SLIDER TURTLES AND NATIVE RED-BELLIED TURTLES IN PENNSYLVANIA, U.S.A.

Steven Pearson, Harold Weeks Avery

Invasive species have affected populations and communities worldwide through predation and competition for limited resources. Globally, the invasive red-eared slider turtle (*Trachemys scripta elegans*) is hypothesized to compete with native turtles for limited food and spatial resources throughout their introduced range. In the Mid-Atlantic region of the United States the red-bellied turtle (*Pseudemys rubriventris*) has undergone population declines where red-eared slider turtles have been introduced. Our research quantifies the extent of overlap for spatial and nutritional resources between sympatric red-eared slider turtles and red-bellied turtles in Pennsylvania, USA. Radio tracking data suggests extensive overlap of

habitat use by both species. Stomach flushing and stable isotope data show that diets of red-eared slider turtles overlap extensively with those of red-bellied turtles in smaller, anthropogenically altered wetlands. In larger, less altered wetlands, turtle species exhibit partitioning of food resources. Our research shows that wetland characteristics may play a key role in determining the extent of competition between invasive red-eared slider turtles and declining native turtle species. These findings have fundamentally important implications to conservation and management of declining turtles world-wide.

Marine conservation

315064 FUNCTIONAL LOSS OF CARIBBEAN REEFS: IMPACTS OF CORAL DECLINE FOR REEF ARCHITECTURE

Lorenzo Alvarez-Filip, Nicholas K Dulvy, Jennifer Agnes Gill, Isabelle M Côté, Andrew R Watkinson

The architecture of corals defines the physical structure of tropical reefs. Coral cover on reefs is declining worldwide but the consequences of coral mortality for changes in reef architecture are unknown. Here we explore whether declines in coral cover in the Caribbean have been mirrored by changes in topographic complexity. We collated a region-wide database of Caribbean reefs on which coral cover and reef structure has been measured more than once (using the rugosity index) between 1978 and 2004. Using this database we quantify annual rates of change of coral cover and structural complexity across the Caribbean. The rate of loss was twice more severe for coral cover than for structural complexity. The rate of coral cover rate loss did not vary with hurricane impact or protected area status but, surprisingly, structural complexity has declined faster in sites impacted by hurricanes and inside protected areas. Direct impacts on reefs (e.g. hurricanes and bioerosion) appear to increase rates of degradation in reef complexity but not in coral cover. The loss of reef architecture is likely to have severe implications for biodiversity and environmental services, highlighting the need for regional schemes to reverse the habitat degradation.

315194 GOVERNANCE OF MARINE PROTECTED AREAS IN CHINA

Wanfei Qiu, Peter JS Jones

There are growing academic and policy debates on how best to govern protected areas. This study evaluates the governance of marine protected areas (MPAs) in China as a country that is undergoing unprecedented economic growth and also emerging from a much more centralized regime. This paper is built on three in-depth case studies of MPAs in China coupled with a programme of policy analysis. Participant observation and 69 semi-structured interviews with stakeholders were conducted during 2007-2008. Results show that MPA governance in China is characterized by incomplete decentralisation, with increasing participation and influence from local governments and private actors, but very limited involvement of local communities. This incomplete decentralisation helps to mobilize the support and resources for MPA management, however there are also potential risks to conservation as the participation from local governments and private actors tends to be driven by pure economic interests. Increasing bottom-up participation by involving the

communities also faces the obstacle of mistrust amongst the stakeholders, resulting from historical conflicts over access to natural resources. Further devolution in MPA management in China needs to be pursued carefully in order to enhance strategic conservation as well as to protect the interests of marginalized communities.

306989 RAPID AND PRECISE UNDERWATER ECOSYSTEM ASSESSMENT ALONG THE EASTERN PACIFIC MARINE BIOLOGICAL CORRIDOR

Luis Camilli

Reef deterioration along the Pacific coasts of Panamá and Costa Rica was first identified nearly thirty years ago; however decoupling natural and anthropogenic effects in this region remains elusive due to highly seasonal oceanographic circulations, overlap of continental littoral ecosystems, and inter-ocean biotic exchange via the Panama Canal. A novel underwater chemical sensing platform (TETHYS) which quantifies real time seascape chemical dynamics and an automated optical imaging SCUBA dive sled (SCUBA COP) which enables 3-D reconstruction and visualization of reef architecture were developed and deployed specifically to identify, characterize, and prioritize underwater habitat conservation along the Eastern Pacific Marine Biological Corridor. Baseline biogeochemistry was coupled with hydrographic surveys, 3-D digital reefscape mosaics, and satellite data to produce high resolution thematic GIS water chemistry and seafloor habitat maps of island and coastal areas contiguous with the Coiba Island Marine Protected Area, a recent UNESCO World Heritage Site.

366622 SEA-USE MANAGEMENT: A TOOL FOR CONSERVATION AND ECONOMIC GROWTH

Robbin Elizabeth Peach

Worldwide there's growing recognition that human uses of our life-supporting oceans need management that balances sustainable ecosystem services and multi-purpose uses of the marine environment. From China to the United States, policy makers, scientists, economists, and stakeholders are creating spatially explicit management plans for their oceans. At present, over sixteen countries have implemented some form of sea use management, many highlighting the need for "ocean zoning" as a means, among other tools, to address energy needs, economic growth, and protection of critically important marine habitats to conserve biodiversity and ensure resilient productive ecosystems and their services upon which society relies.

Stresses to ocean ecosystems manifest both ecological and socioeconomic consequences, including decreasing biodiversity and biomass, loss of coastal and marine habitat, impaired water quality, declining fishing industries, and extensive and costly damage from coastal storms. This presentation will outline administrative frameworks being implemented to address ocean management worldwide, including in our host country of China. We will then take a detailed look at pioneering Massachusetts' multi-use integrated ocean management plan, the first in the U.S. The roles of natural and socioeconomic science as decision-making tools will be emphasized.

319607 CHICKENFEED: FISHING FOR SCRAPS IN AN UNCERTAIN SEA**Aaron Savio Lobo, Andrea Manica, Andrew Balmford, Rohan Arthur**

Bottom trawling is among the most destructive fishing practices, profoundly impacting benthic habitats while generating large quantities of economically unviable bycatch (trash fish). However, with declining fish stocks and profits, fishers are finding more commercial value in 'trash fish'. A study was undertaken (July 2007 to September 2008) to understand the drivers of trash fish landings along the Coromandel coast of India. Trawlers were monitored to quantify operational costs, quantities and prices of target and trash fish. Our data indicate that trash fishing helps subsidize the trawl industry, particularly when commercial catch profits are low, fuel prices increase or the catch variability is high. Landing trash fish is an important strategy, supporting a thriving industry that processes it into poultry feed. A stepwise multiple regression identified the CPUE of commercial catch (negative), the total gross profit per hour of trawling and the total catch (positive) as being the most important variables explaining the amount of trash landed. Our study suggests that trawl fishing has become increasingly unsustainable, and trash fish acts as an extremely important economic driver and could be subsidizing an already overexploited industry.

315091 SPATIAL ZONING FOR FISHING AND MARINE CONSERVATION: A CASE STUDY FROM CALIFORNIA**Carissa Joy Klein, Charles Steinback, Matthew Watts, Astrid Scholz, Hugh P. Possingham**

Protected areas are the cornerstone of most conservation strategies as they are effective at curbing biodiversity loss. There are many different types of protected areas, ranging from areas that allow the extraction of some resources to those that are strictly no-take. One approach in determining their location is to use a numerical optimization tool to identify areas that cost-effectively achieve ecological objectives of comprehensively and adequately representing biodiversity. To date, numerical optimization tools can only identify one type of protected area in a given analysis. We present the first application of a multi-zone optimization tool, Marxan with Zones, to design protected areas in the context of California's Marine Life Protection Act Initiative. We planned for 5 zones, each restricted to different commercial fisheries and applied two types of zone-specific targets: 1) Biodiversity targets for protected areas and 2) Fishery targets in zones where fishing is allowed. We found that zoning solutions produced using zoning software affect the fishing industry less than those produced using previous software. Fishing targets of up to 91% for each fishery could be achieved while still meeting the biodiversity targets. We show the trade-offs between increasing the fishing target and achieving biodiversity targets. Tools should complement, not replace, a stakeholder-driven planning process. Our methods can be applied broadly to marine and terrestrial spatial planning problems.

Mammal Conservation

368708 THE EFFECT OF SELECTIVE LOGGING ON THE HABITAT USE AND SELECTION OF WAPITI (CERVUS ELAPHUS XANTHOPYGUS) IN THE WANDASHAN MOUNTAINS, NORTHEAST CHINA

Minghai Zhang, Changzhi Zhang, Yankuo Li

The boreal forest provides a variety of habitat for wildlife. the conversion of forest land into agricultural land and urban areas continues to reduce forest cover while logging continues to change the composition of the forests that remain. Not all logging is necessarily detrimental to wildlife. Selective logging can in some circumstances actually benefit wildlife.

In 2004 and 2005, we studied winter habitat use and selection of wapiti by the methods of "used habitat versus available habitat", in the Wandashan Mountains, China. Using GIS and RS, we measured habitat availability in terms of the area of each habitat category in the study area. The results revealed that middle and high harvested habitat were heavily used by wapiti and were selected positively, while low harvested habitat was less used and negatively selected. There had been high food abundance and availability in deforested land during 7 years after timber harvest.

Wapiti bed-site habitat heavily used mixed coniferous and broadleaf stands, brush land, broad-leaved scattered woodland. The forage habitat heavily used cleared area, broad-leaved scattered woodland brush land. Wapiti bed-site and forage habitat were mainly distributed in the distance range from 600m to 1km to open road, and there was a buffer zone around resident area with radius 2.74 km where no Wapiti activity point was observed.

315653 PHYLOGENY, TAXONOMY AND DISTRIBUTION OF CRESTED GIBBONS (GENUS NOMASCUS) AND IMPLICATIONS FOR THEIR CONSERVATION

Thinh Van Ngoc, Christian Roos

All *Nomascus* gibbons are considered Endangered or Critically Endangered, knowledge about their taxonomic classification and their exact distribution zones is a major issue for their conservation. Currently, several classification schemes based on morphology, fur colouration and genetics are available, but no consensus of crested gibbon taxonomy exists and the distribution areas of different taxa are not well defined.

This study was established to clarify the taxonomy of crested gibbons and to elucidate their exact distribution zones. An approach was used in which acoustic, morphological and genetic data were combined. Call parameters from acoustic signals were extracted and analysed in combination with already published data. Genetic material was collected during field surveys and expanded with further material from museums and zoos. In order to detect hybridization or introgression, genetic studies include maternal, paternal and biparental marker systems.

Based on these results, we 1) clarify the taxonomy of crested gibbon taxa, 2) depict their exact distribution zones, 3) reconstruct phylogenetic relationships among them, 4) reconstruct biogeographic patterns leading to their current distribution, and 5) detect possible hybridization zones. This research provides critically needed information for crested gibbon conservation management.

315356 STATUS AND CONSERVATION OF SMALL CARNIVORES (MUSTELIDAE, VIVERRIDAE, PRIONODONTIDAE, HERPESTIDAE, FELIDAE) IN MONTANE TROPICAL FOREST OF NORTHERN LAOS

Arlyne Johnson, Chanthavy Vongkhamheng

Laos harbors globally significant populations of small carnivores, including mustelids and viverrids of conservation concern and small felids that are relatively rare or unknown from other parts of Asia. Although hunting and trade are cited as major threats to small carnivores in Laos, few have received conservation attention as managers still lack basic information on the status and distribution of even the most common species. To address this problem, we established the country's first systematic camera trap monitoring program for carnivores in the Nam Et-Phou Louey National Protected Area (NPA) on the Lao-Vietnam border. We conducted intensive sampling across 500 km² from 543-2288 meters for 8,499 CTD from 2003-2006. We detected 14 small carnivore species including six that are globally threatened as well as Owston's civet; the latter being the first field record for the country. Preliminary patch occupancy estimates for the seven most common species ranged from 11% (SE 0.10; $p=0.205$ (SE 0.06)) for marbled cat to 42% (SE 0.14; $p=0.050$ (SE 0.01)) for Asian golden cat with felid pairs depicting evidence of reproduction. Small carnivores were recorded at 48% of sites and across the entire altitudinal range. Results were used to establish a 3000 km² no-hunting core zone and to devise regulations that protect threatened species and manage the hunting of common species for subsistence consumption by rural communities bordering the NPA.

320490 QUIET LOSS: COULD PHYSIOLOGICAL STRESS BE CONTRIBUTING TO GRADUAL DECLINE OF 'NON-THREATENED' VERTEBRATE SPECIES IN FRAGMENTED HABITATS?

Christopher Perry Johnstone, Alan Lill, Richard Reina

Although some species rapidly drop to extinction following anthropogenic fragmentation of their habitat, others may persist for years or decades before succumbing to gradual decline and expiration. Mechanisms of gradual decline may pose a long-term 'cryptic' threat to species that are currently considered secure. One possible factor contributing to gradual decline of vertebrates in fragmented habitats is chronic physiological stress. This disease state can be brought on by an increase in the stressfulness of an environment and is associated with reduced reproductive output, decreased growth rates and immunosuppression. This study examines free-living populations of a common south-east Australian small mammal, the agile antechinus (*Antechinus agilis*). We investigated whether populations living in forest patches show higher measurable indicators of physiological stress (e.g. white blood cell counts, neutrophil-lymphocyte ratios) when compared to populations in relatively similar continuous habitat (60 study sites over 2007/08, $n=573$). We found that indicators of physiological stress were significantly elevated in fragment populations. However, the situation is not a simple one. Interactions appear to occur between stress, habitat fragmentation, time of year and sex in this species. Our approach may make it possible to identify stressors acting on a species before population declines becomes apparent. A more preventative approach to conservation management could result.

317837 ALTITUDINAL RANGING OF WESTERN BLACK CRESTED GIBBON IN WULIANG, YUNNAN: RESPONDANCE TO HUMAN DISTUBANCE IN LOWER ZONE AND FOOD SCARCITY IN HIGHER ZONE

Peng-Fei Fan, Xuelong Jiang

Western black crested gibbon (*Nomascus concolor*) is one of the critical endangered primates. The global population was estimated to 1,300 individuals and fragmentally distributed in northern Vietnam, western Laos, and Yunnan, China. The largest population in the wild (*N. c. jingdongensis*) was endemic to the Mt. Wuliang, comprising 98 groups. The area was near the northern distribution limit of Hylobatidae with seasonality of temperature and rainfall. We studied the altitudinal ranging of one habituated group at Dazhaizi, Mt. Wuliang between March 2005 and April 2006 and recorded the individual's behavior, group's location, important food patches, and the maximum altitude of human activities every day. The study group ranged from 1,900 m to 2,680 m. Bonferroni corrected comparison test showed gibbons preferred the forest between 2,100 m and 2,400 m and avoided to be over 2,500 m. The altitudinal ranging pattern was significant correlated with the distribution of important food patches and was affected by anthropogenic disturbance. The human activities including grazing were limited below 2,100 m because of inaccessible terrain, but often approached to 2,400 m in June and July for fungi collection. Some seasonal important fruit species mostly distributed below 2,100 m and gibbons would visit them while fruiting, usually for feeding, and then retreated between 2,100 m and 2,200 m for resting after feeding, which resulted in the highest resting proportion in this elevation range.

365184 DISTRIBUTION, ABUNDANCE AND CONSERVATION OF THD INDO-PACIFIC HUMPBACK DOLPHIN IN CHINA

Guang Yang, Bingyao Chen, Dongmei Zheng, Xinrong Xu, Kaiya Zhou

The Indo-Pacific humpback dolphin *Sousa chinensis* was recorded from Dalian, the north of the Yellow Sea, to the Beibuwan Gulf in the South China Sea. Five resident populations were confirmed. However, the species' current status has not been clarified. We conducted boat surveys, questionnaire surveys, and established stranding & incidental catch network in Chinese waters. In addition, published literatures, other dedicated cetacean surveys and some unpublished records are also reviewed in the part of 'Result'. 10427 km of transect line was carried out in total, the Indo-Pacific humpback dolphins were sighted for 162 times. Over 17 000 photographs and above 700 minutes video of Indo-Pacific humpback dolphin were taken. 723 interview questionnaires were gathered. Our boat surveys generated estimates of 74 (58-90) and 201-448 dolphins respectively in Xiamen and the Beibuwan Gulf. Questionnaire surveys suggested that the dolphins occur year-round in Ningde waters and Shantou waters. The wild populations are suffering from heavy human disturbance and habitat deterioration, including underwater blasting, vessel collision, fishing, mariculture, and water pollution, etc. Some protected areas were established to cover an area of 1,660 km², however, there was virtually no effective protection provided to the dolphins.

366660 LARGE AND FINE SCALE GENETIC CHARACTERIZATION OF JAGUARS (PANTHERA ONCA) THROUGHOUT THEIR RANGE

Cristina Pomilla, Bart J. Harmsen, Rebecca J. Foster, Allison Devlin, Cecilia Bartholomew, Carly H Vynne, Samia Carrillo-Percastegui, Leonardo Maffei, José Moreira, Benoit de Thoisy, George Amato

Since the beginning of the 1900 jaguar range has halved following deforestation. Habitat fragmentation is expected to reduce genetic diversity and increase genetic structure due to isolation and drift, yet genetic information on jaguar populations is still scarce, especially at the regional and local level. A total of 1173 scat samples were collected from Mexico, Guatemala, Belize, French Guiana, Bolivia, Brazil, and Perú. Species identification was carried with a success rate of 89% and 524 jaguar scats were identified. Microsatellite markers and 590bp of the mitochondrial DNA control region were used to identify duplicate samples and to analyze genetic diversity and population structure. Many comparisons across the range resulted in significant but moderate differentiation. In particular, the previously suggested North-South partition, likely induced by the Amazon River, was supported. The spatial distribution of variation at the regional level was consistent with an isolation-by-distance model. At the local level, genetic diversity for each population was comparable to previously published data with the exception of the Belize population, which was characterized by reduced variability. An improved understanding of dispersal patterns and local population characteristics will be critical in order to support more effective conservation management.

Urban Area Conservation

368049 COMPARISON OF ORGANIZATION STRUCTURE OF INSECT DIVERSITY ALONG AN URBANIZATION GRADIENT

Zhimin Su, Dingcheng Huang, Runzhi Zhang

Urbanization is a major driver of native biodiversity loss. Many previous studies showed that rural/suburban areas always harbor more species than urban areas. However, species richness is not the equal of biodiversity that it cannot reflect the relationships among different levels of organization of biodiversity. Ignoring these relationships, the understanding of intrinsic succession mechanism for species in a changing environment remains incomplete, and this may impede biodiversity conservation. In 2008, we conducted a survey for insect diversity on tree trunks using band-shelter traps in fifteen sites of urban parks and greenbelts of Beijing. The results showed that the number of family and species increased along an urban-rural gradient, whereas that of order maintained stable. This implied that negative relation between species richness and urbanization degree could not be reflected at order-level but family- and species-level. Therefore, more closely related and functionally similar species groups, such as more families and species belonged to the same order, are possessed by lower urbanized areas. Diversity and evenness of higher taxonomic category might be evolved under higher urbanization pressure in the urbanized areas. It is suggested that optimizing the phylogenetic relationship of species might be available for biodiversity conservation. (Supported by the CAS Program for Sci. & Tech. Innovation of Graduate Student, and the CAS Program KSCX2-YW-N-42.)

315090 DEMISE OF FAUNA IN URBAN VEGETATION REMNANTS: PERTH, A CASE STUDY IN A GLOBAL BIODIVERSITY HOTSPOT

Ric A How

Great changes have occurred in the vertebrate fauna of Perth in the 180 years since European occupation. Perth is central to the south-western Australian global biodiversity hotspot. Native vegetation now occurs in isolated remnants and occupies only 22% of its original extent. Loss and fragmentation of habitat has irrevocably altered the environment for all fauna. A five-year survey on 34 vegetation remnants in urban and peri-urban environments indicated that few native mammal species survive and over 73% are now locally extinct. Birds have been less affected by urbanization with reptiles and frogs the least impacted. Small vegetation remnants remain important for conservation of reptile assemblages although a strong correlation exists between remnant size and species number for all reptile groups, except skinks. The broad range of trophic patterns represented in faunal assemblages in larger remnants indicate that many elements of the original food chain can persist in the longer term, however, adjacent offshore islands provide evidence for the likely long-term outcomes of isolation on the composition of faunal assemblages.

314921 CHALLENGES AND GUIDELINES TO BRIDGE THE GAP OF HABITAT RESEARCH AND REAL-WORLD INTEGRATION OF HABITATS IN URBAN LANDSCAPE BY PLANNING/DESIGN

Zhifang Wang

Despite the increasing interest in biodiversity, landscape planners/designers could frequently puzzle about how to integrate habitats in urban landscape due to lack of easily-accessible or easily-understandable information about "habitat". This presentation draws from professional planning/design experiences, reviews efforts to integrate habitats by landscape planners/designers and highlights many challenges in need of research synthesis from conservation scientists. Those challenges include: 1) what is the best representation of local habitat condition? Vegetation/landscape types or required living environment for certain species? 2) If landscape types can represent local habitat condition, which landscape types should be selected as the design focus in urban landscape highly modified by human activities? Following surrounding local ecosystems (where) or following historical data (when)? 3) If required living habitat of specific species should be the concern, which types of species should be the target? Endangered species? Umbrella species? Keystone species? Focal species? Invasive species? And what is the geographic distribution of the target species? Following the discussion of challenges encountered by planners/designers, some general guidelines are suggested for conservation scientists to synthesize their research efforts in order to address the concerns from the application realm and to produce integrated/ standardized data translucent to other professions.

315440 IMPORTANCE OF TADPOLES TO STREAM COMMUNITIES IN TROPICAL ASIA**Nancy E Karraker, David Dudgeon**

In some ecosystems, amphibians play important ecological roles and comprise a significant proportion of the community biomass. In light of recent amphibian population declines it has become imperative to determine how population losses may impact ecosystems. Our objectives were to delineate the importance of larval amphibians relative to other aquatic organisms in Hong Kong's streams. We conducted bi-monthly surveys of streams, quantifying density and biomass of larval amphibians (*Paa exilispinosa*, *Xenophrys brachykolos*), fishes, insects, and crustaceans. Mean biomass of tadpoles was 5 times higher than that of Decapoda shrimp and crabs, the second and third most important taxa. Densities of tadpoles in pools ranged from 0-76 m⁻² and averaged 17 m⁻² during the study period, but this was eclipsed by mean densities of Trichoptera (188 m⁻²) and Decapoda shrimp (64 m⁻²). Despite harboring the highest human densities in the world and the attendant chronic pollution, hillslope streams in Hong Kong are relatively well-protected and contain some of the highest densities of tadpoles ever reported. Declines of these two amphibian species in this region would result in the loss of the most important herbivores in these streams and a significant source of prey for other stream-dwelling organisms.

314954 STUDY AND APPLICATION ON DISTRIBUTION OF MERCURY AND ARSENIC IN TREE SPARROW IN WINTER IN MUDANJIANG**Yu Zhang**

In 2006, 2007 and 2008, using the microwave digestion and the atomic fluorescence spectrometry measured the contents of mercury (Hg) and arsenic (As) in heart, liver, pectoral muscle and primary feather of tree sparrows (*Passer montanus*) in winter in Mudanjiang. Sparrows were caught from the three types of sampling places (the industrial area, the green area and the control area) for studying the differences. The results showed as the following: The two elements varied in accumulation in these tissues, but the As total concentrates of tree sparrows was more highly than the Hg's, the Hg and As contents of in liver and primary feather were obviously higher than in other tissues'; besides, sparrows living in the industrial area had higher concentrations; and the Hg content in liver was significantly correlated with that in muscle and feather ($P < 0.01$), the As content in liver with that in heart and muscle ($P < 0.05$), consequently, making liver as indicator of environment pollution, the situation in 2007 was better than that in 2006, but 2008 became worse again.

365121 TRACKING BIRDS MIGRATING AT NIGHT THROUGH AN URBAN-RURAL CORRIDOR AND QUANTIFYING THE EFFECTS OF LIGHT AND NOISE POLLUTION**J Alan Clark, Rachel Bricklin**

Many migratory bird species are in serious decline. Understanding how birds assess and use increasingly large, brightly lit, and noisy cities as they travel through urban landscapes and encounter tall buildings, towers, and

aircraft is essential to their conservation. However, little is known about how birds evaluate the obstacles presented by cities during migration, which generally occurs at night and is confounded by ubiquitous, yet highly variable, light and noise pollution. We test a novel approach to tracking birds migrating through an urban-rural corridor and quantify the effects of light and noise pollution on such migration. We recorded and identified nocturnal flight calls at multiple sites along an urban-rural gradient from New York City north. To provide a measure of migrating bird density as well as flight path directionality, we used radar to track birds and simultaneously collected data on measures of light and noise. Some studies suggest that birds are drawn to brightly lit areas and that bird density is artificially increased in cities. We found that night migrating birds call less in bright and noisy environments. Reduced calling rates may add to increased confusion of birds in urban environments and result in flock disintegration or increased collisions with artificial structures.

Recovery of endangered species

365411 CONSERVATION BIOLOGY OF TANICHTHYS ALBONUBES

Zusheng Yi

As one of the most representative fish in Lingnan area, China, White Cloud Mountain minnow(*Tanichthys albonubes*)has been listed in the II class state protected animals in China, and its status is extinct in nature in the China red data book of endangered animals. In 2003, the natural population of *T. albonubes* were rediscovered in CongHua city. Investigations indicated that the distributions of its natural population were CongHua city, ZengCheng city, QingYuan city, GaoMing city ,HeShan city, and LuHe city. On respect of the body color of *T. albonubes*. The wild fish displayed two color types. The fish color of LuHe city was different from other distributions, with the red basal margin of basal fin and black spots on its body. The characteristics of habitat are as follows: 1. It mainly lived in stream and marsh. 2. There are much aquatic plant in its habitat. 3. Other fish are seldom in its habitat. No other fish appear in marsh, only several fish appear in stream, such as *Puntius semifasciolatus*. Reproductive behaviors of *T. albonubes* were observed, including range behavior, stretching fins, confronting, collision, attacking, courtship and mating. CongHua Natural Reserve of *T. albonubes* was set up in 2008.

314999 CONSERVATION OF ENDANGERED ENGLISH YEW (*TAXUS BACCATA* L.) POPULATIONS IN THE EASTERN ALPS

Amalsh Dhar, Harald Vacik, Bernhard Aigner, Gerald Oitzinger, Herwig Ruprecht, Raphael Klumpp

English yew (*Taxus baccata* L.) is one of the ancient European tree species. Due to the intensive human land-use and the effects of forest management this species is declining sharply from most of its ranges and recognised as an endangered species. The aim of present study was to develop conservation measures by studying the different ecological and genetics parameters in the eastern Alps. The most significant result was shortcomings of certain regenerative height classes although all forests showed abundant number of one-year seedlings. Considering the tree health condition of the adult yews, results indicate that the vitality is

influenced by the inter-specific competition of the neighbouring tree species. Besides these eastern Alps English yew populations showed a high level of genetic variation. From the investigation it was found that the major risk factors related to yew decline were competition, light availability, browsing by animal, illegal cutting, soil water relationship and lack of public awareness. For protection and conservation of English yew in forest level may require continuous selective thinning for reduction of competition, protection from the herbivore, increase the public awareness and a multi dimensional and institutional approach is needed for implementation of conservation activities.

314968 ESTIMATING TIGER ABUNDANCE IN THAILAND'S WESTERN FOREST COMPLEX AS GLOBALLY IMPORTANT LANDSCAPE FOR RECOVERY OF INDOCHINESE TIGER POPULATIONS

Somphot Duangchantrasiri, Saksit Simcharoen, Anak Pattanavibool, Mayuree Umponjan, Ullas Karanth

A study on abundance of Indochinese tigers (*Panthera tigris corbetti*) in Thung Yai Naresuan East (TYE), Thung Yai Naresuan West (TYW) and Huai Kha Khaeng wildlife sanctuaries, a core area of Western Forest Complex (WEFCOM), was carried out during October 2007 to July 2008. The objective of this study was to estimate abundance and density of tigers by using photographic data from camera traps using a capture-recapture framework. A total of 257 camera trap points were distributed across the 3 contiguous reserves which together form a World Heritage Site. In 4,079 trap nights a total of 235 photos were obtained of 47 individuals. Capture data in each protected area was analyzed separately. The results indicate each population was closed during the study period (TYE, $p = 0.54$; TYW, $p = 0.83$; HKK, $p = 0.68$). When using M_{h2} model tiger abundance was 7 (SE = 1.41) in an effective area of 1,036 km² for TYE, 9 (SE = 2.01) in an effective area of 583 km² for TYW, and 40 (SE = 4.57) in an effective area of 1745 km² for HKK. This study shows that WEFCOM is a globally important source for recovery of Indochinese tigers. In addition to intensive long term tiger monitoring in WEFCOM's core area, Thai government with support from international tiger communities is initiating a "Smart Patrolling Monitoring System" as a major intervention to increase tiger population and occupancy in this 19,000 km² protected landscape

315376 ASSESSING AMPHIBIAN MARKING TECHNIQUES IN RECENT TOAD METAMORPHS: RELIABILITY, EFFECTS ON SURVIVORSHIP AND PHYSIOLOGY, AND CONSERVATION IMPLICATIONS

Jon Davis, Stephanie Cassel, Andy Kouba

Global amphibian declines are a rapidly escalating and widespread problem resulting in significant population reductions, and even extinctions of some amphibians. Monitoring of wild populations and reintroduction of captive-bred individuals has key conservation implications for imperiled species. We empirically examined the reliability of four marking techniques: Toe Clips (TC), Visual Implant Elastomers (VIE), Passive Integrated Transponders (PIT), and Alpha-Numeric Fluorescent Tags (Alpha Num), in identifying individual metamorphic Fowler's toads (*Anaxyrus fowleri*) (<60 days post-metamorphosis, mean mass \pm 1SD = 1.50 \pm 0.61 g). We also

determined whether marking techniques affect survival, growth rate, or physiological performance compared to unmarked controls. We measured terrestrial and aquatic locomotion as well as water balance to evaluate physiological performance because these variables can influence survival. After 150 days, VIE (77%) and Alpha-Num (46%) accurately identified a lower percentage of individuals than TC (100%) or PIT (100%). Moreover, none of the marks affected survival or water balance and only PIT negatively affected growth rate (<20% mass gain versus 50-110% for controls and others). The evaluation of marking techniques is not novel, yet studies of their effects on survival and physiological performance are rare. The results of this study will inform decisions regarding the most reliable and least-invasive marking technique for small amphibians.

366499 COMPLEX EX SITU - IN SITU APPROACH FOR CONSERVATION OF ENDANGERED PLANT SPECIES AND ITS APPLICATION TO IRIS ATROFUSCA OF THE NORTHERN NEGEV

Sergei Volis, Michael Blecher, Yuval Sapir

We introduce a novel approach for conservation of endangered plant species in which ex situ collections maintained in natural or semi-natural environment are a part of a complementary ex situ - in situ conservation strategy. We provide detailed guidelines for 1) representative sampling of the populations; 2) collection maintenance; and 3) utilization for in situ actions. Our approach is the first that explicitly takes into account ecologically significant (i.e. adaptive) variation of plants in both ex situ and in situ conservation actions. We propose that an important part of conservation strategy is preserving both neutral and adaptive genetic diversity through quasi in situ conservation approach. Finally, we demonstrate this approach using a critically endangered plant species, *Iris atrofusca* from the Northern Negev, Israel.

315344 MANAGEMENT PRIORITIES FOR 700 OF NEW ZEALAND'S MOST THREATENED SPECIES: COST-EFFECTIVENESS ANALYSIS AND STOCHASTIC LEAGUE TABLES

Liana Nicole Joseph, Richard Maloney, Hugh P. Possingham

Conservation funds are grossly inadequate to address the plight of threatened species. Government and conservation organizations faced with the task of conserving threatened species desperately need simple strategies for allocating limited resources. Cost-effectiveness analysis is a useful tool for allocating resources among threatened species management programmes. By simultaneously considering cost of management, the technical capacity to manage, and potential for species' recovery, conservation outcomes of threatened species programmes may be maximised. As estimates of management costs and potential for success are not exact, a framework is needed to guide management decisions while considering parameter uncertainty. We present the results of ranking management actions for 700 of New Zealand's threatened species. We demonstrate that efficiency in spending is substantially improved and, hence, the number of species managed and the expected overall benefit to threatened species is increased remarkably. We illustrate a method for making decisions under uncertainty: Stochastic League Tables, and demonstrate that in many cases the strategy (i.e. which projects to fund) does not change despite severe parameter uncertainty. No work of this scale has been undertaken in any country using optimal resource allocation theory, yet all countries face similar issues in determining how to make best use of limited resources given severe data limitations.

315188 FATAL ATTRACTION: RARE SPECIES IN THE SPOTLIGHT

Franck Courchamp

The exploitation of rare and endangered species can end in the species' extinction because the increased value people associate with rarity increases the economic incentive to exploit the last individuals, creating a positive feedback loop. This recently proposed concept, called the Anthropogenic Allee effect, relies on the assumption that people do value rarity but, this remains to be established. We estimated how much the general public valued rare species compared to common ones using five different metrics related to personal investment: time spent, physical effort, unpleasantness, economic investment and risk. We surveyed visitors of a zoo in Paris. To see rare species, visitors of the zoo invested more time in searching and contemplation; they were ready to expend more physical effort, they tolerated more unpleasant conditions, they were willing to pay more; and finally, they risked more to obtain (steal) a rare species. Our results provide substantial evidence of how the general public places more value in rare species, compared to common species. This confirms the Anthropogenic Allee effect as an actual process, which in addition, concerns a large part of the population. This has important consequences for the conservation of species that are rare now, or that could become so in the future.

315547 TROUBLE IN THE LAND OF THE JAGUAR: CONFLICTS AND INITIATIVES TO PROTECT JAGUARS IN MEXICO

Rodrigo Medellín

Jaguars have a broad distribution in the Americas and are present in many transcultural representations from the prehispanic and present times. However, they have disappeared from a dangerously large portion of its original range, and particularly in Mexico jaguars face very severe threats, from fragmentation to competition for prey animals to direct extermination when human interests are affected. The conflict generally starts with humans moving into the core of a jaguar population range, removing forest cover, depleting prey species such as deer and peccary, and replacing them with otherwise suitable prey species such as cattle. Once displaced, its home destroyed, its food replaced, jaguars can only try to survive by feeding on cattle. Then they are considered vermin and destroyed. Mexico has launched a jaguar conservation program that includes several elements to protect the species and prevent further damage to its populations. Strategies include translocation of jaguars, improvement on cattle management, alliances with land owners to protect jaguars, and incentives for ecosystem services provided. Priorities are placed on viable populations and on bridge populations. Although incipient, these strategies are beginning to improve the jaguar's probabilities for its future conservation.

Wetland conservation

315397 COMPENSATORY MITIGATION FOR WETLAND LOSSES: PRACTICAL LESSONS

Ron Abrams

Compensatory mitigation for wetland impacts increased after 1991. Dru Associates, Inc. has designed and constructed wetlands or watercourses for 20 years. The science behind and methods used are described, with keys to success highlighted. A successful wetland compensation project requires (1) clear delineation of the habitat lost (for which compensation is required), (2) detailed field study of the compensation site's hydrology, (3) detailed ecological assessment of the wetland functions to be restored/created, (4) design specifications that are flexible, (5) arrangements with a reliable plant material supplier, (6) direct involvement of design experts during implementation, and (7) sponsor commitment to cultivation/maintenance for up to 5 years. Examples of such work in Africa (Kenya and South Africa) will be referenced. While much progress has occurred around the globe in wetland construction, the scientific approach taken herein is unique so that this paper offers lessons learned in the United States that could be employed elsewhere.

315182 ESTIMATING THE POPULATION SIZE AND DEMOGRAPHIC PARAMETERS OF GREATER WHITE-FRONTED GEESE WINTERING IN JAPAN

Sachiko Moriguchi, Tatsuya Amano, Katsumi Ushiyama, Go Fujita, Hiroyoshi Higuchi

It is often difficult to estimate demographic parameters, such as survival rates and breeding success, accurately with limited amount of data. Moreover, population count data are usually accompanied by large observation errors. Bayesian models can combine population count data and mark-resight information to estimate population size and demographic parameters, taking into account observation errors. This study estimated demographic parameters and population size of Greater White-fronted Geese wintering in Japan using a Bayesian model. The number of wintering geese declined to 3000 in the early 1970s, but has since increased rapidly. This is a major concern, since higher arrival densities of the geese have caused serious agricultural damages in wintering and stopover sites. The management of foraging sites and spatial decentralization of habitats are important issues to be studied. However, understanding the population dynamics would be important if the population management is needed for a long-term vision. We used the nation-wide annual count data of waterfowls from 1970 to 2008 and observation records of collar-marked geese. The number of juveniles per pair in autumn was used as an index of reproductive success. The population growth rate, reproductive success and adult survival rates were not particularly high, but juvenile survival rates were comparatively higher than in other studies. It is suggested that survival rates are critical for the management of this species.

305762 RESTORATION AND MANAGEMENT STRATEGIES OF WETLANDS OF WORLD FAMOUS KAZIRANGA NATIONAL PARK, ASSAM (INDIA)

Arup Kumar Hazarika, Amalesh Dutta,

Kaziranga National Park Assam (India), which has been declared as a world heritage site by UNESCO, 1985 has unique wetland ecosystem which serves important ecological roles. These wetlands act as natural buffer and serves to protect the quality of water. They also play an important role in the life of many species. However, these wetlands are confronted with myriad of problems such as shrinkage in size, depth due to continuous sedimentation and invasion of *Eichornia*, *Mikania*, *Mimosa* etc. Apart from these Pollution and contamination from effluents from the oil industry posing a great threat.

We tried to devise suitable restoration plan by characterization of the types of wetlands and the source of pollutants entering into these eco-systems. Physico-chemical and biological parameters were also investigated which helped assessing the status of these wetlands, which in turn was required for evolving appropriate restoration methods towards conservation and management. Efforts were made to address the fundamental forces that lead to the degradation and loss of these wetlands. This research tried to involve the public regarding economic and ecological valuation of the unmeasured wealth of these wetlands. Thus, this research will become an essential instrument for countering the forces deteriorating these wetlands.

329643 STATUS, DISTRIBUTION AND CONSERVATION OF FRESHWATER TURTLES OF SINDH PROVINCE, PAKISTAN

Muhammad Zaheer Khan, Zaheer Muhammad Khan

We present current status and distribution of all species of freshwater turtles in the province of Sindh, including information on taxonomy, natural history, threats, and conservation status. Eight species i.e. *Lissemys punctata*, *Kachuga smithi*, *Kachuga tecta*, *Chitra indica*, *Aspiderates gangeticus*, *Aspiderates hurum*, *Hardella thurjii*, and *Geoclemys hamiltonii* were recorded. According to results of three years study, in the Thatta district, 6 species, in the Badin district, 4 species, and in the Sanghar District, 6 species were recorded including *G. hamiltonii* recorded as rare. In the Right bank area of Sukkur Barrage, 6 species were recorded including *H. thurjii* as less common, while *G. hamiltonii* recorded as rare. Along the Left bank of Sukkur barrage, 6 species were recorded including *G. hamiltonii* recorded as rare.

On the basis of three years study, it is concluded that *Geoclemys hamiltonii* (Spotted Pond Turtle) was recorded as rare in Badin, Sanghar and Sukkur districts. Due to habitat destruction, pollution, agricultural activities including use of pesticides and chemical fertilizers, over grazing of aquatic vegetation, deficiency of water, and fisheries interactions (intentional killing for treading) are the main threats to the survival of eight freshwater turtles species. Incidental catch of freshwater turtles in fisheries is considered by many as to be the single threat to freshwater turtles today in Pakistan.

329637 THE ECOLOGICAL SENSITIVITY EVALUATION IN YELLOW RIVER DELTA NATIONAL NATURAL RESERVE

Song Xiaolong, Li Xiaowen, Bai Junhong, Li Cong, Zheng Yu

As a typical coastal wetland of large number of rare water-birds and many other species, Yellow River Delta has important biological conservation value. Ecological sensitivity analysis, an effective way to evaluate regional eco-environmental conditions, became study focus at home and abroad. Based on the grid analysis of GIS, with the combination of habitat suitability assessment and human interference analysis, the ecological sensitivity evaluation model was established. Firstly, by established the endangered water-birds database according to IUCN 2007 Red List, a Comprehensive Habitat Suitability Index was developed and calculated by habitat suitability assessment model on GIS-based 200m×200m gridding system. Secondly, the typical species Cranes was selected from the established database as indicator species and the habitat loss rate of indicator species associated with anthropogenic interference was also analyzed on 200m×200m grids by GIS. Finally, on the basis of habitat suitability evaluation and human interference analysis, ecological sensitivity analysis was conducted. The results showed that: the ecological sensitivity of study area was quite high on the whole; the overall distribution was high in the coastal region low in the inland region, ranking in five classes of extreme sensitivity, fair sensitivity, moderate sensitivity, sensitivity and no sensitivity. Although the result was not the precise description of study area, it reflected local conditions as a whole.

366342 HOODED CRANE BREEDING POPULATION AND THEIR CONSERVATION IN CHINA

Guo Yumin, Jiao Shengwu, Wang Fupeng, Gu Yanchang, Liu Baocai

Hooded Crane (*Grus monacha*) is an international endangered species of a total number of around 9,100. Nowadays, they are known to have bred in the Far East of Russia and the Small Xing'an Mountain in the Northeast of China. From the year 2002 to 2008, we discovered two breeding populations of Hooded Crane in Dazhanhe and Xinqing of the Small Xing'an Mountain, with 16 nests found in all. Synchronized field researches have revealed that there are 104 individuals of hooded crane inhabiting in the forest swamp of 400,000 ha area, making up over 1% of global population. There are locally two nature reserves and one national wetland park established with a total area of 290,000 ha. Every year fire balloons, helicopter and other vehicles are used to carry scientific researches and educational activities. Hooded cranes and their breeding habitats have been protected effectively.

315019 BIODIVERSITY CONSERVATION PROJECT OF THE MARIN PARK OF MANGROVES IN THE DEMOCRATIC REPUBLIC OF CONGO

Patrick Kongo Kipalu

The Congolese Observatory for Environmental Protection (OCPE) carried out a feasibility study in 2001 on agroforestry techniques aimed to collect scientific, socio-economical and political informations to protect mangrove forests in the Marin Park of Mangroves in the Democratic Republic of Congo. Prior to this study,

there had been no systematic inventory of fauna and flora in the park. Likewise, there was little known about the cultural diversity of the local communities and poverty remained the greatest threat to biodiversity conservation in the park. By engaging local communities, the OCPE launched a biodiversity conservation project to inventory the Park's biodiversity, and to gain a better understanding of local community needs and the socio-economic aspirations of the area. Based on research, education, micro-credit schemes and other socio-economical activities launched through the Biodiversity Project, resources management has improved in the Park - including mangroves, fish, sea turtles and manatees - income generating activities have been encouraged and the lives of local communities are improving.

365291 DISCOVERY OF MIGRATION HABITAT AND ROUTES OF WILD BIRD SPECIES

Tang Mingjie, Cui Peng, Wang weihang

Knowledge of wetland use of migratory bird species during the annual life circle is important to construct conservation strategy and explore the implication for avian influenza control. Biologists have used GPS satellite telemetry to determine the habitat areas and the migration routes of wild birds. However, since there is no efficient methods to process the location data sets, scientists have to devote themselves to calculating the scattering location points in the GIS to find the approximate home range and the migration routes. This paper shows how data mining approaches enable the ecologists to discover migration habitat and routes. Preliminary results have shown the Spatial-Tree which was built by a hierarchical clustering method, an illusive map which depicts the breeding and wintering home range of bar-headed geese. Further more, the resulting association patterns could reveal bar-headed geese's potential autumn migration routes between the breeding sites in the Qinghai Lake ,China and the wintering sites in Tibet river valley.

Community-driven conservation

314957 ASSESSING FARMERS AND FOREST WATCHERS EFFORTS IN MITIGATION OF HUMAN-ELEPHANT CONFLICT IN SOUTHERN INDIA

Kumaran Surendra Varma, Vijay Dhinakaran Anand, Ashok Kumar K, Gopalakrishna S P

Farmers and forest watchers appointed for scaring away elephants in some regions of southern India, act as the front line defence in preventing elephants from crop raiding. This investigation takes an insight into the approaches adopted them and the results achieved. It was assumed here that incidents of elephant visits and subsequent damage to crops/property and injury/death to human beings are the indicators of their efficiency. The results show that during Elephant Driving Observations, 100% of the times elephants were located by the forest watchers and were driven back during 89% of the times and 63% of time the forest watchers were able to prevent the raid. A clear division of labour and team work was observed among them during the operation. The farmers participated on all days in the Night Watching Operations (NWO) and with all their efforts, were unable to prevent elephant visits/damages even once. Even though the effort during NWO was exhausting and de-motivating for the farmers, it was found to be worthwhile as the crop damaged by elephants was only 5 % of the total cultivated area, if not the extent of damage could probably range from 80 to 100 % of total area of cultivation.

306649 CUSTOMARY FOREST TENURE IN SOUTHERN MADAGASCAR : A CONTRIBUTION TO BIODIVERSITY CONSERVATION BUT INCOMPATIBLE WITH CONTEMPORARY CONSERVATION POLICY

Hugh Barry Ferguson

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

308030 FOREST QUALITY AND ROLE OF INSTITUTION IN A TROPICAL FOREST: A CASE STUDY ON BICHHABHANGA FOREST AREA, GARUMARA NATIONAL PARK, WEST BENGAL

Sampa Sarkar, Animesh Sarkar

The present study on forest flora in Bichhabhanga Forest located in the buffer area of Garumara National Park — area under Biodiversity hotspot of Himalaya — aims to accumulate information about floral distribution in forest managed through reorganized institution through Joint Forest Management (JFM). This paper has estimated density of standing tree and shrub per hectare, crown cover and Simpson Biodiversity Indices from forests in use by the local community people and the area under entirely untouched. Phytosociological cooperation between different plant groups is also analyzed to provide necessary inputs to the forest department for selection of plant species according to their affinity during plantation. Phytosociologically to groups exists in the studied vegetation and each group maintain distinct association. Above ground biomass and existing carbon pool have also been quantified. The institutional contribution in protecting the forest resources has been analyzed. Formation of new institution under JFM is positively contributing to present effort on conservation in this important forest area.

305913 TRADITIONAL FOREST-BEEKEEPING ARRANGEMENT: A SUCCESSFUL FOREST CONSERVATION STRATEGY IN SOUTHWEST ETHIOPIA

Tefera Belay Endalamaw, Freerk Wiersum

Forest beekeeping is an ancient form of forest exploitation in south west Ethiopia. The practice has continued to the present with a gradual evolution in beekeeping technology and resource access and management arrangements. The aim of the present study is to study traditional forest management systems and their significance for forest conservation. The study was carried out in southwest Ethiopia. Data was collected through household interview, group discussions, expert interviews, observations and secondary sources. The collected data were analyzed through spreadsheet and logical explanation. The studies reveal that there are diversity of customary tree and forest tenure arrangements with respect its use for beekeeping. Four types of tenure for hive hanging trees identified; free access, temporary tree tenure, transferable tree tenure(kobo system) and private land tenures. They also have a clear traditional conflict resolution mechanism on honey colony, honey tree or kobo lands. Traditional beekeepers use the forest for hive construction, hive hanging, pollen source and fumigation. The beekeepers also invest to the conservation of beekeeping trees. The interaction of trees and honey bees is well maintained by the traditional beekeepers to sustain their hive products. Thus, this traditional system is very promising and can help improve modern forest management practices in the region.

303455 TRIBAL COMMUNITY DEER SANCTUARY IN KIMANGKIL MOUNTAINS

Gliceto Olarte Dagondon

Higaonon tribal community in Impadiding and Kalahaan in barrio Minalwang, Mindanao Island Philippines has novel undertaking. In 2000, late Datu Mansipadano was worried of diminishing Philippine brown deer (*Cervus mariannus*). The same period they secured ancestral domain certificate and recently ancestral domain title to 17 thousand hectares forestland. They sought assistance from government and non-government agencies such as GREEN Mindanao. In 2004, European-Union-United Nations Development Program-Promoting Tropical Forestry funded Minalwang Higaonon Tribal Council project establishment of deer sanctuary. This was successfully undertaken in tribal villages of Impadiding, Kalahaan, Mintapod and Lakbangan. Estimated 5 to 7 thousand hectares are designated deer sanctuaries by tribal elders, hunters, trappers, barrio officials and community. Local tribal resolutions supported by barangay ordinances promulgate simple rules, penalty & agreements enforced by tribal guardians, elders and barrio officials. An evaluation recently resulted to successful deer sanctuary, increase wild pigs trapped outside and demand for more sanctuaries expressed by neighboring villages.

320344 DIRECT PAYMENTS FOR BIODIVERSITY CONSERVATION: COMPARISON OF THREE SCHEMES FROM CAMBODIA

Thomas John Clements

Direct payments for conservation - a payment for environmental service - were proposed by Ferraro (2001) as a more effective tool for delivering conservation outcomes in comparison with indirect social projects due to their simple institutional arrangements, cost-efficiency, and simplified monitoring. However, the majority of existing direct payment schemes are found in countries with strong property rights and usually target the behaviours of private landowners. This paper compares three schemes from a forest landscape in Cambodia, where land and resource rights are weak, species populations are low and threats are high. The schemes varied in the extent to which payments were directly linked to conservation outcomes and the degree of management authority by local institutions. Each scheme was evaluated against Ferraro's original claims using five criteria: conservation outcomes, poverty reduction, efficiency, local understanding and sustainability. The most direct schemes were found to meet many of the original claims, particularly delivering effective and efficient conservation outcomes, but failed to build local institutions or understanding. By contrast the more indirect approaches were also effective at delivering conservation but crucially were widely understood and supported by communities. Payment schemes may therefore be more successful when they act to empower local institutions, and this may involve the payment being less directly linked to conservation outcomes.

307084 ASSESSING THE EFFICACY OF CHILLI-TOBACCO REPELLENT ON ASIAN ELEPHANTS IN HIGH HUMAN-ELEPHANT CONFLICT REGION OF SOUTHERN INDIA

Vijay Dhinakaran Anand, Surendra Varma, Gopalakrishna SP

The efficacy and viability of Chilli Tobacco Barrier (CTB) was assessed through 1) presence/absence of elephants or signs close to CTB test plots 2) irrespective of the presence/absence of elephant preferred/non-preferred crops in test plots and adjacent lands (with no CTB), if damage by elephant was reported and 3) economic viability of CTB vis-à-vis other elephant barriers. Elephants came as close to 0 meters to the CTB, with no damage to barrier or crop during 52 days of monitoring. These distances ranged from 0 to 110 meters from the test plot and 73% of times elephants have come within 0 to 5 meters, with no damages to CTB test plots. However crop damages were reported in adjacent crop lands; 44% of the damage was within 0-5 m distance from the CTB test plots. Elephants are reported to select crops in reproductive stages; crop lands where damages occurred had only 30% of the crops in reproductive stage as against 64% in CTB test plots. The average net profit from test plots was found to be only Rupees 604/- (Rupees 402 to 2800/1US\$=Rupees 48.40). The CTB was found to be effective in deterring elephants; however more investigation on economical viability is suggested.

Invertebrate conservation

306115 FIRE AND TERMITES IN A SOUTHERN AFRICAN SAVANNA: IS THERE A LONG-TERM RELATIONSHIP?

Andrew Byron Davies, Catherine Parr, Berndt Van Rensburg

Fire in savanna systems is regarded as a major and necessary disturbance for the maintenance of biodiversity. Most fire ecology studies have focused on vegetation dynamics with little attention given to other taxa, especially invertebrates. Termites are considered to be major eco-system engineers in savannas, but are often neglected due to sampling and taxonomic difficulties. Hence very little is known on the interactions between termites and ecological processes such as fire. But if we are to conserve biodiversity, interactions between ecological processes and drivers need to be well understood. We made use of a long term burning experiment initiated in 1954 in the Kruger National Park, South Africa, to test different fire regime effects on termite assemblages in three savanna types along a rainfall gradient and across seasons. Termites were sampled using a variety of methods in order to sample a large suite of functional groups. Results show variations across savanna types and seasons, with significantly higher levels of termite activity on annually burnt plots but higher species richness on plots which are burnt at less frequent time intervals. We show that different fire management practices do have an effect on savanna termite communities, especially in higher rainfall areas. These effects will have potential impacts on savanna conservation and eco-system functioning, and should be considered in conservation management planning.

315196 THE ALLEE EFFECTS IN INVASIVE ANT SPECIES

Gloria M. Luque

The Allee Effects (AE) gather phenomena in which specie's population growth shows a positive relationship between a component of individual fitness and population size, as a direct consequence of individual aggregation and cooperation. Recently its importance in conservation has been shown for its potential role in extinctions of endangered species as well as in the dynamics of invasive species. Eusocial insects are strong candidates for many AE mechanisms, due to the nature of their social structure. We aim at determining the presence and the mechanisms that may cause AE in ants, including native and invasive species, through the study of the success of colony survivorship in relation to the number of queens and workers that cooperate to found a new colony. We set up lab colonies of *Linepitema humile* (Argentine ant), one of the most devastating of the invasive species worldwide and the non-invasive *Messor barbarus*. We studied the relationship between reproductive colony fitness and the initial size of the colonies (number of queens). We measured colony survivorship (as a direct measure of reproductive fitness) and other components of fitness (such as reproductive output). Significant differences in the effect of colony size and some measures of fitness between the two species are useful to determine the existence of a critical population size for the colony of invasive species to survive, which is crucial for the management and control of invasive species.

369317 THE INBREEDING HISTORY OF A POPULATION INFLUENCES MATING DECISIONS: CASE STUDY IN BARK BEETLES

Daphna Gottlieb

Various conservation aspects of inbreeding have been widely studied. However, the relative roles of inclusive fitness and inbreeding depression in shaping the characteristics of mating behavior remained poorly understood. We studied the evolutionary implications of mating behavior in the beetle *Coccotrypes dactyliperda*. We analyzed the consequences of mating behavior using genetical, behavioral and modeling tools. Beetles from 7 sites in Israel were found to be predominantly inbreeding with high variability between populations (0.125-0.620) suggesting that populations differ in their inbreeding history. The model investigated the trade-off between two opposing components; inclusive fitness and inbreeding depression, in populations that differ in their inbreeding histories. In a game theory model, females are given males at different densities and degrees of relatedness. The females can choose either to inbreed or to wait for an out-breeding opportunity. We found that the mating system of a population experiencing high inbreeding rate is in congruence with the version of the model that assumes no inbreeding depression. In contrast, the results from the population with relatively low inbreeding rate had the best fit with the version of the model in which inbreeding depression was assumed. Our results highlight the combined effects of population inbreeding rate and the game involved in mate availability when conserving mating behavior.

315451 THE VALUE OF RARITY : A NEW THREAT FOR ANIMALS OF HOBBY COLLECTIONS

Pierline Tournant, Koichi Goka, Franck Courchamp

In some categories of wildlife exploitation, rare species are especially sought after. They then bear a lucrative economic value, which further fuels their exploitation, to the point that even when they decline beyond the point of sufficient benefits, the demand remains sustained. Consequently, this precipitates these rare species into an overexploitation vortex, where they become increasingly rare, valuable and exploited, down to extinction. This is a well-known paradox in economy that can be related to the Allee effect concept in population dynamic.

A concrete example of exploitation is hobby collections of wild species (plants and animals alike), in which the rarest species are the most valuable.

It is the case, in Japan, of insect collectors who are involved in acquisition of stag beetles. This market concerns more than 700 species from all over the world, with over 50 million specimens imported a year, some sold to more than 5 000 Euros a piece.

From a database of the imports of stag beetles in Japan, we assessed whether acquisition is more based on morphological criteria, such as body size, mandible size and shape, body colour, or on the species' rarity. We also accounted for market price of the individuals. The importance of rarity as an acquisition criterion in this market is a worrisome result for the conservation of the many rare stag beetle species concerned. The consecutive impairment of their essential functional role is a further, undefined concern.

315341 BIOLOGICAL DIVERSITY STUDY OF BENTHIC MACROINVERTEBRATES IN JIANGSU SURFACE WATER

Yong Zhang

Benthic macroinvertebrates community structure are closely related to water quality and aquatic ecosystem health. Its community structure change after affected by outside interference can reflect the nature and degree of water pollution. In 2008, benthic macroinvertebrates assemblages were collected from 154 sites in Jiangsu Province, including source of drinking water, the Yangtze River and Beijing-Hangzhou Grand Canal and other major rivers, Taihu Lake and other key lakes. In source of drinking water, 78 species were collected; in major rivers, 96 species; in major lakes, 65 species. From the evaluation results of species diversity index, the main lakes's benthic macroinvertebrates diversity was better than surface water sources and major rivers. The proportion of rich and less rich was 58%. The main rivers's diversity was the worst, the rich and more enrich proportion only 30.7%, and had 11.3 percent of points very poor, most of the water body's zoobenthos were tolerance species, its dominant species was *Limnodrilus hoffmeisteri*. The water quality of main rivers was worse than drinking water sources and major lakes.

Conservation modeling

315203 BIODIVERSITY, ARE WE MISSING SOMETHING? SPECIES DETECTABILITY AND EXTINCTION

David Lesford Roberts

Following the 2002 World Summit in Johannesburg, the Convention of Biological Diversity called for a decrease in the rate of biodiversity loss by 2010. However, a 2003 UK Royal Society report on "Measuring Biodiversity for Conservation" discussed the unavailability of satisfactory measures of biodiversity, and the difficulty of reporting accurately on the loss of biodiversity by 2010. It is estimated that there are around 2.5 billion specimens in biological collections. These records represent primary, verifiable observations on the distribution of taxa through time and space. For most species this is the only source of information. Any attempt to use specimen data to infer a species' conservation status needs an understanding of the collection process itself. If sampling effort is consistently lower for recently identified taxa, there will be a tendency to underestimate key parameters such as size ranges. This begs the question as to why taxa are discovered when they are? Whether conservation and biodiversity prioritisation reflect a level of conspicuousness and accumulation of knowledge? An even more important question is whether what we are collecting is even representative of biodiversity? Answering these questions is vital given the time and money spent on 'rapid biodiversity assessments'.

306614 CONSIDERING THE INTERACTION BETWEEN CONNECTIVITY AND ANTHROPOGENIC THREATS IN DYNAMIC RESERVE DESIGN: THE NEIGHBOURHOOD VULNERABILITY APPROACH

Piero Visconti, ROBERT L PRESSEY, Daniel Segan, Matthew Watts

Methods for scheduling conservation action over time to promote the persistence of species are poorly developed, yet urgently needed. For species sensitive to habitat fragmentation and isolation, persistence within a reserve depends importantly on unreserved neighboring habitat. If this external habitat has some likelihood of disappearing, it follows that we should consider not just local vulnerability (within an area of interest) but also neighborhood vulnerability when prioritizing areas for conservation. We present a reserve selection approach that incorporates both local and neighborhood vulnerability with biodiversity value and conservation cost. We compare it against other heuristics in a marine and a terrestrial case study. This new approach results in two new courses of prioritization for conservation: 1. protection of areas with neighbors that have low vulnerability and are more likely to retain their biodiversity value; or 2. protection of highly vulnerable neighboring habitat that is important to retain the value of important nearby areas, avoiding species loss from these areas after loss of neighboring habitat. The new approach outperforms other heuristics by minimizing both losses of habitat and connectivity, improving species persistence within reserves and across whole planning regions, in both reserved and unreserved areas.

315097 HABITAT VULNERABILITY IN CONSERVATION PLANNING. WHEN DOES IT MATTER AND HOW MUCH?

Piero Visconti, ROBERT L PRESSEY, Daniel Segan

Effectively addressing vulnerability of areas and natural features remains a challenge for conservation planners around the world. Different areas within a region are often assumed to be equally vulnerable to habitat loss, so prioritization proceeds only according to biodiversity benefit and, sometimes, cost. When vulnerability is negatively correlated with biodiversity value and positively correlated with cost this assumption makes conservation investment ineffective, pushing it towards remote areas with low opportunity cost and vulnerability, or de facto already protected. On the other hand, gathering information on vulnerability to habitat loss and its impacts on species distributions can be time consuming, expensive, and involve uncertainty. We investigated in which situations incorporating information on vulnerability produces better conservation decisions in terms of improved species persistence. We varied three parameters expected to influence this choice: the spatial variance of vulnerability across the study region; uncertainty about data on vulnerability; and the spatial correlation between vulnerability and biodiversity value (positive, random, negative). We provide rules of thumb for conservation planners to make three choices: 1. invest all their money in conservation action using any available information on vulnerability; 2. improve information on vulnerability; or 3. discard information on vulnerability and prioritize solely on biodiversity benefit and cost

315222 HOW TO ADDRESS CONNECTIVITY FOR MULTIPLE SPECIES IN MULTIPLE LANDSCAPES: EXAMPLE FROM BIRDS OF THE ATLANTIC FOREST, BRAZIL

Guy Pe'er, Miriam Melanie Hansbauer, Klaus Henle, Cristina Banks-Leite, Alexandre Camargo Martensen, Jean Paul Metzger, Karin Frank

Functional connectivity is the outcome of intricate interactions between landscape structure and the response of animals to it. Due to the complexity of animal-landscape interactions in fragmented heterogeneous landscapes, tools are lacking to predict functional connectivity for multiple species and/or across landscapes. We present a spatially explicit, individual-based model (IBM) of connectivity which takes into account that species differ from each other not only in habitat requirements but also in behaviour. One of the model's novel attributes is in separating everyday movements from rare dispersal events, and random movements from directed ones (e.g. gap-crossing between forest fragments). We use the model to investigate connectivity for birds of the Atlantic forest in Brazil. Exploring the varied response of species to forest edges, we show that the separation into different behaviours, as well as the change in the response parameters, substantially affects connectivity. We further demonstrate the capacity of the model to link connectivity with the sensitivity of species to fragmentation. We discuss the implications for conservation along two lines: advancing connectivity theory (e.g. comparing and unifying connectivity indices), and assessing connectivity as a decision-support tool in restoration and protection projects.

315312 THE RETURN OF THE SAKER FALCON IN BULGARIA - A DREAM OR A CHALLENGE THAT CAN BE ACHIEVED? AN EX-SITU PERSPECTIVE

Elena Kmetova, Dimitar Ragyov, Andrew Dixon

The Saker falcon (*Falco cherrug*) is an endangered species of global conservation concern, which has no recent proof of breeding in Bulgaria. Taking into account the present environmental and social conditions in the country, the species is considered for possible reintroduction to its former breeding areas with the help of both translocation and captive breeding techniques within a feasibility study developed in accordance with the IUCN reintroduction criteria.

The current study provides insight on the ex-situ aspects of a potential reintroduction programme of Saker falcons in Bulgaria, modeling the behaviour of a captive stock of birds using given data on breeding success and survival rates and tracing the possible development of the released birds in time, according to several management scenarios. Models are developed using STELLA model simulation software, using survival and breeding data gathered on field and from literature sources. Some limitations and additional requirements of the captive method are also discussed.

The outcomes reveal a possible scenario for Saker falcon captive stock management for securing the establishment of a viable wild population of the released birds. Despite that, considering the limitations of the methods discussed, combining the ex-situ breeding with direct translocation and release is suggested.

315266 SETTING CONSERVATION PRIORITIES FOR TROPICAL ANDEAN BUTTERFLIES USING MUSEUM AND FIELDWORK DATA

Blanca Cecilia Huertas Hernandez, Keith Willmott

The tropical Andes are considered a global conservation priority due to high species diversity and being one of worlds' hotspots. Conservation assessments have been developed and implemented for some taxonomic groups such as vertebrates. However, in other highly diverse groups such as Neotropical butterflies, few species evaluations and conservation studies have taken place. One of the high priorities for effective assessments of species and habitats is to improve our currently scarce knowledge of geographic distribution. In an unprecedented initiative in the region, the Tropical Andean Butterfly Diversity Project is working together with major national and international museums and students to produce a comprehensive database to assess actual and predicted distributions of Andean species. Currently, a random selection of neotropical butterfly species has been evaluated following the IUCN categories to assess if there are threatened species of butterflies in the Andes. We will present an analysis on how this random selection will affect the assessments and if there are any trends on the groups assessed. A proposed list of potential areas for butterfly conservation in the Andean region is presented and the issues arising during the assessments are discussed.

315672 MULTIPLE ECOLOGICAL PATHWAYS TO EXTINCTION IN MAMMALS

Gerardo Ceballos González, Ana D. Davidson, Marcus J. Hamilton, Allison Boyer, James H. Brown

The 2008 Global Mammal Assessment estimates that one-quarter of all mammals are in danger of extinction, and over half of all mammal populations are in decline^{1,2}. As human population and resource demands continue to grow, biodiversity conservation has never been more critical¹. A major priority for conservation science is to help focus conservation efforts by understanding not only the key ecological predictors of extinction, but also the interactions among those predictors that make certain species more vulnerable to extinction than others. Here, using a newly compiled database of nearly 5,000 mammal species and the 2008 IUCN Red List, we use decision tree models to quantify the multiple interacting factors associated with extinction risk. We find that the causes of extinction vary widely across mammals, and identify unique pathways to extinction for species with different lifestyles and sets of traits. These new insights provide a richer understanding of extinction processes, and the simple rules of thumb generated by the decision tree model should increase the ability of conservation scientists to identify those species at greatest risk due to their specific suites of ecological traits.

Scientists and managers: bridging the gap

306318 CHEMICAL COMMUNICATION IN PARROTS WITH A SPECIFIC EMPHASIS ON THE KAKAPO (*STRIGOPS HABROPTILUS*)

Anna Clarissa Gsell, Dianne Brunton

New Zealand's isolation and the absence of mammalian predators and in particular the lack of mammals that rely on scent to find their prey have New Zealand enabled to evolve a unique bird fauna, characterized by many flightless and nocturnal species. Having adopted features more common for mammals than birds, it is therefore plausible that olfaction may be an important aspect of the ecology of this unusual avian assemblage as the use of scent would not have increased their vulnerability to predation over evolutionary time. For New Zealand birds, olfaction might indeed play an important role in social communication and mate choice. Moreover, New Zealand is home to one of the world's most unusual parrots, the critical endangered kakapo, which is known for its strong smell. The aim of this project is to investigate the role that chemical communication may play in the ecology of parrots and specifically in the social and mating interactions of kakapo. This study has three lines of investigation: 1) An anatomical approach - the histology of the olfactory bulb in parrots; 2) a biochemical approach using GC-MS technology to identify the chemical compounds of the body-scent parrots emit; and 3) a behavioural approach using scent presentations to parrots to evaluate the ability of olfactory cues to influence behaviour. In this talk we present our findings on the chemical composition of kakapo scent and give our initial findings on the histological distinctiveness of the kakapo brain.

***** A STRATEGIC REINFORCING PROGRAM FOR *MAGNOLIA SINICA*: THE FIRST REINFORCEMENT ATTEMPT FOR CRITICALLY ENDANGERED TREE SPECIES IN CHINA

Weibang Sun, Xiaoya Li, Huabin Yang, Enliang Yang, Pengyun Tao

Magnolia sinica is one of the most endangered *Magnolias* in the world, estimated only around 50 individuals in China. Habitat destruction, poor fruiting and difficulty of seed germination are main threats. For a long-term conserving the species in its natural habitat, a strategic reinforcing program has being planned and started since July, 2007. Meanwhile this is the first attempt following the IUCN/SSC guidelines for re-introductions for Critically Endangered tree species in China. The goals are 1) restoring the population in where the species was historically present, 2) developing the practical methodologies of threatened trees restoration. For reaching the goals: a multidisciplinary working-team consisting of Botanic Garden (Kunming), Conservation NGO (FFI China), local Forestry Bureau (Wenshan), and Nature Reserve (Wenshan) has been organized. Based on field survey, a scientific reinforcing plan was developed and conducted; two reinforcing sites within the historic range were selected; a training workshop was held before tree planting; 400 saplings were selected, planted and labeled; the guideline of monitoring and patrolling was developed; and conservation awareness raising activities have been conducted afterwards. As progress result, the two sites presented 89% and 92% surviving rates respectively and the survived individuals had a high growth. The sustainable management system for the reinforcing population has been established primarily.

365279 INTEGRATING SCIENTIFIC METHODS WITH ADAPTIVE MANAGEMENT FOR RECOVERY OF THE CRITICALLY ENDANGERED GRAND AND OTAGO SKINKS

James Thomas Reardon

As conservation literature grows, it's challenging for managers to apply scientific methods to management. Scientists are often reluctant to engage in applied management due to compromises in experimental design. This study of critically endangered Otago and grand skink (the most critically endangered reptiles in New Zealand, with declines likely due to invasive predators) recovery presents success achieved by pragmatic synthesis of scientific methods and realities of applied management. We established three treatments at sites where lizards were monitored over 4 years: 1) mammal proof fencing with eradication of mammals within fences; 2) predator trapping and 3) unmanaged sites. Treatments were designed to identify agents of decline, test viable management options and prove whether possible to recover these species *in situ*. Outcomes enabled a cost analysis of resulting management options and highlighted methods necessary to conduct an adaptive management programme.

This study emphasises the need for: 1) robust trial designs that facilitate decision making including through induction and inference, 2) multiple management and monitoring methods to be included where only limited time available to detect responses and avert extinction, 3) expert engagement throughout management and 4) acceptance by funding agencies of the large cost of elucidating even simple management questions.

310103 PROTECTING WILD TIGERS: DEVELOPING A RANGE-WIDE SITE-BASED APPROACH FOR MONITORING LAW ENFORCEMENT EFFECTIVENESS

Emma Jane Stokes, Saw Htun, Arlyne Johnson, Hannah O'Kelly, Anak Pattanavibool, Samantha Strindberg, Kevin Sallee

Wild tigers are in a precarious state and their conservation requires a coordinated region-wide effort. In 2006 Tigers Forever, an initiative developed by the Wildlife Conservation Society and Panthera, was established with the goal of increasing wild tiger populations by 50% in 10 years across key sites. Improving the effectiveness of law enforcement in reducing direct threats to tigers - poaching, over-hunting of prey and habitat loss - is a fundamental objective. Central to this theme is the development of an efficient site-based law-enforcement monitoring (LEM) system to evaluate and inform management decisions. We outline the approach taken to developing a standardized system based on the information management tool 'MIST' and highlight the technical and practical challenges involved in its design and implementation. This system is now operational in seven countries across Asia. We illustrate how the system is being applied with four case-studies that examine 1) evaluation of performance under different law enforcement strategies, 2) analysis of trends in poaching of tigers and their prey, and 3) measuring effectiveness of law enforcement in reducing threats to tigers. Given the urgency of the situation facing wild tigers combined with limited conservation funds, we strongly advocate the adoption of standardized LEM that is designed to improve performance, highlight models of success and promote accountability of protected area management across the tigers' range

315407 HOW USEFUL IS PATROL DATA FOR MONITORING PATTERNS OF ILLEGAL RESOURCE USE?

Aidan Keane, Julia Jones, E.J. Milner-Gulland

Ranger-based monitoring has been promoted as an effective means of gathering data for natural resource management, including information on compliance with conservation rules. However, the primary objective of most ranger patrols is to deter rule breaking and, consequently, using such datasets to draw valid inferences about changing patterns of illegal resource use (e.g. poaching) is challenging. A rise in recorded poaching incidents may indicate a real increase in poaching levels, but could also be caused by an increase in the effort devoted to detection. Similarly, an apparent fall in poaching may be due to deterrence or it might arise because poaching effort has been displaced to unmonitored areas. Using Masoala National Park, Madagascar, as a case study, we illustrate how the choice of spatial and temporal scales for the analysis of patrol data are crucial to their interpretation. We also discuss the problems of statistical non-independence due to spatial and temporal autocorrelation, which have thus far been neglected. Finally, we suggest ways - such as the consistent recording of an appropriate measure of effort - to improve the usefulness of ranger-based monitoring for measuring and improving conservation success.

Fish Conservation

315465 ANTHROPOGENIC EFFECTS ON THE CONDITION OF INTRODUCED TILAPIAS IN UGANDAN CRATER LAKES

Jackson Efitre, Lauren Chapman, Debra J. Murie

This study identified environmental predictors of condition of two introduced tilapia species (*Oreochromis leucostictus* and *Tilapia zillii*) that have divergent trophic niches (planktivore and herbivore, respectively) in 17 crater lakes in western Uganda. We asked whether fish condition differs among lakes characterized by differences in fishing pressure and catchment deforestation; and we related relative condition factor to gradients of environmental variation across lakes. Mean relative condition factor was higher in populations with high fishing pressure compared to populations with low fishing pressure for both *O. leucostictus* and *T. zillii*. Condition of *O. leucostictus* populations was higher in lakes with severely deforested catchments; but mean relative condition factor of *T. zillii* did not differ between deforestation categories. Principal components analysis indicated a stronger association between fish condition and environmental gradients for *O. leucostictus* than for *T. zillii*. For *O. leucostictus*, the factors that loaded most heavily included Chl-a, water transparency, lake area and depth, suggesting higher condition in very productive and smaller lakes. For *T. zillii*, the factors that loaded most heavily included lake area (positive), conductivity and total nitrogen (negative). Integration of environmental predictors of fish condition should aid in the development of innovative approaches for management of tilapia populations in these lakes.

315693 CONSERVATION STATUS OF BULGARIAN ICHTHYOFAUNA

Milena Nikolova Pavlova, Luchezar Zlatev Pehlivanov

A review of the actual conservation status of the species in the Bulgarian ichthyofauna was made referring to the Bulgarian Biodiversity Act, the IUCN Red List of Threatened Species, the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention), the Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, the Bulgarian Red Data Book, the Black Sea Red List and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The endemic status of the species was reported as well.

Habitat degradation, water pollution, over-exploitation of populations and the impact of exotic fish species were identified as the main threats to the biodiversity of fishes in Bulgarian waters. Conservation activities defined in the Bulgarian legislation were presented, and further activities were proposed for conservation, recovering and sustainable use of the species richness of the ichthyofauna.

315542 A PRELIMINARY ASSESSMENT ON THE STATUS OF PYGMY SEAHORSES (SYNGNATHIDAE) IN SABAH, MALAYSIA

Choo Chee Kuang, Yeong Yee Ling, Juanita Joseph, Orosco A Christine

The status of pygmy seahorse in Semporna, Sabah was assessed through underwater surveys and interviews conducted on recreational divers and dive operators. Two species (*Hippocampus bargibanti* and *H. denise*) were found, with *H. bargibanti* being more common. Underwater surveys revealed that *Hippocampus bargibanti* was the obligate inhabitant of the seafan *Muricella plectana* (depth range: 16-24 m) and had the mean size of 27.7±2.8 mm (N=22) as measured underwater using scaled photograph, while *H. denise* was associated with *Annella reticulata* and *Echinogorgia* sp. From the interviews (N=100), an estimated 60% of divers used flashlight in photographing the specimens, while 23% exhibited direct physical contact with the sea fans and 5% touched the pygmy seahorses. Dive operators (2 out of 50) admitted to transferring pygmy seahorses to other locations in order to customize tours for divers. The potential adverse impacts of these practices can be inferred by the signs of stress observed on specimens: aversion to flashlights, loss of individuals from relocated sites and deaths of gorgonian hosts. There is an urgent need for studies on the life histories and ecological requirements of pygmy seahorses to guide development of policy and management plans. Meanwhile, improved codes of conducts in recreational diving through awareness and outreach would be a tangible conservation approach.

315514 ARTISANAL SHARK FISHERIES OF THE INDIAN OCEAN ISLANDS OF COMOROS AND MAURITIUS: THEIR STATUS AND PRELIMINARY THREAT ASSESSMENT

Christopher Narinder Singh Poonian, Maoulida Kamal, Melissa Hauzer, James Beeharee, Paul Ivory

Over one hundred million sharks are killed by commercial fisheries every year through intentional harvest and bycatch, however little is known of the impact of artisanal fisheries on these species. This work investigated local perceptions, fishing practices and bycatch of sharks in the Comoros and Mauritius through semi-structured interviews with artisanal fishers. A wide diversity of shark species was regularly caught by artisanal fishers in both countries, most commonly by longlines, both intentionally and as bycatch. The most common species recorded included *Sphyrna* spp, *Galeocerdo cuvier* and *Triaenodon obesus* in Mauritius and *Carcharhinus longimanus*, *Carcharhinus amblyrhynchus* and *Sphyrna* spp in the Comoros. Fishers generally perceived sharks as dangerous man-eaters of the sea and shark meat was found to be worth less than other fish, although shark fins were worth substantially more. Overall, sharks did not currently appear to be highly valued as a resource in either country, and less than half of the fishers interviewed stated that they intentionally targeted sharks. However the disproportionately high value of shark fins and increasing demand for this product could result in rapid and unsustainable increases in shark catches in the future. A fuller understanding of the current status of and fishing pressures affecting coastal shark populations in the Indian Ocean is an urgent requirement for effective regional conservation measures.

315371 CONSERVING PACIFIC SALMONIDS IN A CHANGING CLIMATE

Doug Demko, Harmony Patricio

Substantial declines in salmon populations along the Pacific Coast of the U.S. may be compounded by the impacts of global climate change, giving cause for growing concern amongst resource managers, fishing communities, and conservationists. Predictions of climate change effects on fisheries are crucial for development of effective conservation strategies for salmonids. As ichthyofauna serve as biological indicators to help establish objectives for ecological quality standards, prediction of climate change effects on salmonid species could be used to inform larger ecosystem-based adaptation and management policies. We evaluated the potential impacts of climate change on salmonid habitat using current regional climate and species population models. We included influential variables of water temperature, timing and magnitude of stream flows, and water quality. Population-level impacts, including extinction risks, on regional and local salmonid stocks and interconnected species were predicted through analysis of anticipated changes in habitat quantity and quality. We also developed monitoring measures to provide the additional data needed for more accurate evaluation of future climate change impacts on salmonids. Ultimately, these monitoring measures can help to develop the science-based management actions necessary for the sustained conservation of Pacific salmonid fisheries in the context of a changing climate.

329160 NATIVE FISH REINTRODUCTIONS: WHY IS THERE VARIATION IN PERSISTENCE AMONG ANCESTRAL GROUPS OF SLIMY SCULPINS?

David D Huff, Loren Miller, Bruce Vondracek

We investigated the persistence of reintroduced populations of slimy sculpin (*Cottus cognatus*) in Minnesota, USA. Native populations were present in this region historically, but were likely extirpated through past land-use practices. Nine streams that previously lacked sculpins were stocked with a mixture of sculpins from three donor sources. DNA analyses indicated a high degree of genetic distinctiveness among the source populations; therefore the origins of offspring were easily identified. Laboratory experiments revealed differences in growth rates among source populations. We studied how genetically and ecologically divergent populations responded to reintroduction in different habitats. The fitness of each source strain and interpopulation hybrids at reintroduction sites was inferred by comparing their overall persistence in the streams and relative body condition. Both persistence and body condition at the reintroduction sites differed in a similar way among source strains and interpopulation hybrids. Offspring from one source out-persisted offspring from the other sources at a majority of sites. Minimum habitat requirements and winter food resources are likely potential explanatory mechanisms. Because these populations are both isolated and geographically close, they provide an ideal model to address important biological questions and evaluate management implications for native fish reintroductions.

Inventory and monitoring

315274 DETERMINANTS OF ROOST DYNAMICS AND ABANDONMENT OF 8 UK BAT SPECIES

Stephen David Gregory, Philip Briggs, Karen Haysom, Franck Courchamp

Since 1995, the Bat Conservation Trust's National Bat Monitoring Programme has managed a nationwide network of 900+ volunteers who conduct standardized roost counts at over 2000 roosts for 11 UK bat species. Although used for national species trends, these data have not been used to examine individual roost dynamics, including their periodic abandonment. Based on knowledge of their roosting ecology, we formulate a set of hypotheses, represented by population dynamical models, to evaluate the empirical support for random fluctuations, density-independent, and negative and positive density feedback in roost dynamics of 8 species surveyed ≥ 7 years. We also examine influences of climate and measurement error on our findings. Furthermore, we hypothesize that roosts are abandoned if individuals number too few because communal behaviors, e.g. thermoregulation, become ineffective (an Allee effect). Over 350 roosts were monitored for ≥ 7 years and revealed greatest support for negative density feedback and random fluctuations in roost dynamics. Positive density feedback received little support. These results were unaffected by mean local climate but measurement error may substantially increase support for random fluctuations. Finally, pipistrelles and Daubenton's bats appear to exhibit a minimum viable roost size and may require careful monitoring. Our findings concord with species' roosting habits and emphasize the importance of long-term data in understanding them.

315398 DUGONG FEEDING PATTERNS, FOOD PREFERENCES AND PROSPECTS FOR CONSERVATION IN PULAI RIVER ESTUARY, MALAYSIA

Anna Norliza Bt Zulkifli Poh, Choo Chee Kuang

Feeding patterns and preferences of dugongs were studied on a multi-species seagrass meadow in the Pulai River Estuary, Malaysia. To infer feeding preferences, photoquadrats (50 cm x 50 cm) were established along the feeding trails and seagrass species and percent cover were mapped digitally. A total of 29 feeding trails were studied. The mean length and width was 3.52 \pm 1.50 m and 0.17 \pm 0.04 m respectively with no correlation between both variables. Four seagrass species were grazed by dugongs at the study site: *Halophila ovalis* was the most preferred seagrass species accounting for 64.5 % of the overall seagrass species while *Halodule uninervis*, *H. spinulosa*, and *Enhalus acoroides* constituted 17.4%, 12.8% and 4.6% respectively. The feeding patterns were serpentine-like and linear (the former being majority) which can be attributed to the distribution of the preferred seagrass species at the site, and diving behaviour corresponding to foraging activity. Interviews with local fishers (n=25) revealed that dugong population have declined considerably over the last 30 years and notes on incidental captures and the cultural values of dugongs were recorded. The relevance of the findings from this study to the future conservation of dugong population is discussed.

310193 POPULATION STATUS OF WILD YAK (BOS MUTUS) IN THE ARJINSHAN NATURE RESERVE, XINJIANG CHINA

Paul Jason Buzzard, Huibin Zhang, Donghua Xu, Howman Wong

Wild yak (*Bos mutus*) are one of the most charismatic members of the Xizang/Qinghai plateau fauna, and nineteenth century explorers described herds in the thousands. Over-hunting, competition with livestock and loss of habitat have greatly reduced wild yak, and they are listed as vulnerable on the IUCN red-list, on Appendix I of CITES and as a Class I protected animal in China. Hybridization with domestic yak is another threat, and the Arjinshan Nature Reserve (ANR) in Xinjiang, China is particularly important in this regard because local herders do not raise domestic yak and the wild yak population is especially pure. We report on data from vehicle transects totaling 31-589 km in ANR from 1993, 1998-2006. The northeastern region of ANR is an important area and its high steppes (~4200m asl) had herds as large as 198 and up to 289 individuals in 53 km (5.5 yak/km). In west-central ANR a combined grouping of ~800 yak was seen in 1993 but the area has not been surveyed recently. Inherent biases preclude calculating yak densities from the vehicle surveys but the data suggest that the population is increasing and confirm that ANR has a globally important population of wild yak.

314981 SPATIAL AND TEMPORAL BIAS IN BIODIVERSITY DATA

Elizabeth Boakes, Philip McGowan, Richard Fuller, Chang-Qing Ding, Natalie Clark, Kim O'Connor, Georgina Mace

In order to assess biodiversity change, historical as well as current data on species distributions are needed. Species distribution data can be found in a variety of sources but it is likely that each will be biased towards certain time periods or places. Such potential biases must be understood in order that data can be interpreted correctly and global diversity monitored effectively. We collated ~170,000 distributional records of the avian order Galliformes dating back over two centuries and spanning the Palearctic and Indo-Malay biogeographic realms, and used these data to investigate the spatial and temporal coverage of five data sources; museum collections, literature records, banding (ringing) data, ornithological atlases and birdwatchers' website trip reports. Museum data were the only source to provide relatively even spatial coverage, the other sources being biased towards Western Europe and Southeast Asia. In the last three decades, literature data have become markedly biased towards threatened species and protected areas. Data from a combination of sources will therefore be needed to obtain a true picture of biodiversity change. Currently, no data source is providing biodiversity base-lines for common and widespread species nor for areas of lower biodiversity, a role previously filled by museum collections. We are concerned that this lack of baseline information will impede our ability to identify emerging trends affecting other species and places.

365911 IRRUPTIVE GROWTH OF REINTRODUCED ELK IN KENTUCKY: LOOMING MANAGEMENT AND CONSERVATION CHALLENGES

John Jobe Cox, Lauren Dahl, Karen Alexy, Willie Bowling, Songlin Fei, David Unger, David Maehr

Reintroductions of large mammals are challenging and often controversial endeavors. Elk (*Cervus elaphus*) were successfully reintroduced to southeastern Kentucky beginning in 1997. Since then, elk have exhibited a decade-long irruptive growth pattern in the absence of mortality factors that commonly limit its abundance in more western portions of North America. As a result, elk nuisance complaints in this area have increased sharply and concurrently with population growth of the species, and local effects of overabundance, particularly on reclaimed surface mines has increasingly been observed. Despite 8 continuous years of hunting, state wildlife officials estimate the current elk population has grown to 7,000-10,000, although rugged topography, thick forest cover, and cryptic behavior of the species have precluded use of typical population surveys. Herein, we examine the current and future challenges that local wildlife managers and land stewards increasingly face in managing elk numbers within human social and ecological carrying capacities in an area with little public land. We discuss recent elk population surveys and predictive population model results, nuisance patterns, and ecological and sociological implications within the increasingly denatured, yet highly biodiverse ecoregion of temperate deciduous forest, as well as offer recommendations for managing and monitoring this population.

315661 ANDEAN BEAR (TREMARCTOS ORNATUS) DIFFERENTIAL CONSUMPTION OF THE GIANT GROUND BROMELIAD (PUYA CLAVA-HERCULIS); IS THERE A NUTRITIONAL EXPLANATION?

Kristina Timmerman, Ellen Dierenfeld

In southern Ecuador, Andean bears utilize the giant ground bromeliad (*Puya clava-herculis*); in fact, they limit their consumption of this plant to reproductive or post-reproductive individuals. This plant species reproduces once per lifetime; therefore only a subset of the puya population is available for consumption each year.

This study explores if there is a nutritional explanation for this unique consumption pattern. Plant tissue was collected on the Mazar Wildlife Reserve, located in the Southeastern Andean Cordillera.

Reproductive plants exhibited higher proportions of protein, fats, potassium, and calcium. Because bears rely on food resources relatively low in protein, the fact that protein is available at more than 300% of the non-reproductive plants (16.62% versus 4.38%, respectively) may explain why bears select this category of plants. On average, bears obtain about 3.3 kilograms of tissue per plant. Therefore, the number of calories ingested by bears per average plant is more than 900 calories.

According to Robbins (1993), understanding patterns of resource use is essential for conservation purposes. This research contributes to the knowledge-base of how this species utilizes an important food resource in the high-altitude grasslands. We provide a potential explanation for limited plant resource use and we estimate specific calorie intake per plant. Both methodologies and data can be adapted to other regions and other bear species.

Environmental politics and policy

315443 AFGHANISTAN: CONSERVATION IN A COUNTRY IN CONFLICT

Peter Smallwood

Afghanistan lies at the juncture between Paleoarctic, IndoMalayan, and African biotic realms, and therefore has a rich biodiversity. For example, there are at least 9 species of cat extant in Afghanistan now, with two others only recently extirpated from the country. It is home to such iconic species as snow leopards (*Uncia uncia*), Marco Polo sheep (*Ovis ammon polii*), and Markor goat (*Capra falconeri*). From deserts to mixed deciduous forests to high alpine grasslands, there are wildlands and wildlife worthy of conservation. The Wildlife Conservation Society began its current project on Biodiversity Conservation in Afghanistan with funding from US AID in 2006. We work closely with local communities in three regions of Afghanistan, and with the central government to help them develop the legal framework and policies for protected areas, protected species, and conservation. There was very little in the way of a legal framework for conservation in Afghanistan when we began, and very little expertise in conservation in the Afghan government or academia. Security has declined over the past three years of the project, and seems likely to decline further for at least the first half of 2009. Despite these challenges, we have made significant progress. Here, I report on our accomplishments to date, our plans for continued work, and the challenges of working for conservation within a country in conflict.

315563 BIODIVERSITY INVESTMENTS PORTFOLIO-MECHANISMS FOR HARMONISING CONSERVATION AND DEVELOPMENT

Kiruben Naicker

Conservation and development have been seen as irreconcilable agendas. The rate of Biodiversity loss continues to spiral out of control, particularly in developing countries. This has warranted a paradigm shift in thinking from conservation or development to conservation for development as a means of enabling development to sustainability. South Africa, a biodiversity hotspot, has undertaken to explore the synergies between several mechanisms deemed to mitigate threats against biodiversity. A suite of incentives are being developed as part of fiscal reform. Biodiversity incentives are created to allow for tax and property rates rebates. These incentives can promote the establishment of formally protected areas. A national Biodiversity Stewardship model provides for the protection of representative biodiversity outside protected areas. Biodiversity offsets are also useful in facilitating a no net loss of biodiversity in the development authorization process. However, regulatory authorities view offsets with trepidation. This is largely due to the abuse of offsets as a passport for irresponsible development. A Biodiversity Investments Portfolio encourages the use of voluntary offsets as a net gain for Biodiversity conservation. Biodiversity Investments Portfolio promotes society to invest in biodiversity as a multi faceted mechanism of investing in their future.

302732 BIOECONOMIC MODELLING OF FISHERY CONSERVATION POLICIES IN THE PHILIPPINES

Maria Rebecca Alviar Campos

The Philippines is surrounded with many fishing grounds. In spite of this, most fishermen in the area live in poverty, and their plight is getting worse, not better. Current fisheries policies for the area have failed to improve the situation but no research has been done to find out why. This report uses a bioeconomic model to simulate the effects of changes in the enforcement levels of current policies. Investments of the government on different levels of enforcement were assessed using benefit cost analysis. The report assesses the effects of enforcing current fisheries policies more stringently. The situation would be transformed into one in which large and perhaps increasing numbers of people would continue to fish, expending larger amounts of effort to comply with various gear restrictions but, in all likelihood, harvesting no fewer fish. Because the bay is already overfished, catch per unit effort and marginal productivity would decrease. Any additional fishing effort in the bay will result in a decrease in the average catch of all fishermen. Enforcement of current policies will not address the underlying problems of open access and the overfishing it leads to.

367945 CONSERVATION REALISM: FAILURE, SUCCESS AND OPPORTUNITY FOR ECOSYSTEM AND BIODIVERSITY CONSERVATION IN MEXICO.

Ernesto C. Enkerlin-Hoeflich

Conservation has over century of history in Mexico mostly from our academic interchange with the USA. Yet only in the recent 25 years has government played and active role sustaining an increasingly active, and constitutionally mandated, conservation agenda. This has resulted in the creation of a number of institutions and programs particularly since the 1992 Rio Summit on Sustainable Development and the ratification of the Convention on Biological Diversity. Conservation failures, successes and opportunity occur and must be measured at appropriate scales. In this case information at a country-wide scale will be presented in terms of growth of program funding and support, expansion of the protected area system, private-public partnerships, participation in international conventions, enhanced policy environment and other indirect measures. Direct measures of impact will be presented that demonstrate success and shortcomings in protected areas, in terms of maintenance of ecosystem integrity, and species-at-risk conservation, by population trends in selected species. Opportunities and gaps will be identified for maintaining direct and indirect conservation in face of climate change, invasive species and global economic meltdown.

315136 THE ROLE OF SOCIAL POLLUTION IN DEPLETION OF NATURAL RESOURCES AND POVERTY ENHANCEMENT IN PAKISTAN

Abdullah Khan, Habib Ahmad

It was hypothesized that Social Pollution is the root cause of environmental degradation and environmental degradation is always visible in the socially degraded environments. We observed that the gains of the so called development were diverted to the intricated network of social pollution resulting in the impoverishment of natural resources leading to an evident increase in the poverty level in Pakistan. The impact of social pollution on the physical environment is also manifold. Air Pollution, surface water pollution, soil and rangeland degradation and forest depletion has caused a loss of 22 billion USD to the country. Worsened law and order situation is another visible impact of social pollution and a prominent threat to the conservation of natural resources. This paper is an outcome of reviewing a number of case studies, which support the hypothesis that Social Pollution is a very organized root cause of the degradation of natural resources resulting in the degradation of culture and enhancement of poverty at the community level.

369296 BIO-ETHANOL IN MALAWI-PROSPECTS AND CHALLENGES FOR COMMUNITY PARTICIPATION

Mxolisi Sibanda, Enos Shumba

European investors are actively seeking land for bio-fuel feedstock cultivation in Southern Africa. This is in response to a recent surge of interest in bio-fuels caused by high prices of imported fossil fuels, insecurity of

supply and climate change concerns. A study was done to examine policy and community participation in this regard in Malawi, southern Africa. Malawi's biofuel policy is still evolving and most legislation has general statements on biomass energy, renewable energy or bio-fuels which are short on specific strategies, institutional frameworks; and, they are not harmonized with other sectoral policies that impact on bio-fuels development. The communities in Malawi are participating in the emerging industry through out-grower schemes but face challenges such as limited land for expansion, lack of water rights and a monopolized market. They require capacity in marketing, negotiation and business operations.

Community-driven conservation

315519 POPULATION STATUS OF MYRISTICA DACTYLOIDES GAERTN. - THRETNED TREE SPECIES IN SACRED FORESTS OF CENTRAL WESTERN GHATS

Raghavendra Shivalingaiah

Prioritization of endangered species to be conserved has gained importance as it is an effective tool to conserve particular species. We prioritized *Myristica dactyloides*, an endangered medicinal tree species in central Western Ghats for assessing its population status in sacred forests that are considered as bio-cultural landscapes. The study was carried out in sacred forests of different sizes in Central part of Western Ghats to test the impact of landscape size on population of *Myristica dactyloides*. Simple random sampling technique was followed for assessing the population structural parameters such as density, basal area, mean tree height and also the regeneration status of the species. It was found from our results that the density of adult population was good in large sacred groves and there was perfect correspondence with the regeneration which was not observed from small sacred groves. The basal area of this tree species was also high in large sacred groves than in smaller ones. It indicates that smaller the size of the sacred forests, lesser the population status because of both spatial availability and also the fragmentation effect. The over all study concludes that as many other endangered tree species like *Myristica dactyloides* are under biotic pressure, they are still being conserved in unique landscapes viz., sacred forests. Hence, the study has relevance in underlining the conservation strategy which should be species specific and habitat specific.

315068 EVALUATING INTEGRATED CONSERVATION AND DEVELOPMENT: CONFLICT RESOLUTION AND MOUNTAIN GORILLA CONSERVATION AT BWINDI IMPENETRABLE NATIONAL PARK, UGANDA

Julia Baker, Nigel Leader-Williams, E.J. Milner-Gulland

Evaluating the conservation impact of integrated conservation and development (ICD) projects is difficult because the links between causes of conflict and biodiversity loss are rarely established. Local dependence on natural resources for subsistence was assumed to be the primary cause of conflict during gazettement of Bwindi Impenetrable National Park, Uganda. An ICD, including subsistence resource harvesting inside the national park by neighbouring communities, was key to improving local attitudes towards Bwindi. However it is unclear how these positive attitudes translate into improved conservation for Bwindi's Mountain gorillas. We assess the conservation impact of the ICD by modelling conflict incidents before and after gazettement

(1986-2000). Most conflict was triggered by arrests of villagers undertaking illegal commercial operations in Bwindi and was instigated by those benefitting financially from the operations. Decline in this conflict type was mainly related to law enforcement, rather than the ICD, which therefore seems limited in its ability to reduce the commercially driven behaviours that inhibit conservation success. Alternative livelihood schemes for villagers employed within the commercial trades are recommended. Thus, by linking conflict with risks to conservation, we can deploy integrated initiatives for resolving conflict strategically to address the socio-economic pressures driving biodiversity loss and deliver conservation goals cost-effectively.

315142 SUPPORTING CONSERVATION OF WETLANDS AREAS THROUGH COMMUNITY-BASED WASTE MANAGEMENT IN JAKARTA - AS A MODEL OF URBAN AREA

Enny Sudarmonowati, Hendra Aquan, Edy Sutrisno, Ady Kristanto

Muara Angke Wildlife Sanctuary (MAWS) is the smallest Wildlife Sanctuary in Indonesia (25.02 Ha) and containing three mangrove species, 17 species of herpeto-fauna, seven mammalian, and 83 species of birds based on surveys in 2008. Efforts conducted to reduce the flow of waste to this area which has been identified one of the most threats to the sanctuary. Clean up has been carried out by surrounding community and volunteers of Jakarta Green Monsters (JGM) with 200 people for 2 hours every three months each time has resulted 10 tons of waste. It has been found that 10% of the population in the neighborhood close to the MAWS still use river for disposing their waste. Environmental education has also been conducted in these neighborhoods. The results of focus group discussion showed that only five highly motivated housewives through their family welfare association (PKK) run the activities related to plastic waste processing to produce various handicraft products. Compost processing has been on going activities involving 200 people. The "Knowledge-Attitude-Practice" survey has been conducted prior to the commencing of the waste management training and the degree of change could be measured after a period of time.

315620 INDIGENOUS KNOWLEDGE AS CONSERVATION SCIENCE: THE CASE OF KAM SWEET RICE VARIETIES IN GUIZHOU, CHINA

Jason Yu-Xiao Long

Drawing on the preliminary findings from recent field research concerning indigenous agrobiodiversity knowledge in relation to conservation of genetic resources such as the Kam Sweet Rice (KSR) varieties in Guizhou, China, this presentation shall demonstrate that indigenous knowledge systems of biodiversity held by ethnic minorities on China's cultural frontiers have long functioned in fact as conservation science. The case study of indigenous knowledge of KSR varieties in association with bio-cultural diversity conservation (funded by a research grant from the Ford Foundation), as featured in a news article of the 9 May 2008 Issue of Science Magazine, was conducted during 2006-2008 with interdisciplinary perspectives centering on ethnobotanical techniques and emerging jurisprudential theories of genetic resources. Indigenous conservation practices and complex forms of traditional wisdom embedded therein, as exemplified in the case of KSR varieties, apparently have much technical substance to contribute to contemporary conservation science, while they have offered important heuristics for the emergence of more viable conservation policy in

China.

315156 TOURISM, LOCAL LIVELIHOOD AND CONSERVATION: A CASE STUDY IN INDIAN SUNDARBANS

Indrila Guha, Santadas Ghosh

This study primarily examines the contribution of tourism on improving livelihood of the local people in a remote island village of Indian Sundarbans. The study shows that with the arrival of visitors in an island village bordering mangrove delta forest, local people spontaneously availed the opportunity to enter into various tourism-related service provisions. They are mostly landless and marginal households who mostly depend on direct forest exploitation. The study finds 78% of the local service providers operate with nil or very small capital investment. No local household survives only out of tourism-money as such jobs are only seasonal. Yet households participating in tourism are found to retain the tourism-money for financing their year-long expenses. Tourism-participant households are found to spend 18.5% more on food and 36.3% more on non-food items per-capita compared to non-participants. The proportion of forest-dependent households is found to be significantly lower among the tourism-participants. This is indicative of substitution of forest-based earning by tourism-earning. Regarding tourism's possible effects on social culture, the villagers' overall perception is found to be positive. However, a significant section of villagers take cognizance of the growing income-inequalities resulting from tourism-money. The study envisages a carefully crafted policy for promoting nature-based tourism with more room for locals' participation.

Landuse planning for conservation

315261 AN APPROACH FOR SETTING MINIMUM PROTECTED AREA SIZE IN SYSTEMATIC CONSERVATION ASSESSMENTS

Robert J Smith, Enrico Di Minin, Simon Linke, Daniel Segan, Hugh P. Possingham

Systematic conservation planning software is often used to identify protected area (PA) networks for conserving different habitats and species. This involves dividing the study region into a number of planning units and using the software to identify portfolios of these units that meet targets for each of these conservation features. For logistical and ecological reasons, conservation practitioners often want each PA within a portfolio to be of a minimum size, but achieving this can be problematic. One approach is to use planning units that are larger than this minimum PA size but this produces inefficient results. A better alternative is to use smaller planning units together with software, such as Marxan, that can preferentially select patches of units by allowing a portfolio's fragmentation level to be adjusted. Thus, the fragmentation level of the portfolio can be reduced until even the smallest PA meets the size threshold. However, this approach also creates inefficiencies because it increases the size of every PA rather than targeting those that are too small. Here we describe MinPatch, a software package that overcomes this problem by removing PAs that are too small and using a cost and complementarity-based algorithm to replace them with PAs of the minimum size. We illustrate the approach using Marxan data from Maputaland, South Africa, and show significant increases in efficiency and changes in the location of some priority conservation areas.

306666 PATTERNS CROP-RAIDING BY ELEPHANTS IN BUXA-JALDAPARA, WEST BENGAL,INDIA

Mukti Roy

The elephant habitat in northern West Bengal, India, is a part of the Eastern Himalaya biodiversity hotspot and the western most limit of northeastern asian elephant population. The habitat is characterized by a high degree of fragmentation and intense elephant-human conflict resulting not only in loss of agricultural crops and property but also in the death of (~50) human lives annually (Lahiri-Choudhury 1975). On the other hand, the elephant population here is believed to be less than 500 individuals (Sukumar et al. 2004). We have been studying the ecology and economics of elephant-human conflict, and experimenting with methods to mitigate the conflict.

There are a total of 24 villages in the area cultivating 5288 ha of land situated in and around the Buxa-Jaldapara area. This was monitored during 2001-2004 to study elephant-human conflict. We visited the villages every fortnight and collected data on various crops cultivated and studied the damaged by the elephants. Additionally, data on crop biomass consumption by elephants were also collected from damaged and undamaged sample plots.

Elephants damaged on an average 3.5% of the total crop cultivated. Crop fields in enclosure (5.2%) and corridor villages (5.1%) experienced higher damage than those in peripheral villages (1.7%).

315526 STUDYING THE THREATS TO THE BIODIVERSITY OF GOLESTAN BIOSPHERE RESERVE, IRAN

Hamta Golkarian, Mohammad Mehdi – ahmadi

Golestan National Park (GNP) is situated in the highlands of the Caspian region in northeast of Iran. It's defined as transition zone between Hyrcanian and Irano-Touranian floristic region, and this makes park rich in fauna and flora. The richness of biodiversity in this area is amazing. It has more than 150 bird fauna (one third of Iran's total bird species), more than %50 of total mammal species and also one fifth of the whole country's flora. GNP is a representative of hyracanian relic forests and holds a variety of endemic and sub endemic elements of this floral province and also supports 16 European rare birds. To conserve rich biodiversity of the area, outstanding landscapes, relic and endemic flora, threatened mammals and birds, unique cultural heritage and ancient historic monuments, It has been protected as a national park since 1970. Because of its enormous values, it also has entitled Biosphere Reserve since 1976. But its biodiversity is strongly endangered caused by different parameters. One of the most controversial issues is the Asian Highway in Golestan Province that continues through the GNP and has divided the habitat into two separated habitats that intensely threatens the biodiversity of GNP. In this study, the threats to the biodiversity of Golestan Biosphere Reserve and also some remedies are discussed.

315046 TOWARDS RED LIST CRITERIA FOR THREATENED ECOSYSTEMS

Jon Paul Rodriguez, Kathryn M Rodriguez-Clark, Jonathan E M Baillie, Neville Ash, John Benson, Tim Boucher, Claire Brown, Neil Burgess, Ben Collen, Michael Jennings, David A Keith, Emily Nicholson, Carmen Revenga, Belinda Reyers, Mathieu Rouget, Tammy Smith, Mark Spalding, Andrew Taber, Matt Walpole, Irene Zager, Tara Zamin

The conservation of individual species has been advanced greatly by the International Union for Conservation of Nature's (IUCN) development of objective, repeatable, and transparent criteria for assessing extinction risk, which explicitly separate the process of risk assessment from priority-setting. At the IV World Conservation Congress (Barcelona, Spain, 2008), a resolution was adopted to initiate a consultation process for the development, implementation and monitoring of a global standard for the assessment of ecosystem threat status, applicable at local, regional and global levels. We present a new proposal for developing Quantitative Thresholds for Categories and Criteria of Threatened Ecosystems, analogous to those currently in use for species. The Criteria are based on indicators of changes in extent, composition, structure and/or function of ecosystems (and indirectly on the delivery of ecosystem services), and have their conceptual roots in ecological theory and field research. We illustrate the methods by introducing a series of examples of the application of the criteria at multiple spatial scales. Most work to date has focused on terrestrial ecosystems, but analogous thresholds and criteria for freshwater and marine ecosystems are under development. These are the first steps of a major global consultation process that would lead to a unified proposal for consideration by the next World Conservation Congress.

315667 CATTLE BOS TAURUS-PRAIRIE DOGS CYNOMYS LUDOVICIANUS INTERACTIONS: NEW WAYS TO RESTORE AND MAINTAIN ARID GRASSLANDS IN NORTHERN MEXICO

Rodrigo Sierra Corona, Gerardo Ceballos González, Ed Fredrickson, Rurik List

Chihuahuan Desert grasslands are undergoing a rapid transition to desert scrub conditions. By removing prairie dogs for the perceived idea that they compete with cattle, livestock owners have created a cascade of events ending in landscape desertification and depauperate socio-ecological conditions. Attempts to recover desertified landscapes have been mostly tenuous and seldom cost effective. Our goal was to develop a better understanding of ecosystem drivers and their interactions, within a large prairie dog *Cynomys ludovicianus* complex in northwestern Chihuahua, Mexico. Beef cattle *Bos taurus* habitat selection was measured on a desert grassland-prairie dog ecosystem using GPS, GIS, and remote sensing technologies inside a 4 x 4 km pasture. To classify vegetation we used multispectral Quickbird imagery with 60 cm resolution and eCognition software. We grouped the vegetation in 6 different types: *Aristida* spp. (50%), *Pleuraphis mutica* (8%), *Panicum obtusum* 8%, *Bouteloa gracilis* (15%), *Amaranthus palmer* (4%) and prairie dog colonies (15%). Analyses of cattle movements during the dormant season showed a direct preference for the prairie dog colonies, with minimal use of other vegetation types. Beef cattle showed a preference to forage near the margins of the prairie dog colonies. From these observations we further hypothesize that cattle-prairie dog interactions may promote the formation and maintenance of desert grasslands in this region.

Spatial ecology and conservation

315405 IMPACTS OF LANDSCAPE DISTURBANCE ON AVERAGE HABITAT SPECIALIZATION OF PLANT COMMUNITIES

Jean-Claude Abadie, Audrey Muratet, Nathalie Machon, Emmanuelle Porcher

The replacement of specialist species by generalist species, generating biotic homogenization, is commonly observed in disturbed natural communities, but the exact mechanisms involved are seldom identified. Here, we address the role of landscape disturbance as a driver of plant community composition in the highly human-impacted Parisian region (France), by examining whether habitat fragmentation (spatial changes) and habitat turnover (temporal changes) in the landscape surrounding a given site are associated with changes in taxonomic diversity and average habitat specialization.

We observed that increased habitat fragmentation and habitat turnover are associated with higher local species diversity, but also higher similarity among communities, a typical case of biotic homogenization. Increased habitat fragmentation around a given site was also associated with a decrease in average community specialization, regardless of the site habitat. In contrast, increased habitat turnover in the surrounding landscape was negatively associated with a decrease in average community specialization in forest sites only, i.e. in the most stable habitat type.

Our results suggest that landscape processes play a major role in the decline of specialist vs. generalist plant species, and provide additional evidence that not only rare species, but also common species are threatened by human activities in the long-term, with possible consequences for ecosystem functions and services.

315561 MODELING THE DISTRIBUTION OF SIBERIAN MARMOTS (*MARMOTA SIBIRICA*) USING MAXENT, BOOSTED REGRESSIONS TREES, AND GAMS: FINDINGS AND COMPARISONS

Karl Didier, Susan Townsend, Samantha Strindberg

We modeled the distribution of Siberian marmots across the 250,000 km² eastern steppe of Mongolia. Presence data were collected from 2005-2007 using driving transects and distance sampling techniques. We produced spatial models of occupancy using Maximum Entropy (MaxEnt) and Boosted Regression Trees (BRT). Models were trained using 171 of 244 observations and 10,171 background locations sampled from a 1-km wide transect buffer, and accuracy assessed using the remaining n=73 observations. We constructed models using (1) environmental predictors (e.g., mean annual temperature) alone, (2) anthropogenic predictors alone (e.g., livestock competition), and both. Models with both sets of predictors performed best, then anthropogenic variables, and then environmental variables (MaxEnt AUCs = 0.83, 0.81, and 0.78). Based on MaxEnt's jackknifing technique, the intensity of hunting by nomadic herders (contribution = 26.5%) was consistently the most important predictor, followed by mean annual temperature (21.3%). Both MaxEnt and BRT models performed well, although the model accuracy was slightly higher for the BRT (AUC = 0.86) than the MaxEnt model (AUC=0.83). Maps showing the probability of presence for the entire study region were created by projecting models to the entire study region. Currently, we are using our distance-based sampling techniques and Generalized Additive Models to produce density surfaces for the study region, and will compare these to occupancy maps.

364675 NON-RANDOM SEED DISPERSAL PATTERNS IN HETEROGENEOUS LANDSCAPES: SPATIAL AND GENETIC CONSEQUENCES AT EARLY RECRUITMENT STAGES

Cristina Garcia

There is growing evidence that vertebrate-generated seed rain patterns show demographic and spatial limitations due to strong selective foraging movements. However, we largely ignore the genetic outcomes associated with non-random dispersal in heterogenous landscapes. Currently, this is a highly relevant issue given the extent of habitat fragmentation leading to changes dramatic changes in the landscape structure. We specifically hypothesized that the spatial distribution of deposition sites not only influence the demographic aspects in the recruitment dynamic, but it also strongly determine the overall genetic variation and the spatial genetic structure in the seedling rain.

In order to explore this issue we developed a spatial-explicit individual-based model to assess the spatial and genetic outcomes at early recruitment stages that result from non-random dispersal under distinctive landscapes with different distribution of deposition sites. By applying sensitivity analysis and spatial-explicit GLM models we document a significant decreased in the overall genetic variability coupled with a strong spatial structure in those strongly structured landscapes, specifically those following a patchy or gradient pattern. Therefore, pervasive genetic effects linked to non-random seed dispersal needs to be considered when evaluating the fate of plant populations inhabiting fragmented or deforested landscapes subjected to dramatic spatial changes.

303241 RANGING PATTERNS, PREDATION ECOLOGY AND DISPERSAL OF RADIO-COLLARED TIGERS IN KANHA TIGER RESERVE, CENTRAL INDIA

Joseph Vattakaven, Yadavendradev Jhala

This study in the Kanha Tiger Reserve, central India used Satellite, GPS, and VHF radio-telemetry to estimate home ranges and dispersal of tigers between 2004 and 2008. Ten tigers were radio-collared for the study. Kills made by tigers were also examined in the study area, and kill details collected. Tiger scats were collected, and analysed in the laboratory. Tigers were radio-tracked daily and also continuously for 8-10 day periods from elephant back to obtain predation data.

The estimated average 95% kernel home range of four adult female tigers was 10.37 sq km (SE=0.65) and that of two adult male tigers was 110.34 sq km (SE=11.73). The predation data obtained from kill examination (n=105), and tiger scats (n=174), shows that the main prey of tigers in the intensive study area is chital (over 70%). The average feeding interval of female tigers was found to be 37.54 hrs and average predation interval was 61.33 hrs.

The dispersal of 4 sub-adult male tigers from their natal areas indicates that the areas beyond the reserve buffer are not very conducive to dispersal. We recommend conservation measures such as corridor restoration and protection for tigers to move between meta-populations in this human dominated landscape.

315433 SEED DISPERSAL BY MEGAHERBIVORES: ARE THERE GENERAL PATTERNS EMERGING FROM BODY MASS ALLOMETRIES?**Luis Santamaria, Asier R. Larrinaga, Javier Rodriguez-Perez, Ahimsa Campos-Arceiz**

Megaherbivores, the most endangered group of herbivores, are considered to have special ecological functions arising from their large body mass (traditionally defined at 1000 kg). Such functions include seed dispersal, with examples of tight co-evolutionary relationships (e.g. plants showing very large seeds or fruits) and specific seed dispersal patterns (e.g. large dispersal distances, but dense "packages" of deposited seeds). We use allometric relationships between body mass and the food retention time, daily movement distance and home range of herbivores to investigate the characteristics of dispersal by megaherbivores. Saturation of the scaling slopes of food retention time at approximately 50 kg suggest that qualitative changes in potential seed dispersal distance take place at weights well below the traditional 1000 kg threshold. Indeed, a comparison of the scaling slopes of daily movement distance and home range indicates that the determinants of seed dispersal change around such 50 kg threshold. Below it, mean dispersal distance is determined by the size of the home range, while it is determined by movement speed (daily movement distance) for larger herbivores. These results have a strong bearing on the methods use to study dispersal by herbivores. Knowledge of factors determining home range and habitat use will be required by small herbivores, while those affecting movement (running speed, navigation rules, feeding rhythms) will be required for large herbivores.

314497 DUNG BEETLES ON FORESTED TROPICAL LAND-BRIDGE ISLANDS: COMMUNITY ASSEMBLY AND IDIOSYNCRASY**Lan Qie**

Forest fragmentation in the tropics is attracting much interest and concern from researchers. This study looked at the community ecology of dung beetles (Coleoptera: Scarabaeidae) on the forested land-bridge islands of Lake Kenyir, Peninsula Malaysia. Twenty-five islands of varying sizes (0.5 - 372 ha) and three mainland control sites were sampled for dung beetle diversity and abundance using baited pitfall traps. Ordination methods and Generalized Linear Models (GLMs) were used to examine the community assembly patterns and the potential biotic and abiotic determiners of species richness and abundance. Area emerged to be the most important predictor for species richness and abundance of the island dung beetle communities. The communities were not significantly nested and, close to the observed threshold island size for dung beetle persistence (0.5-4 ha), species compositions of small islands are idiosyncratic. Although there was great dissimilarity among this group of small islands, vegetation structure and presence of primates are most important in determining the dung beetle species richness and abundance. Dung beetles provide multiple ecosystem services and have been shown to be closely associated with mammals. This study sheds light on conservation planning for not only protecting this functionally important group of species but also for maintaining functioning forest ecosystems.

Amphibian and reptile conservation

AN ACTION PLAN FOR TURTLE CONSERVATION IN CHINA AND A BRIEF INTRODUCTION ON OUR CONSERVATION AND RESEARCH EFFORTS OF TURTLES IN CHINA

Haitao Shi, James F. Parham, Kevin Buley, Micheal Lau, Donna O'Connell, Jonathan Fong

China has a rich turtle fauna with approximately 35 native species. However, turtles have been exploited in China as food and for Traditional Chinese Medicine for thousands of years. This exploitation has become unsustainable. There is a lack of distributional, taxonomic, and ecological data. Basic ecological data are available for only 10% of Chinese species. All native turtle species are endangered, but less than 25% are listed as 'State Major Protected Wildlife'. Today, the Chinese turtle trade is impacting other populations. Effective legislation and enforcement for trade control is difficult due to insufficient survey data and the lack of a practical identification manual. The captive breeding turtles in China has been growing rapidly with a potentially negative impact on turtle conservation. Conservation education is seriously inadequate, as most Chinese people are unaware of the critical status of turtles. As a result, turtle conservation is given a very low priority. Consequently there is a desperate need for an integrated and specifically targeted approach to turtle conservation in China.

Our Action Plan incorporates eight areas. 1. Capacity building will develop and support the Chinese scientific community and encourage programs for research, training and collaboration. 2. Research plans will be formulated, and a network of turtle researchers will be developed while encouraging young scientists to become involved. 3. Trade monitoring will involve documenting the extent of the turtle trade and the adoption of relevant measures to enhance enforcement and monitor changes in the trade. The development of a practical identification manual for Chinese officials and biologists is essential. 4. Legislation efforts will include the lobbying of relevant government officials. Existing laws need to be modified and new regulations must be proposed to minimize current conflicts among different laws. 5. Captive breeding efforts will be investigated to understand their influence on wild populations, enhance effective management and provide guidance. 6. Rescue centers, 2-3 in South China, will be established. 7. It is essential to establish 3-5 nature reserves in areas of high turtle diversity in southern China. 8. Education: we will design an education plan including a set of effective education materials and initiate an extensive education campaign across a wide sector of the public and wildlife and government officials. Our efforts in this action plan will be reviewed.

315288 AN EVENING OF SONG: COMMUNITY MONITORING OF FROGS

Wendy Foster

Public involvement in wildlife monitoring can provide valuable information for environmental managers as well as providing a structured way for people to learn about the natural world. In South Australia, 14 years of public involvement in frog monitoring has seen 3 000 participants collecting more than 22 000 frog records; approximately three times as many collected by formal survey methods. The program had required participants to collect cassette recordings of frog calls, which were then analysed by an expert. This created a bottleneck, limiting the number of samples that could be processed and also slowing feedback to participants. In 2008 the program utilized new technology to shift to a web-based system

(www.frogatlas.com.au) in which participants enter data online directly into the database, uploading calls which they or others can be trained to analyse. This move has provided participants with real-time feedback on their personal contribution to the project through a member's area, as well as information about general frog distributions through access to the combined data set. Participants found the Frog Census program was enjoyable, easy to be involved with and fitted with their environmental ethos. Information gained from volunteers has led to the known ranges of several species being expanded, and has been incorporated into government planning and management programs.

315395 CLIMATE CHANGE IN THE IBERIAN PENINSULA IS A SERIOUS THREAT TO AMPHIBIANS AND REPTILES

Silvia Carvalho, José Carlos Brito, Eduardo Crespo, Hugh P. Possingham

Current climate change is a major threat to biodiversity. Species unable to adapt or move will face local or global extinction and this is more likely to happen to species with narrow climatic and habitat requirements and limited dispersal abilities, such as amphibians and reptiles. The impact of global warming on biodiversity is likely to be most severe in biodiversity rich regions which are predicted to be affected by more severe climate change, such as the Mediterranean region, and in particular the Iberian Peninsula. Here we assess the impact of climate change in the herptiles of the Iberian Peninsula by predicting species distributions for three different years in the future (2020, 2050 and 2080) using an ensemble of bioclimate models, under different emission and dispersal scenarios, and different global circulation models. Our results show that species with Atlantic affinities that occur mainly in the North and North-western Iberian Peninsula will have their potential distribution severely reduced. Seventeen species may completely lose suitable habitat by 2080, eight of each are Iberian or Pyrenean endemisms and hence are likely to become extinct. We will discuss new ideas about how models of predicted distributions present challenges for conservation actions in terms of where to locate future reserves, how to connect them, and when is the best time to allocate funds for particular actions.

366880 ENVIRONMENTAL FACTORS AFFECTING GAS EXCHANGE IN SEA TURTLE NESTS

Michael O'Connor, Shaya Honarvar, Paul R Sotherland, James Robert Spotila

Sea turtle nest development is one of the life stages where conservation efforts for sea turtles have been shown to be potentially effective. The sandy environment of developing sea turtle eggs creates a significant resistance to both diffusive and convective exchanges of respiratory gases. Data suggest that the resulting relative hypoxia and hypercarbia affect egg metabolism, development times, and hatching success. Unfortunately, the magnitudes of the induced resistances are not clear and quantitative dependences on nest depth and density are unknown. We modeled the effects of several environmental factors on concentrations and fluxes of O₂ and CO₂ by numerically solving the Stokes equations for creeping flow in a porous substrate. Models argue that: 1) Convection caused by metabolism with a low RQ will slightly increase O₂ and CO₂ concentrations. 2) Crowding of nests in arribada nesting species could limit O₂ concentrations and nesting success. 3) The deeper nests constructed by larger sea turtle species provide larger resistances to gas exchange. Such models are computationally intensive, but can be used to predict under which circumstances gaseous exchanges might limit metabolism and development.

314509 SOME ASPECTS OF ANURAN CONSERVATION IN A SOUTH AFRICAN LANDSCAPE**Mohlamatsane McDonald Mokhatla, Chris Chimimba, Berndt Van Rensburg**

Amphibian populations worldwide are being significantly threatened by anthropogenic activities and constitute the least represented taxon within current global conservation network. Using frog richness data from South Africa, random draw techniques and correlation analyses were used to examine the nature and extent of anthropogenic threats in important frog areas (IFAs) for conservation, and to investigate the relationship between frog species richness and the proportion of protected land. Our results indicate that IFAs for frog conservation were characterised by higher levels of alien plants species richness, land use transformation and human population density than expected by chance. These anthropogenic threats were most prevalent within sensitive biogeographic regions such as Maputaland and the South-western Cape. A positive, but rather weak relationship was found between frog species richness and the proportion of protected land. The strength of this relationship increased significantly after considering the wider unprotected matrix. These results suggest that frog biodiversity, at least in South Africa, are, on average, equally well-represented in small and large protected areas. Finally, our results highlight the importance of the wider off-reserve matrix to adequately conserve frog assemblages in the long-term.

307718 REPRODUCTIVE MONITORING AND SEX IDENTIFICATION OF A MONOMORPHIC NEW ZEALAND FROG USING URINARY HORMONE METABOLITES**Jennifer Germano, Frank Molinia, Phil Bishop, Ben D. Bell, Alison Cree**

With the world facing an amphibian extinction crisis, management techniques such as captive breeding and translocations have become more important for conservation. For effective management practices, it is imperative that we develop a non-invasive technique for elucidating details about reproductive biology and for sex identification in monomorphic species. *Leiopelma pakeka*, the Maud Island frog, is a monomorphic endemic frog found in New Zealand and represents one of the world's most archaic lineages of frogs. It spends the majority of its life under rocks, making conventional research difficult for determining details about reproduction. Enzyme immunoassays were developed to measure metabolite concentrations of estrone conjugate, testosterone, and progesterone (relative to creatinine) within the urine of *L. pakeka*. Seasonal fluctuations in concentrations of testosterone and estrone conjugates suggest an earlier breeding season than previously thought. Additionally, differences in the concentrations of urinary estrone conjugate between males and females provide us with a minimally invasive way to identify the sex of adult individuals for this species. While non-invasive urinary hormone monitoring has been used for years to identify sex and track fluctuations in reproductive hormones in mammals and birds, very little has been done in other taxonomic groups. This study is the first to do so for a monomorphic amphibian.

Environmental or ecological economics

305639 BIODIVERSITY VALUATION OF PROTECTED AREAS: THE CASE OF BANYANG-MBO WILDLIFE SANCTUARY (BMWS), SWP, CAMEROON

Diangha Mercy Nambu

Banyang-Mbo Wildlife Sanctuary (BMWS) is rich in biodiversity but traditional respect for its biodiversity has diminished, in part because the values of goods and services it offers are more implicit than explicit. Also, management of this area involves many stakeholders holding contradictory views and values of biodiversity, which are often not recognised yet may have major impact in management. This study was conducted with the specific objectives of understanding the term biodiversity, the values of biodiversity as perceived by stakeholders, and their willingness to pay (WTP) to conserve it. Data were collected through focus groups and household surveys. The contingent valuation method was used to estimate the economic values with emphasis on selected components of use and non-use values. Stakeholders' definition of biodiversity ranged from basic to comprehensive. Respondents found BMWS of benefit for its regulatory, carrier and production functions and also for its cultural, spiritual and aesthetic values. Most respondents (89.2%) recognised the area for its direct use value and were willing to pay for its conservation. Expressed WTP by respondents adds to the value of BMWS with serious consideration on its non-marketed potentials. Identified specific interest and values held by stakeholders can serve as points through which incentives or disincentives can be introduced to ensure the conservation of BMWS's biodiversity.

317821 GLOBAL CONSERVATION AND THE ALLEVIATION OF POVERTY

Will Turner, Katrina Brandon, Thomas Matthew Brooks, Holly Gibbs, Keith Lawrence, Elizabeth Selig

The benefits of biodiversity conservation to human well-being are controversial, largely because the benefits are scale-dependent, and most existing studies are highly localized case studies. These are contrasted with generalized global-scale studies, e.g., one which values Earth's ecosystems at \$33 trillion in services to humans. While ecosystem services may be vital to the lives and livelihoods of the poor, broad-scale research demonstrating the importance of these services and their contributions to poverty alleviation and development are lacking. We analyze new, state-of-the-art datasets of carbon stores, hydrological flows, population, and poverty to value ecosystem services to human communities at the scale where users receive the benefits. We then estimate the value of natural habitats to the world's poor if mechanisms were developed to compensate local populations for protecting these services. Comparing mapped results to the distribution of terrestrial biodiversity, we find, e.g., that loss of the 25% of places most important for saving species would cut almost half (47%) of the benefits that nature can provide to improve the well-being of the poor. Conservation can not alleviate all poverty, and trade-offs remain. Yet this work suggests that biodiversity conservation and poverty alleviation share win-win synergies, that compensation schemes are needed to realize these synergies, and that biodiversity conservation is fundamental to sustainable economic development.

365973 CLARIFYING THE OPPORTUNITY COST OF CONSERVATION- CONCEPTS AND APPLICATION FOR PRACTITIONERS

Patricia Zurita, Eduard Theodorus Niesten

The concept of opportunity cost lies at the heart of economic analysis of decision-making. As efforts to address biodiversity conservation challenges become increasingly grounded in economic appreciation of the factors driving resource use, it is therefore important that conservation practitioners are equipped with a clear understanding of this concept. Given that well-trained economists can exhibit an imperfect grasp of opportunity costs (Ferraro and Taylor 2005), a degree of confusion among conservation practitioners is understandable; this presentation provides conceptual clarification with practical examples to inform design of conservation interventions. The presentation also employs the opportunity cost concept to identify project-specific challenges that must be addressed explicitly to achieve long-term sustainability. Fundamentally, biodiversity conservation requires that people change resource-use patterns and thereby incur an opportunity cost; hence, clarity regarding the concept is crucial to the design of successful tools and strategy. As conservation increasingly relies on incentive-based approaches (easements, set-aside payments, conservation covenants, payments for environmental services, etc.), opportunity cost becomes ever more relevant in terms of making conservation viable and attractive to resource owners, and with respect to design of efficacious and cost-effective interventions.

315686 ECOLOGICAL ISSUES AND LOSS RISK OF COLD-RESISTANCE RUBBER GERMPLASM BRED AND PLANTED IN XISHUANGBANNA

Yan-Ping Chen, Zhao-lu Wu

Rubber cultivation at high latitude, not only supplying key raw material for national industry but also bringing heavy threat to natural rain forests, has been debated for a long time. In this study, the breeding and utilization of high cold-resistance and productivity rubber germplasm (HCRG) for rubber cultivation in Xishuangbanna, Southwestern China and its ecological impact as well as loss risk of the HCRG were analyzed, based on the information from literatures and field survey. The results indicated that cultivating rubber nursery and rubber plantations is a general cycle model for rubber farmers. The abuse of the HCRG makes the rubber plantations expand to upland with an elevation of 1300 m, which results in serious ecological issues such as destroying nature forests and species, increasing regional drought, reducing soil fertile, causing rubber diseases and insect pest, and boosting wildlife-human conflicts. The human-elephant conflict caused by rubber plantation in Xishuangbanna has markedly impacted the regional sustainability. The HCRG and the intellectual property right are running off without any control, making even more potential ecological and economic risks. The authors argued that agency for nature rubber production should pay great attentions, and take effective measures, to conserve the HCRG and reduce the potential risks.

308000 DO EXOTIC LIVESTOCK BREEDS BRING HIGHER PRODUCTIVITY THAN INDIGENOUS ONES IN SMALL HOUSEHOLDS IN ARID AND SEMI-ARID AREAS?

Yanbo Li, Wenjun Li, Mingming Fan

Livestock diversity, which is an important part of biodiversity, has greatly decreased since indigenous livestock breeds are being displaced with a few of exotic high-performance ones. The fundamental reason for such displacement is that exotic breeds have higher productivities. But is higher productivity can really be achieved in small households in arid and semi arid areas which are confined in multiple resources and face high ecological risks? Yongsheng Cun, a village located in the farming-pastoral ecotone of east Inner- Mongol, China, is importing Australia Merino to displacing the indigenous fat-tail sheep under a sheep breed improvement program. We divided the sub-villages of this village into three groups based on the level of their process in sheep breed improvement and household interviews were carried out in twenty households in the three groups in Jun. and Jul. 2008. It was found that, after the breed improvement, inputs of capital, forage and labor increased in all villages, while output increased only in a few villages with convenient traffic, and decreased in other villages; considering the limiting factors, breed improvement didn't increase the productivity of capital, decreased the productivity of forage and induced higher risk. It can be concluded that improving productivity can not be take as a reason for displacing indigenous livestock with exotic breeds in small household in arid and semi-arid areas.

315216 AN ANALYSIS OF THE EFFECTS AND PROBLEMS OF ECOLOGICAL MIGRATION POLICY

Mingming Fan, Wenjun Li

The natural environment is the foundation of our human being's survival and development in some ecological fragile areas in western China, in order to protect the local environment, ecological migration policy has been widely implemented. Through home interviews, talking with local officials and field research methods, our fieldwork at X Banner reveals that the ecological migration policy reflects the complex relationship between nature and herdsman, herdsman and social, as well as social and natural. During dealing with the relationship, the most direct stakeholders "herdsman" and the natural environment has not been given enough consideration, but the outside society whose direct representative is the "Government" , makes the decision. It makes the policy do not achieve the desired results on ecological, economic, and social objectives. Such as the degradation of the grassland after the the absence of livestock, and emerging problems in employment, living habits and so on after migration .

319061 SUSTAINABLE UTILIZATION OF ECOSYSTEM SERVICES: A CASE STUDY OF THE NORTHERN SLOPE OF TIANSHAN MOUNTAINS

Bo Li

It is recognized that ecosystem services play an important supporting function in social sustainable

development. Its stability maintenance and efficient utilization get more attention. The northern slope of Tianshan Mountains is the key area of the western development and the eco-environment problems, caused by social economic development recently, restricts the sustainable development. The paper made a systematically discussion on the optimum combination and sustainable utilization principle of ecosystem services in the northern slope of Tianshan Mountains, based on the previous research achievements of study team. The results showed that the whole regional ecological environment maintained stability comparatively, but partial areas deteriorated and received the obviously disturbance, especially oasis. Measures should be taken from five aspects followed: (1) keep balance and comprehensive utilization in services use, (2) keep long-term utilization of services, (3) keep spatial balance in services use, (4) establish the mechanism of monitoring, evaluation and early warning, (5) optimize economy layout. Adjustment of policy, system and custom action should be adopted to avoid the ecological degradation and mass loss of ecosystem services for the aim of sustainable development.

Alien and invasive species

315723 THE ROLE OF SPECIES TRAITS IN THE ESTABLISHMENT SUCCESS OF EXOTIC BIRDS

Tim Blackburn, Phillip Cassey, Julie Lockwood

There is now abundant evidence that propagule pressure (the number of individuals released into the non-native location) is the most consistent predictor of establishment success in exotic species. An effect of propagule pressure is expected because larger propagules ameliorate the effects of demographic, environmental or genetic stochasticity, or of Allee effects. However, these reasons also lead to the expectation that species traits should influence success. A quantitative meta-analytical approach was adopted to assess the effect of three categories of species traits in the establishment of non-native bird species: traits relating to population growth rates, traits that predispose species to Allee effects, and traits that enable a species to cope with novel environments. Traits that predispose species to Allee effects tend to decrease introduction success, whereas traits that enable a species to cope with novel environments tend to increase success. The breadth of habitats a species uses has the strongest mean effect ($Z = 0.38$) of all variables analysed here. These results suggest a likely influence of some species-level traits on exotic bird establishment success, especially traits that enable a species to cope with novel environments. Considering the effects of species-level traits on establishment success in terms of the small-population paradigm from conservation biology may be a productive avenue for future research.

314786 THE IMPACT OF FRUIT FLY (TEPHRITIDAE) MANAGEMENT ON THE CONSERVATION OF ENDEMIC HAWAIIAN DROSOPHILIDAE DIVERSITY

Luc Leblanc, DANIEL RUBINOFF, ROGER VARGAS

The Hawaiian Islands support the greatest drosophilid diversity in the world (over 900 endemic species), including several officially endangered species. Hawaiian *Drosophila* have been formative in nearly 100 years of research in genetics, evolutionary theory and conservation. Hawaiian farmers are plagued by invasive pest fruit flies (Tephritidae) and use a variety of control measures, based on female food attractants

and synthetic male lures as safer alternatives to insecticide cover sprays, which may result in non-target impacts on endemic *Drosophila*. To evaluate these risks, baited traps were maintained and emptied weekly along five altitudinal transects on the islands of Hawaii and Maui, cutting across agricultural, non-native and mixed forest and intact Hawaiian forest habitats. Male lures failed to attract drosophilids. A female lure, however, proved to be a potent drosophilid attractant. Of the 283 described endemic species known to occur in the sampled areas, 123 were collected, but over 99% were collected only in forest, at altitudes above 900 meters, largely away from fruit growing areas. Fruit fly lures may be safely used if traps are set at least 200 meters away from native forest. The distribution of endemic and invasive Drosophilidae in endemic forest and agricultural areas and the implications are discussed. Understanding the scale and degree of non-target impacts is essential to conservation of native insect biotas.

315367 SUCCESSFUL DEVELOPMENT OF A NON-LETHAL FORM OF MANAGEMENT FOR INVASIVE VERTEBRATE PESTS IN AUSTRALIA

Tarnya Elizabeth Cox, Peter J Murray, Graham P Hall, Xiuhua Li

Previous studies on the effects of carnivore odours as repellents for invasive and pest species have been strongly geared towards the use of eutherian odours on eutherian pests. While for many countries this approach is adequate, Australia is in the unique situation of having both introduced eutherian and native metatherian invasive and pest species. To address the gaps in this knowledge, we evaluated the effect of eutherian and metatherian carnivore faecal odours on eutherian and metatherian invasive and pest species in Australia. Lion, tiger, dingo and Tasmanian devil faecal odours were tested against goats and eastern grey kangaroos. Tiger and lion faecal odour was effective at deterring goats from feed while Tasmanian devil and dingo faecal odour was not. Only lion, tiger and dingo faecal odours were 100% successful in deterring kangaroos from feed. These results suggest a phylogenetic response with eutherian odour more effective ($P=0.03$) than metatherian odour. Success in the testing of these odours as non-lethal repellents is an important breakthrough for a variety of wildlife managers in Australia, predominantly those in areas where lethal forms of control such as shooting and baiting are inappropriate or considered inhumane and other non-lethal forms such as trapping are inappropriate for the species.

315334 ASSESSING ENVIRONMENTAL SUITABILITY FOR INVASIVE SPECIES USING STATISTICAL APPROACHES: A CASE STUDY ON BYTHOTREPES LONGIMANUS IN ONTARIO LAKES CANADA

Lifei Wang

Bythotrephes longimanus is an invasive planktonic crustacean that has arrived in North America from Europe and poses a leading threat to the biodiversity of Great Lakes. Determining the suitability of a lake to *Bythotrephes* establishment is an important step in quantifying its potential habitat range and environmental risk. In this study lake environmental conditions and *Bythotrephes* occurrence data were collected from south-central Ontario lakes in Canada. The performance of different modeling approaches and multivariate analysis offered a strategy to determine the environmental conditions that are suitable for the survival of

Bythotrephes and the hidden factors that regulate its spread. Four modeling approaches were used and compared to predict Bythotrephes occurrence: linear discriminant analysis, multiple logistic regression, classification trees and artificial neural networks. The four approaches ranked lake size and nutrient level as important predictors of Bythotrephes occurrence. Multivariate analysis indicated that Bythotrephes is more likely to establish in large, deep and nutrient poor lakes. Resemblance analysis comparing each model's prediction for each lake was performed to determine how similar the four approaches were at predicting Bythotrephes occurrence. Although multiple logistic regression had better overall performance than the other three approaches, linear discriminant analysis showed higher model sensitivity which is important for predicting invasions.

365319 EFFORTS AT CURBING RELIGIOUS ANIMAL RELEASE IN TAIWAN

Lucia Liu Severinghaus

Large Scale religious animal releases are practiced in Taiwan and in Asia. Previous studies showed that 29.5% of residents of Taipei participated in such practices, and 28.8% of the temples organized release activities. A survey in 2004 found the types of organisms released included birds, mammals, reptiles, amphibians, fish, and invertebrates that were wild caught, domestic, or imported. Government agencies in Taiwan implemented a series of educational programs in 2005-2006, aiming at dissuading people from such practices. National Science Council supported several social-religious research programs in order to understand the motivations behind this practice. A survey in 2007 showed that government educational programs did not reach broad audiences. Because religious animal release is wide spread, its ecological impact on biodiversity needs urgent attention.

315680 THE IMPACT OF THE TOTAL LOSS OF BIRDS ON SEED DISPERSAL IN THE FORESTS OF GUAM

Haldre Rogers, Joshua J. Tewksbury, Janneke Hille Ris Lambers

Birds make up a small percentage of the biomass of forest ecosystems, yet are thought to provide essential services including pollination, seed dispersal and control of insect herbivores. However, few studies have measured the importance of birds on a community-wide basis. The Mariana Islands of Guam, Saipan, Tinian and Rota offer a unique opportunity to study the role of birds in tropical forests. Virtually all forest birds were extirpated from Guam between 1945 and 1990 by the introduction of the Brown Treesnake (*Boiga irregularis*) whereas the nearby islands of Saipan, Tinian and Rota support relatively healthy bird populations. We are investigating how the loss of frugivorous birds has affected plant recruitment by comparing seed rain and seedling recruitment patterns on Guam to those on Saipan, Tinian and Rota. Results from the seed rain traps indicate a reduction in long-distance dispersal on Guam compared to nearby islands with birds. The effect of disperser loss is also apparent at the seedling stage. Our results suggest that the full effects of the Brown Treesnake on the forests of Guam's may far exceed their direct impact on the bird fauna; the indirect impacts caused by the loss of ecosystem services performed by frugivorous birds are more subtle, but have potential to be equally devastating to the forest community.

Ecosystem/conservation area management

314946 EVALUATING THE EFFECTIVENESS OF A LAW ENFORCEMENT STRATEGY IN PROTECTING SUMATRAN TIGERS

Matthew Linkie, Deborah J Martyr, Maryati Moechlisin, Rudjanta Nugraha

Conservationists need to evaluate the success of their efforts, in order to develop cost-effective strategies. However, few programs measure project performance adequately, as most carry out no assessment at all or rely on descriptive analyses that cannot distinguish between the confounding effects of different covariates. This is particularly relevant to law enforcement strategies aimed at protecting tigers, which over the past decade have received millions of dollars of funding. Here we conduct the first such study by analysing, post hoc, law enforcement patrol data collected from 2000 to 2008 within a robust statistical framework to assess the performance of a tiger protection strategy from Kerinci Seblat National Park, Sumatra. More specifically, we quantitatively determine the trends of tigers, their prey and their threats both temporally and spatially and then assess the relationship between these trends and law enforcement effort, while controlling for a series of environmental covariates. We illustrate the importance of our major findings in informing managers and policy makers on protected area management and in informing donors on the return from their investment.

315466 PRELIMINARY ASSESSMENT OF TIGER POPULATION STATUS IN THE GUNUNG LEUSER NATIONAL PARK, NANGGROE ACEH DARUSSALAM AND NORTH SUMATRA, INDONESIA

Hariyo Tabah Wibisono, Goddilla Viswanatha Reddy, Nick William Brickle, Noviar Andayani, Mohamad Tarmizi

The Tiger Conservation Landscape review highlighted the Gunung Leuser National Park and its ecosystem (2.7 million ha.) as lacking sufficient data but described the region as being "of no doubt, some of the best habitat available for Sumatran tigers", thus strongly urged initiation of population status assessment. We have conducted a rapid survey across park using a robust patch occupancy approach. A total of 59 grids of 17 by 17 km were surveyed between May 2007 and June 2008. We have collected tiger signs along a total of 2,183 km (@ 36-km/grids) searching routes. Detection/non-detection matrices of tigers were compiled from footprint only due to concerns about identification accuracy of other signs. Repeated samples from each grid were defined at a 6-km of the searching routes. Finally, a Bayesian Markov-Chain Monte-Carlo simulation and a Gibbs sampler were used to estimate the parameters of the Royle/Nichols heterogeneity model. The mean estimates of the animal specific detection probability (r) and abundance index (λ) per grid were 0.170 (0.044) and 1.117 (0.377) respectively, indicating that the park holds a low tiger density.

308066 PERCEPTIONS ON RANGE CONDITION CHANGES IN MAASAI COMMUNAL RANCHES AND THEIR IMPACT ON LIVELIHOODS AND WILDLIFE CONSERVATION IN THE AMBOSELI ECOSYSTEM

John Warui Kiringe

The Amboseli region is a prime wildlife conservation landscape in Kenya, one endowed with natural resources that support Maasai livelihoods, but which is undergoing land use and land cover change. This study examined perceptions on range condition in Maasai ranches through household interviews, complemented with a vegetation study of ranges in settled and unsettled areas. Respondents attributed changes in rangelands to an interaction of anthropogenic activities and climatic changes. Rangeland parameters thought to have decreased included amount of forage, annual rainfall, water resources, wildlife species, vegetation cover and perennial grasses. Parameters reported to have increased are presence of annuals, soil erosion, resource conflicts, invasive species and prevalence of drought. Results from the vegetation survey support local perceptions of a decline in range conditions: significant differences were found in vegetation cover and forage potential between settled and unsettled sites. Both sites were dominated by increaser II species and forbs and had high prevalence of invasive species. This study suggests that changes in Amboseli rangelands negatively impact the socio-economic condition of the Maasai, and, if not mitigated, will undermine government efforts for poverty reduction as envisioned in the Millennium Development Goals. It will also undermine wildlife conservation as an alternative land use.

315339 ABUNDANCE AND DISTRIBUTION OF PINK SPOT SYNDROME ON CORAL REEFS IN THAILAND AS AN INDICATOR OF REEF HEALTH

Makamas Sutthacheep, Thamasak - Yeemin, Chaipichit Saenghaisuk, Sitiporn Pongsakun

The coastal areas of Thailand between latitudes 6^o and 13^o N, offer suitable environmental conditions for coral reef development. There are an estimated over 153 km² of coral reefs along the total coastline of about 2,600 km in the Gulf of Thailand and the Andaman Sea. Main threats to coral reefs include over-fishing, destructive fishing, eutrophication, sedimentation, coastal development, unsustainable tourism and coral bleaching. Coral reef health in Thai waters was monitored during 2006 - 2008 in Trat and Chonburi Provinces (the Gulf of Thailand) and Krabi and Satun Provinces (the Andaman Sea). The appearances of pink spot syndrome in certain scleractinian corals, mostly *Porites lutea*, have been observed frequently. Pink spots appeared mainly in disturbed areas from coastal development and were associated with various stressful conditions caused by sediment, nutrient, competition with macroalgae and reef animals. Several coral reef sites are being exposed to chronic stressors, especially sediment and nutrients or related factors, recovery from future acute anthropogenic and natural disturbances might be at risk. Ecological studies should continue to long-term monitoring at these sites and management action plan should focus on alleviating the impacts of sediment and nutrient inputs.

366653 MANAGEMENT OF SOIL TILLAGE IS THE KEY FOR A HIGHLY THREATENED ENDEMIC WEED, *CENTAUREA TCHIHATCHEFFII* FISCH. & MEY

Yasemin Erguner Baytok, Aysegul Yildirim, C. Can Bilgin, Mecit Vural

Centaurea tchihatcheffii is a highly threatened endemic annual occurring only within 700 km² in central Turkey. Its known range is highly fragmented and populations are under threat due to intensive agriculture and urban encroachment.

In a series of field experiments during 2004-2007, we simulated the effects of tillage, herbicide use, and stubble burn as farmers practiced them. To assess their effects, we studied plant demography and estimated seed production and plant density. For seeds that had received different field treatments, germination rates were measured as a function of soil depth and seed age.

Herbicide applications caused up to 99% mortality and reduced the number of viable seeds produced that year. Stubble burn had a detrimental effect only on seeds at the surface. Tillage in spring led to a 1.6- to 4.8-fold increase in plant density, and a 3.3- to 4.7-fold increase in seed production per individual the next year.

Our results demonstrate that timing of tillage is crucial. If carried out after flowering, it can stimulate reproductive output and improve survival in the following year. Therefore, we propose controlled tillage every few years as a conservation management option for populations that are designated as reserves to ensure their long term persistence. Alternatively, unprotected subpopulations elsewhere can benefit from organic or nature-friendly farming.

315172 ECOLOGY AND BIODIVERSITY OF THE SIRAN RIVER CATCHMENT

Habib Ahmad

The Siran River catchment represents an important part of the internationally recognized Western Himalayan Province. The Catchment occupies nearly an area of 10,000 km² of the Western Himalayan Moist Temperate Forest. The area has a steep relief of 500 to 4000m within c.2.00 km aerial distance. Vegetation of the area of the area is predominantly Sino-Japanese in composition. Habitat types of the area vary within influence of various microclimatic, topographic and anthropologic changes. The area is divided into six climatic zones, which preserve the precious biodiversity resources like Himalayan Musk Deer, Kashmir Elm, Grey Langoor, Himalayan Black Bear, Monal, Koklas pheasants, and Westren Tragophan. This paper is the first ever report of its nature, which communicates ecological zones with respect to species diversity and indicator species of the Siran River Catchment, Western Himalayas, Pakistan.

Poster

DISCIPLINES: Biogeography

315474 IMPROVING CONSERVATION OF RARE AND POOR KNOWN TAXA THROUGH SPATIAL MODELLING APPROACH: THE THREATENED *LEONTOPITHECUS CAISSARA* AS A CASE STUDY

Maria Lucia Lorini, Vanessa Guerra Persson, Lrene Ester Gonzalez Garay, Jorge Xavier da Silva

Knowledge gaps on the taxonomy and geographical distribution of biodiversity, known as the Linnean and Wallacean shortfalls, lead to a conservation paradox: many of the most endangered species are also the least known taxa. The lack of information on geographic ranges hinders several conservation actions, specially in tropical areas where the Wallacean shortfall affects even well-studied groups. With the advances in Geo- and Eco-Informatics this problem can now be tackled through spatial modelling. Here we illustrate this approach with an emblematic case: the Black-Faced Lion Tamarin (*Leontopithecus caissara* Lorini & Persson, 1990), one of the world's 25 most endangered primates, recently discovered in the Brazilian Atlantic Forest hotspot. We applied remote sensing, GIS and machine-learning tools for modelling the species' distribution in a multiscale framework: species (global), metapopulation (regional) and population (landscape). The spatial analysis optimized field surveys, range mapping and conservation status assessment. We found the species to be Critically Endangered (under CR D criterion), endemic to quaternary coastal forests, and having a diminute range structured in three populations. This framework was able to highlight suitable areas out of reserves network, and will be used to support Population Viability Analysis and management scenarios. Spatial modelling approaches are promising to conservation of rare and poorly known species in the Tropics.

366400 BETA DIVERSITY SCALING: SAMPLING MEASURE MATTERS

Yuxin Zhang, Keming Ma

Beta diversity is a measure that incorporates two important components of scale: the spatial grain, which corresponds to alpha diversity, and the spatial extent which corresponds to gamma diversity. This measure lends itself naturally to a study of biodiversity scaling. Here, we examine the scaling relationships of beta diversity and its components both theoretically, as well as in application to forest vegetation data from a mountainous region in China. Our results show that a power law exists for beta diversity-area relationships, but the parameters of the power law are dependent on the grain and extent for which the data is defined. Coarse grain size generates a steeper slope (scaling exponent z) with lower values of intercept (c), while large extent results in a reversed trend in both parameters. We also find that, for a given grain (with varying extent) or a given extent (with varying grain) the two parameters are themselves related by power laws. These findings are important because they are the first to simultaneously relate the various components of scale and diversity in a unified manner. They also bring to light new scaling laws which may simplify the quantification of diversity. Further theoretical consideration and exploration of these patterns across different

ecosystems is suggested.

307083 ISOTOPE SIGNATURES IN WINTER MOULTED FEATHERS PREDICT MALARIA PREVALENCE IN A BREEDING AVIAN HOST MIGRATING THROUGH SUB-SAHARAN AFRICA

Elizabeth Yohannes, Max-Planck

It is widely accepted that animal distribution might have co-evolved in relation to selection pressures exerted by parasites. To investigate this, we first determined the prevalence and types of malaria blood parasites in a breeding population of great reed warblers *Acrocephalus arundinaceus* using PCR. Secondly, we tested for differences in individual feather stable isotope signatures ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, δD and $\delta^{34}\text{S}$) and examined whether malaria infected and non-infected birds had occupied different wintering areas. Birds moulting in Afro-tropical habitats with significantly higher $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ but lower δD and $\delta^{34}\text{S}$ feather values were more frequently infected with malaria parasites. Established patterns of isotopic distributions indicate that birds that have moulted in sites that are drier and situated further to the north in West Africa have higher incidence of malaria. 56% of the birds that mainly relied on dietary sources primarily derived from C4 plants were infected with malaria parasites, compared to 14% of the birds that relied on a C3 plant source. Understanding the link between local biomes and avian malaria may assist for adequate assessment of the risk of infections. These results also demonstrate the potential use of stable isotope analysis as a powerful tool for addressing questions relating to conservation of migratory animals.

DISCIPLINES: Communications, outreach and education

314923 ALDER AMAZON PROJECT: IMPLEMENTING CONSERVATION ACTIONS IN ARGENTINA

Roberto Jesus Caceres, Eronica Miranda, Ariel Cazon, Pamela Fierro, Atalia Politi, Luis Rivera,

Alder Amazon (*Amazona tucumana*) is an endemic species of subtropical montane forests of Argentina and Bolivia (Southern Yungas) whose populations declined drastically in the 20th century due to pet trade and habitat loss. Previous information gathered in Argentina and Bolivia lead us to conclude that the species recovery depend on increasing local awareness on the status of Alder Amazon and its habitat. We used Alder Amazon as a flagship species to conserve other components of biodiversity and Yungas. In 2008 a conservation education campaign was launched in six prioritized communities in Argentina. We conducted structured surveys before and after our activities to assess our impact on the attitude and awareness on locals. Our results show that awareness is easier to enhance (e.g., knowing that Alder amazon is a Yungas species increased in >60%) than attitudes (e.g., wanting a parrot as a pet only decreased in <20%). Nonetheless, two towns declared through legislation protection to Alder Amazon and Yungas, which highlights that education can trigger conservation alliances that go beyond expectations. Education programs require long-term and continuous efforts to deeply change locals attitudes which could have a conservation effect on the species and habitats.

315364 A SUCCESSFUL STRATEGY FOR CONSERVATION EDUCATION IN RURAL AREAS: A CASE STUDY AT THE BIOSPHERE RESERVE OF CALAKMUL, MEXICO.

Patricia Manzano-Fischer, Heliot Zarza,

Conservation education in rural communities face several problems; trained personnel is needed in the area, lack of funding to keep programs going, and willingness from teachers to use education materials. At the Calakmul Biosphere Reserve in southern Mexico, we have applied a new strategy to overcome these problems. We developed an education program which includes a printed itinerant exhibition, a teacher's guide and an activity booklet for children. We developed 2 teachers' guides, one on rainforest and its birds and one on Mexican felids. Each guide has an activity booklet for students (ages 6 to 15). The relevance of this program is that one person, who does not need any special training, can do the follow up, moving the itinerant exhibition between the schools of the area. Activity booklets are used only at the school, so if students want to work on them, they press the teachers to work on an activity from the teachers' guide in order to use their own booklets, reducing teachers' resistance to use the materials, which is further reduced when the exhibition reaches each school. This is a cost-effective, long lasting form of conservation education for reaching a large number of people, through schools in rural communities, where trained personnel is unavailable and communications are difficult, and therefore could be of value around protected areas in other developing countries.

315110 CULTURAL FESTIVALS: ITS IMPLICATIONS TO BAT CONSERVATION ON NEGROS ISLAND, PHILIPPINES

Ma. Renee P. Lorica, Vincent Noe Villarin Gunot, Tammy L. Mildenstein, Samuel Cord Stier

Cultural festivals in the Philippines have been a tradition by many cities and provinces of the different regions of the country annually. These festivals attract tourists both nationally and internationally. Aside from sharing traditional culture, history and myths of each city or island where the festival is held, wildlife themes are now incorporated to showcase the diversity of flora and fauna in their area. A lot of celebrations from different Provinces in the Philippines adopted this concept. Among these wildlife themed festivals are the "Langub" or Cave Festival of Mabinay, the "KaSuLAD" Festival of Pamplona, both are municipalities of the Province of Oriental Negros and the Mud Pack Festival of Mambukal, Murcia, Negros Occidental. These festivals depicted the life and ecology of bats and swifts living in caves and on trees and how they forage in the night and eventually adopted and survived feeding in agricultural areas of the Island. This paper further discusses the impact of their presentations to the status and conservation of bats on the Island and its sustainability. It is hoped that this cultural appreciation will help sustain the conservation and awareness of bats throughout the Island of Negros and the country as a whole.

315634 VISUALIZING IMPACTS: USING ANIMATION TO ILLUSTRATE THREATS TO CONSERVATION PRIORITIES

Leo John Bottrill, Charles Huang, Nikolai Sindorf

Rapidly emerging and changing threatening processes require dynamic approaches to conservation planning

and management. A series of major hydroelectric dams, for example, are being planned for the mainstem of the Mekong River, which will have wide ranging environmental and social impacts. Access to technical data and public consultation has been restricted, limiting effective scientific and civil society engagement in the planning process. To illustrate the potential impacts of these projects, a series of three-dimensional animations were produced to visualize future scenarios for fish migration, critical species habitats, and river dependent communities. Google Earth, ArcSCENE, and Flash animation applications were used to produce the animation clips with spatial data provided from various publicly available sources. This animation tool has a variety of applications for land and freshwater use planning, particularly when consultation with a wide spectrum of stakeholders is essential for sustainable decision making. It also demonstrates a cost-efficient, expedient, and adaptive approach to disseminating information in a transboundary priority area. We explore potential applications of this tool for a range of conservation scenarios in other priority areas.

320381 THREE WHITE CRANES, TWO FLYWAYS, ONE WORLD: LINKING CLASSROOMS IN THE UNITED STATES, CHINA AND RUSSIA

Sara Moore, Joan Garland, Zhang Juan, Maria Vladimirtseva

The International Crane Foundation, with partners in China and Russia, is implementing a multi-year education project targeting the eastern crane flyways in the United States and East Asia. The education activities focus on the importance of wetlands and other natural resources from the perspective of local communities and are designed to enhance local leadership. In the United States, project activities are integrated with education programs centering on the eastern migratory whooping crane population, integrating classroom activities and field trips with online education activities. Project activities link American educators and students with their peers in East Asia through education materials developed for students and for teachers, student art exchanges, environmental education camps, and a project website. Educators visit teachers and students in the other countries, to give firsthand experience with different outlooks and cultures, as well as shared hopes and needs. Through these activities, students learn the importance of their personal actions in effecting change and their connection to global environmental issues.

315226 PROTECTION OF BIRDS IN THE DAURAI WETLAND AREA

Lulu Cong,

Since March of 2007, our team has started a project on research and conservation of wetland and important species in Daurai Area, which is support by Conservation Leadership Programme. The area covers Hulun (Dalai) Lake in China, Torey Lakes in Russia, Uldz River Valley in Mongolia, and the flood plain of Argun River. We set up the GIS database covering biotope data of 20-years in the drainage areas from Hailaer to Argun River and the endangered birds, including the Red-crowned and White-naped Cranes, Swan Goose and biotope monitoring network in the area. Comparing the historical data, we analyzed the changes of threatened birds populations and their habitat, and factors influenced by human. Our team sent questionnaires to investigate the impacts of climatic change on lives of local residents and biodiversity. We carried out environmental education activities at local elementary schools based on our knowledge and local custom. Finally, we sent our recommendations to local authority and administration regarding to wildlife conservation issues. Through all these activities students gained experiences in research, environment education and organization.

306056 CALCULATING CARBON EMISSIONS IN A MICROSCALE**Henrique Bergallo Rocha, Thiago Ferreira Pinheiro Dias Pereira**

The aim of the study was to calculate carbon emissions from our school showing the importance of geosequestration even in a microscale. We highlighted school elements emitting carbon (vehicles, natural gas) and applied a questionnaire to every person in school asking the size and fuel used by the vehicle and distance from home to school. Also, we obtained the average monthly cost of natural gas by the school. Electrical energy was not considered in estimations as it comes from a clean source in our city. We measured the total distance (Km/week) travelled by students, teachers and employees and converted the amount to a school year, considering vehicles size and fuel used. We converted the total litres used in kg/carbon, and the amount of Km travelled to spend this quantity of fuel was obtained on specialized sites. Total carbon emitted from natural gas and vehicles gave a total of 71 tons of carbon dioxide/year. This value divided by the amount of CO₂ an average tropical tree would absorb in 20 years indicated that for my school to neutralize one year/carbon emissions, 119 trees would have to be planted. We obtained native seedlings from plant nurseries and each school grade symbolically planted a tree. In a next step, we intend to spread this microscale estimation to other schools to obtain a wider geosequestration response. Planting so many trees every year is not an easy task and people should be aware that the best way is diminishing their own carbon emissions.

315002 SCHOOL CHILDREN'S PERCEPTION OF FROGS IN WEST JAVA, INDONESIA**Mirza Dikari Kusriani, Neneng Sholihat**

To explore Indonesian school children attitudes towards frogs we carried out survey to 2519 students of elementary school from Western part of Java (Bogor, Sukabumi, Cianjur and Jakarta). In general, students' knowledge of frog's basic biology is good. Rural children seem to perceive frog in positive sense contrary to cities' students. Older children seem to perceive frogs in negative sense by choosing words such as scary, dangerous, distasteful, poisonous, dumb, weird, noise, dirty to describe frog. Positive perception by younger children can be seen by the higher frequency of choosing word to describe frog as animal in affirmative word such as that is funny, interesting, likeable, playful and like to sing. The highest frequency of word chosen by children to describe frog that related to negative perceptions is dangerous animal (24% by high school student and 17% by elementary school student). Different tactic need to be made when conducting frog conservation education in Indonesia. Hands on experience (bringing frog to school, outings) might be more needed to increase older students' understanding on frog, especially those that live in the city.

314890 CONSERVATION ACTIONS FOR FIVE THREATENED SPECIES AT WESTERN ANDES OF COLOMBIA**Karolina Fierro-Calderón, Eliana Fierro-Calderón, Carolina Montealegre**

The study areas in the Western Andes of Colombia, San Antonio and Chicoral, have been transformed severely. The objectives of our project are to determine the population density of threatened species in these Important Bird Areas (IBA), and to promote conservation actions for them and their habitat, involving local

communities. This document reports our results about community outreach and education. First, we performed interviews and the results showed that most of the people identified threats to the forests and the birds (78%), San Antonio's people knew more about the IBA (82%) than Chicoral's people (59%) and only 4 people identified the threatened bird species of the region. This suggested a strengthening of the educational and informative activities in the sites. With this purpose, we carried out the Bird Month Celebration in October with 128 people. We invited several institutions, two public library and 15 schools. Five schools participated with artistic activities and all people played the game "I am a Chestnut Wood-quail". They also stamped their hands in the mural, as symbol of compromise with the endangered birds. We also have published two editions of "La reinita", a local magazine supported this year by Conservation Leadership Programme.

318168 INVOLVING LOCAL COMMUNITIES IN IMPERIAL EAGLE CONSERVATION IN GEORGIA

Zura Javakhishvili, Kimberly C Cofer, Giorgi Darchiashvili

During the last decade in Georgia, Imperial Eagle populations have dramatically declined (from 53 pairs in 1991 to 10-15 pairs in 2003). Decline is caused mainly by the influence of anthropogenic factors (disturbance, habitat destruction, persecution etc.). Negligence from local communities and other key stakeholders towards the problem is caused by lack of knowledge and awareness.

We conducted Field research to identify unknown nests and to map them together with known nests. We Monitored those nests and identified most vulnerable ones by analyzing data about breeding success, threat severity and nest conditions.

We Used "Targeting behavior" method of participatory approach developed by Conservation International to influence behavior of the local communities leading to disturbance of breeding Imperial eagle and low breeding success.

We worked 3 different communities influencing 3 different nest sites of Imperial Eagle. In two occasions disturbance was linked with sheep and cattle herding behaviors and one was linked with hunting management practices in hunting reserve, in all cases those practices were causing disturbance of the birds during breeding season. After conducted work with those communities in all three occasions bird disturbing behavior was changed by more friendly behavior that avoided further disturbance of Imperial Eagle during breeding season.

DISCIPLINES: Community-driven conservation

365461 RESTORING RED-CROWNED CRANES AS WINTER RESIDENTS ON THE ANBYON PLAIN IN THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA (DPRK)

George William Archibald, James Thomas Harris

Bird counts by the State Academy of Sciences of the Democratic People's Republic of Korea (DPRK) indicate attrition of Red-crowned Cranes (*Grus japonensis*) wintering in DPRK from hundreds in late 1980s to zero within the next decade. Economic changes in the DPRK as a result of the collapse of their major ally, the former USSR, led to a scarcity of chemical fertilizers and then to inadequate food production for humans. Two years of floods and one year of drought in the mid 1990s further exacerbated the situation. With the diminishing of cranes frequenting the DPRK, the population shifted to wintering in the Demilitarized Zone

(DMZ) and in the civilian Control Zone of the Republic of Korea (ROK), where they have increased from several hundred to more than 900. The Anbyon Plain in the southeast of DPRK previously had been a wintering site for more than 200 cranes. Collaboration among the Korea University in Tokyo, BirdLife International, the International Crane Foundation, the DMZ Forum, and the State Academy of Sciences of the DPRK, has led to a program to promote organic farming on the Anbyon Plain to increase agricultural productivity. As part of this project, a pair of captive cranes and the cultivation of food plants for cranes along islands in and banks of a small river are being used to attract migrant cranes to winter in the DPRK while they are en-route to ROK from Russia.

315429 RECONCILING MODERN CHALLENGES WITH PAST OPPORTUNITIES: CONSERVATION IN AFGHANISTAN'S WAKHAN CORRIDOR

Lnayat Ali, Anthony Simms

The Wakhan Corridor in Northeast Afghanistan is a narrow strip of land connecting with China. Around 17,000 km² in size, Wakhan is a mountainous landscape where the Hindu Kush, Karakorum and Pamir ranges meet. The area is isolated and steeped in history, forming part of the ancient Silk Road, over which Marco Polo travelled in the 13th century. Russia and Britain's "Great Game" defined the political boundaries in 1895. It hosts a number of globally threatened species: Marco Polo sheep (MPS), snow leopard, urial, Siberian ibex, brown bear, wolf and lynx.

WCS has worked in Wakhan since 2006. Objectives for the landscape include re-establishing the Big Pamir Wildlife Reserve, a former royal hunting area managed for MPS trophy hunting tourism in the 1960s-70s. This management ended in 1979 with Soviet invasion and it reverted to traditional livestock grazing. The present situation is complex: the MPS population has declined more than 50% since the 1970s and livestock numbers have increased three-fold. Without dramatic changes to current land-use the MPS are likely to disappear.

Along with helping to establish the protected area, WCS and partners are developing incentives for graziers, which will act as a bridge until more lucrative and sustainable land-uses become possible. But with few livelihood opportunities beyond livestock the situation is challenging.

329228 USING SOCIAL MARKETING TO CHANGE THE WAY PEOPLE RELATE TO NATURE

Ximin Wang, Rare

Established in 1973, Rare is an international conservation organization based in the U.S. Its mission is to conserve imperiled species and ecosystems around the world by inspiring people to care about and protect nature.

Rare has a proven model for changing awareness, attitudes, and behaviors toward conservation at the local community called "Pride Campaign", and it inspires people to take pride in the natural assets that make their communities valuable and take action to protect them. Rare trains local conservationists all over the world to run Pride Campaigns using social marketing as effective communication tools.

Pride Campaigns utilize a charismatic flagship species, like the Saint Lucia parrot, which becomes a symbol of local pride and acts as a messenger to build support for habitat and wildlife protection. Marketing tools - such as billboards, posters, songs, music videos, sermons, comic books, and puppet shows - make conservation messages positive, compelling, relevant, and fun for the community. Campaigns appeal to people on an

emotional level, generating an increased sense of pride and public stewardship that goes beyond mere awareness-raising.

Rare has trained 158 local leaders in the developing world, whose campaigns have influenced more than 6.8 Million people living in over 2,400 remote communities. The first cohort of seven Chinese Pride campaigns has been launched on Oct 20th, 2008, including in Yunnan, Gansu, Inner Mongolia, and Jilin.

315221 PUZZLE OF INTEGRATING CONSERVATION AND DEVELOPMENT: A CASE STUDY OF LOCAL GOVERNMENT DOMINATED TOURISM OPERATIONAL RIGHT TRANSFER

Tao Wang, Wenjun Li

There is ongoing debate on whether separating conservation and tourism service in nature reserve can achieve a win-win goal of tourism development and environment conservation. In 2004, M Nature Reserve (MNR) transferred its tourism operational rights to a company. To study whether the win-win goal has been achieved, we interviewed the local governments, MNR Administration (MNRA), company and local residents. Research shows that since the local government hopes to raise local reputation and economic development, the company wants high profits, both of them give policy or capital support for tourism development. The reputation of MNR has been improved and the number of tourists in 2008 is thrice of that in 2004. Under the personnel and financial control of the local government, the MNRA may not carry out effective supervision on the company's activities which may cause adverse effects on the environment. However, there is no evidence indicating the changes of the environment, but as the residents said, the quantity and quality of local water resources are declining. Lack of participation, local residents have objection with the company in land use and tourism profit distribution. The conclusion is that tourism has been developed but it is difficult to determine the conservation situation. Local community played an important role in the Nature Reserve, but often it has been neglected and suffered a loss, more attention about community is called in the future.

305502 RELATIONSHIP PATTERNS BETWEEN NATURE RESERVE AND LOCAL COMMUNITY IN WOLONG NATURE RESERVE, CHINA

Jing Liu, Hong Miao

In recent decades the conflict between reserves and local community has been the main interest of conservationists. As a case, we designed ten indexes to evaluate the relationship pattern between Wolong Nature Reserve and local people. We employed expert assessment and entropy method to weigh the indexes. Questionnaire survey of four stakeholders (i.e. farmers, governors, businessmen, and tourists) was our direct method to collect data. We also gained some indirect data from Wolong Administration Bureau. Totally 377 questionnaires were collected. We used ANOVA to compare the pattern scores of stakeholders, and translated the indexes into a set of principal components with PCA. In addition, we used Pearson bivariate correlation analysis and partial correlation analysis to calculate the correlations between characteristics and pattern scores. The reserve-community relationship in WNR is generally harmonious, though resource-use restrictions, unequal distribution of tourism benefits, and grazing are still serious. In addition, alternative energy of fuel wood, tourism, and locals' assistance in fire extinguishment and protection are all handled effectively and efficiently. For local people there was a significantly linear negative correlation between their annual income and scores of conflict-competition pattern. Furthermore, our surveys suggest improving locals' living standard

and establishing wildlife compensation mechanism to coordinate the reserve-community relationship.

315127 THE ROLE OF LOCAL COMMUNITY IN THE NATURE CONSERVATION AT THE EASTERN PART OF LAKE BAIKAL

Eduard Batotsyrenov, Denis Sandanov, Zhargalma Alymbaeva

The Russian Federation has issued a governmental order to establish a special economic zone (SEZ) in the Pribaikalsky district, located at the eastern part of Lake Baikal. According to the proposed plan, this SEZ will include two mountain resorts, a marina, and various other infrastructure basics. Although the federal government has already approved the plan to establish a SEZ, it is unclear how the local people feel about the development of the zone. Information for this project was gathered through interviews and questions to local residents. We asked people what they thought about specially designated areas for nature conservation, recreation and economic development. Results of study showed that the main environmental impacts on the territory of SEZ are garbage - 31.3%, tourist bases - 28.6%, local industry - 19.3%, local people - 12.6%, illegal logging - 6%, quartzite mine - 6%, transport - 4.6%, boiler rooms- 4%. Number of tourists who spent vacation and weekends at the eastern part of Baikal during last years rapidly increased. Local authorities cannot solve the problem of garbage utilization. Mostly school students and members of local NGO's did clean up of the territory. Generally, local people do not know what to expect from the SEZ because plans of development are constantly changing. In future decisions regarding development of SEZ, all interested parties (local people, NGO's, etc.) need to be considered and involved.

314970 SUPPORTING WETLAND MANAGEMENT AND IMPROVED LIVELIHOODS AT FERAYDOON KENAR, I. R. IRAN THROUGH DEVELOPMENT OF TRAPPERS ASSOCIATIONS AND TRUST FUNDS

Sadegh Sadeghi Zadegan

The only known wintering area for the Siberian Crane in Iran is the complex of damgahs (duck trapping units) around Fereydoon Kenar in Mazandaran Province. The damgahs are also important for the internationally important numbers of waterfowl that use the area, including a number of other globally endangered species. The UNEP/GEF Siberian Crane Wetland Project aims to develop integrated management of this area in order to achieve conservation goals. Four Trappers Associations were established within the Non-Shooting Area (NSA). The establishment of these associations and their trust funds was necessary for the Department of Environment (DoE) to work effectively with local trappers in implementing the project at this site. In general, the objectives of the Trappers Associations are as follows:

- 1) To encourage local duck trappers to be involved in the management and development of the Non Shooting Area;
- 2) To support the work of DOE in managing the NSA especially development of a management plan and establishment of a Management Committee;
- 3) To create sustainable development opportunities for the local community, and help the reserve achieve co-development with the local community;
- 4) To support improved livelihoods for the trappers and to improve the sustainability of traditional duck-trapping practices;
- and 5) To support conservation of the Siberian Crane and other waterbirds.

320517 EFFECT OF LARVAL FOOD PLANTS AND SEASONS ON THE QUALITY OF THE AFRICAN WILD SILKMOTH, GONOMETA POSTICA WALKER (LEPIDOPTERA: LASIOCAMPIDAE) COCOONS

Ken Okwae Fening, Esther N Kioko, Suresh Kumah Raina, Jones M. Mueke

Gonometa postica Walker is known to produce high-quality silk. It is being utilised for commercial wild silk production by the forest-adjacent communities in Mwingi District in Kenya. The developmental time of *G. postica* larvae and cocoons quality were studied in the Imba and Mumoni woodlands of Mwingi during the long and short rainy seasons of 2006 and 2007. *Acacia elatior* Brenan, *Acacia tortilis* (Forssk.) and *Acacia nilotica* (L.) Del were used as larval host plants. Larvae were reared in semi-captivity by using net sleeves attached to the branches of the host plants. Also, cocoons from the wild population were sampled from the host plants to evaluate their quality. The weight and size of cocoons were used as the determinant of their quality. Larval developmental period and cocoons quality differed according to host plants, seasons and sites, for those reared in semi-captivity. However, cocoons quality from the wild habitat varied with seasons and sites but not with host plants. Larvae reared on *A. elatior* had the shortest developmental period and highest cocoons quality than those raised on *A. tortilis* and *A. nilotica*. Thus, *A. elatior* is recommended as the most suitable host plant for the semi-captive rearing of *G. postica* larvae.

314910 INTEGRATING LOCAL COMMUNITIES INTO WILDLIFE CONSERVATION ON BIKO ISLAND, EQUATORIAL GUINEA, AFRICA

Shaya Honarvar, Daniel B. Fitzgerald, Filemon Rioso Etingüe, Gail Walker Hearn

The local community of Ureca has been collecting sea turtle nesting ecology data on the southern beaches of Bioko Island since 1998. Our goal was to: 1) reassess the data collection regime from the past 11 years; 2) educate the local community and local university students in sea turtle nesting ecology; 3) train census takers for more accurate data collection. We patrolled the nesting beaches with local census takers during the 2007-2008 nesting season and compared our data to their collected data. During the 2008-2009 nesting season, we educated the local community and students as well as trained them in census taking through weekly visits to the village over 6 months. During these visits we explained turtle nesting ecology and solved problems that they encountered while on census. We incorporated the use of GPS units to improve supervision and data collection. We found that it is very important to have onsite supervision for better data collection. Our efforts for better education and training of the local community improved the quality of data. Lastly, having local people on the nesting beaches not only decreased the number of turtles poached but also helped decrease the number of primate hunters in the area.

364699 THE TALAKHAYA WATERSHED REVEGETATION PROJECT: CONNECTING COMMUNITIES WITH CONSERVATION

Kathleen Marie Herrmann

Introduction: A multiagency partnership facilitated the Talakhaya Watershed Revegetation Project to plant 31,473 seedlings, employ 25 community members through the Luta Livelihoods Initiative, and as a result,

measure statistically significant improvement on adjacent coral reefs.

Methods: The goal of this project is to revegetate the Talakhaya Watershed to reduce the flow of land-based pollutants to the marine environment using community volunteers to assist in the restoration and management to address erosion and sedimentation. Since 2006, CNMI government agencies, NOAA, and NRCS have worked together to provide grant funding, technical assistance, and training.

Results: Data collected since 2000 reveal that low coral cover and high algae cover exists on Talakhaya's reefs as compared with others in the CNMI. A recent statistically significant increase in coral and decrease in algae over the past two years corresponds with the initiation of revegetation efforts. Continued data collection will help understand benefits that watershed revegetation have on the coral reefs. The Talakhaya was officially declared a conservation area in 2007.

Conclusion: By engaging the community directly in conservation management to reduce land based pollution by active revegetation methods, statistically significant improvement can be measured on adjacent coral reefs.

315564 BAND-I-AMIR NATIONAL PARK PROGRAM, A MODEL FOR AFGHANISTAN'S PROTECTED AREA SYSTEM

Mohammad Ayub Alavi, Chris Shank

Afghanistan is home to a rich assemblage of wildlife. However, more than 30 years of war have decimated the country and its vulnerable fauna and flora. A lack of conservation management has hurt not only the wildlife populations, but also severely impacted people's agrarian livelihoods leading to economic insecurity. Since 2006, the efforts of WCS in the country have focused on establishing Afghanistan's first Protected Area: Band-i-Amir National Park. Band-i-Amir is composed of six, high-altitude, travertine-dammed lakes of exceptional beauty and with high potential for biodiversity and probable benefits to local people through tourism. This unique ecosystem provides habitat for a multitude of wildlife such as the Afghan urial, as well as eighty-four species of birds, including the sole endemic bird, the Afghan Snowfinch and the endangered Saker Falcon. Band-i-Amir has been recognized for its potential as a national park for many decades, however the Park has not yet been legally designated because of challenges related to the national legislation and institutional capacity of the government. Despite the challenges, the community-based ecosystem approach employed will be a use as a model for the establishment of other elements of the Afghan Protected Area System now under development.

315253 THE GOLDEN FROG OF SUPATÁ PROJECT: AN EXAMPLE OF A LOCAL AMPHIBIAN CONSERVATION INITIATIVE FROM COLOMBIA.

Giovanni Alberto Chaves Portilla, Erika Nathalia Salazar Gómez, José Drigelio Gil Acero, Jenny Paola Gallo Santos, Astrid Nossa Pardo, Sergio Omar Pulido Barrera, Fabian Tavera Beltrán, José Oswaldo Cortés Herrera, Nidia Rodríguez Gaitán, Daira Ximena Villagrán Chavarro

In the year 2007 during a field prospecting to search Colombian amphibians threatened in the Supatá municipality, was discovered a new species of poison frog in a small relict of cloud forest. The first studies to ascer-

tain the conservation state and the current geographical distribution showed that this frog is facing a serious threat due to the habitat destruction for the human activities as the use of land for livestock and the inadequate timber extraction in the forest relicts still persist.

With this finding and taking into account the serious environmental problems facing the Supatá municipality, arose a good opportunity to implement a wildlife conservation strategy that not only allowed the preservation of this new amphibian and the habitat where this live, but this species serve as a flagship species to increase the local community's awareness about the need to conserve and protect the last natural resources of the region. Among the activities that have been made with the local community was the first festival of the Supatá's golden frog where by a day over 2000 people gathered to participate in diverse cultural, sports and environmental activities around of the protection of this frog, which was officially named by the Supatá's council as natural heritage, demonstrating the high level of appropriation that has taken the community towards this amphibian and the great community's commitment to protect the wildlife in their region.

314980 COMMUNITY-BASED CONSERVATION OF CAMBODIAN CHELONIAN IN SOUTHWEST CAMBODIA

Sokhorn Kheng, Sitha Som

Living far deep in the forest, facing with decade of civil war, inaccessible to school, and society, making them uneducated people, they are cutting forest and hunting animals for supporting their family, especially turtles. In 2007 with granted from CLP and CI, a community-based conservation was initiated which is led by local people themselves in Tatai Krom commune, Koh Kong province. The aims are: 1) to implement patrols and remove and stop turtle collection in their area; 2) to educate and raise awareness to local kids and people with class lesson and education materials such as poster. The implementing means are: 1) CLP trained-members are in charge of awareness raising; 2) local committee members with local polices are responsible for area patrolling; 3) incentive agreement with community. As the results, there are 358 students and 105 villagers participated in turtle education courses. Fourteen patrols have been conducted in the site which 150 snares and 58 turtle hooks have been removed from the area. Two boats, one tractor, and other incentives were given to the community to use as their transportation and rice production. They are now aware of turtle conservation as they are very happy with the training and patrol.

315360 COMMUNITY-BASED MONITORING OF THE THREATENED AVIFAUNA OF MT. TALINIS AND TWIN LAKES AREA, ORIENTAL NEGROS, PHILIPPINES

Vincent Noe Villarín Gunot, Apolinario Bernardo Carino, Angelita Morales Cadelina, Rene Villalon Vendiola

On Negros Island and elsewhere in the Philippines, where over 90% of its original forest has been removed and implementation of existing wildlife laws remain weak, populations of many wildlife species including birds, are rapidly declining and may become extinct. Though these species were studied by experts and/or scientists once or twice a year the monitoring process of the threatened species becomes limited to these periods. It is fortunate however, that most of the threatened birds of Negros still thrive in the fragmented forests of Mt. Talinis and Twin Lakes, the only remaining forests of southeastern Negros. This

community-based monitoring project started with a capacity-building program to empower local communities surrounding the area by providing skills on survey techniques necessary to monitor the threatened birds found in their forests. The results of the monitoring were presented to the Protected Area Management Board of the Twin Lakes for its urgent management plan and the possibility of integrating the data generated to enhance the bird watching activity as part of the ecotourism plan in the area. Data presented were also used by the Provincial Wildlife Conservation Committee in increasing environmental awareness on birds throughout the Province of Oriental Negros.

DISCIPLINES: Conservation funding and philanthropy

367505 DOES BIODIVERSITY AID FOLLOW BIODIVERSITY?

Sarah Amy Wyatt, Thomas Matthew Brooks, Michael Hoffmann, J. Timmons Roberts, Conrad

E Savy

Many of the countries with the most imperiled and irreplaceable biodiversity are also economically poor. Development assistance for biodiversity conservation can work to protect species and alleviate poverty. Many factors influence development aid, but the relationship of biodiversity aid to biodiversity begs scrutiny. Information on development aid for biodiversity was collected from the PLAID database: from 1991 to 2001, 1,489 projects invested \$1.87bn in conserving biodiversity. We calculated each country's proportion of this total investment. Then, we used data from the IUCN Red List for nine taxa to measure the proportionate biodiversity conservation significance of each country (measured two ways: endemic species and threatened species-country occurrences). The relationship between proportionate investment and proportionate biodiversity conservation significance across countries is positive, and remains when area is factored out. Although most highly biodiverse countries received aid proportional to their biodiversity score, some, such as Cameroon, the Philippines, and the Solomon Islands, did not, while others (especially in dryland Africa) received more than expected. These discrepancies are likely largely explained by the focus of development aid where governance is stable and poverty alleviation potential high. We conclude by recommending that biodiversity donors use tools like the IUCN Red List to assist in the allocation of their resources.

DISCIPLINES: Conservation genetics

315616 NOVEL SPECIES- AND SEX-SPECIFIC PCR AMPLIFICATIONS FOR SPECIES AND SEX IDENTIFICATION FROM INVASIVE AND NON-INVASIVE SAMPLES OF KOREAN UNGULATES

Baek Jun Kim, Hang Lee, Sang Don Lee

There are five representative ungulates species, such as long-tailed goral, feral goat, roe deer, water deer and musk deer, in the wild of the Korean peninsula. To distinguish the species and sex identity without any direct observation, we developed novel species-specific and sex-specific PCR amplification methods for various samples, in particular hair and feces. For species identification, we first tested invasive samples (e.g., tissue and blood), and then did non-invasive samples (e.g., hair and feces) of the five species using five species-specific primer sets. All of the invasive samples were completely distinguished (Table 1). About 75% and 67% of the non-invasive samples were successfully distinguished (Table 1). Each primer set could amplify

only one species and show a different sized PCR product (Fig. 1 and 2). For sex identification, we preliminarily amplified zfx and zfy PCR products of X- and Y-chromosome from a male of each species using a set of sex-specific primers. Presently, we try to design a new set of sex-specific primers to amplify 100-200 bp PCR products for fecal sample (Data not shown). The methods would be an essential tool for the further conservation genetic or ecological studies of the Korean and the Far-East Asian wild ungulates.

314972 PHYLOGENETIC RELATIONSHIPS OF THE CHE WONG ORANG ASLI IN PENINSULAR MALAYSIA BASED ON HVS 1 MITOCHONDRIA DNA AND Y CHROMOSOME ANALYSIS

Ang Khai Chung

One of the ancient Malaysian populations is the minority of the Orang Asli composed of the Negrito, Senoi and Malay Proto. The Che Wong Orang Asli which belongs to the Senoi tribe is only found in the state of Pahang. DNA was extracted from blood according to phenol/chloroform methods before HVS I and SRY gene were amplified. Sequencing was carried out and aligned and phylogenetics trees were built using PAUP software. Analysis of the HVS I using ML and NJ methods reveal that Che Wong formed a sub clade with the Jah Hut sub tribes which separate them from the other sub tribes of Senoi. It also showed that the Che Wong is the most closely related to the ancestors. The SRY analysis also forms a clade by itself. The results showed that the Che Wong to be socially and genetically isolated groups. Small effective population size (N_e) and low level of gene pool in Che Wong, this group continues to be an isolated group, forming a clade and to be the closest population to the ancestors. The location of the Che Wong settlement that is far from other sub-tribes of Senoi also is a contributing factor the isolation of this population. With the number of this tribe continues to decrease and the development surrounding their settlement which pushes them away from their livelihood, the survival of this population remains a threat and at large.

320339 THE ORIGIN AND GENETIC DIVERSITY OF DOMESTIC HORSE IN CHINA

Tiao Ning, Heng Xiao, Jing li, Ya-Ping Zhang

Horse as a very important livestock greatly influenced on the development of human civilization. Although there are abundant genetic resources and long taming history of Chinese horse in record, many valuable horse breeds were extinct with the development of Industrial Revolution. To conserve genetic diversity of Chinese domestic horse, we analyzed mitochondrial DNA (mtDNA) hypervariable segment I (385 bp) fragments of 606 Chinese (28 breeds from 10 provinces) and 12 Indian individuals, together with the 645 available sequences in GenBank. The result suggested that multiple maternal forms joined in Chinese horse population and a possible scenario of the Chinese horse domestication was that horses of the west and the northwest regions outside China contributed more genetic resources into Chinese horse population firstly, and then localized domestication came forth in China. Besides, plentiful genetic diversity, strong gene flow and moderate phylogeographic structure were detected in Chinese domestic horse. Furthermore, based on 317 new mtDNA cytochrome b (1140 bp) data, three clades were confirmed more early diverged from the most recent common ancestor with a time range of 64,000-153,000 years before present. Our research shed light on the domestication, population genetics and phylogeographic structure of Chinese domestic horse that will help us effectively conserve and utilize Chinese horse genetic resource.

366201 A CONTRIBUTION TO UNDERSTANDING OF HERP-BIODIVERSITY AND CONSERVATION IN YUNNAN, CHINA FROM GENETICS: AN EXAMPLE FROM SPINY FROGS (DICROGLOSSIDAE)

Jing Che

Yunnan Province, China has not only the unique and diversified animal resources of the Eastern Himalayas biodiversity hotspot (western Yunnan), but also a wide variety of species from across Southeast Asia, being part of the Indo-Burma biodiversity hotspot. A detailed exploration of local fauna evolutionary relationship can well contribute to our understanding of the biodiversity of amphibians. We present the distributional data on spiny frogs (Dicroglossidae: tribe Paini) in Asia. Especially, by a detailed molecular phylogeographic studies, here we showed the six well-recognized species in this group and a candidate species from Yunnan Province. Furthermore, the evolutionary history of these frogs from Yunnan, compared with other species within this tribe was investigated. This example from our data indicated that herpetofauna in Yunnan are widely related to Himalaya, Qinghai-Xizang Tibet Plateau, Western Sichuan, Eastern China, and also Indochina. This calls for a key conservation priority for herp-biodiversity in Yunnan Province. Five new evolutionary clades in present tribe Paini were found which indicated some possible candidate species, among which, two clades are related to Yunnan herpetofauna. Presently, it is apparent that traditional morphological data alone obscures divergent evolutionary lineages that deserve recognition and protection and molecular genetic technique can play a critical role in more realistically deciphering amphibian biodiversity in coming years.

366834 NON-INVASIVE GENETIC SAMPLING OF THE ASIAN ELEPHANT TO ASSESS POPULATION STATUS AND CONSERVATION PRIORITIES IN A FRAGMENTED LANDSCAPE IN NEPAL

Narendra Man Babu Pradhan

Bardia National Park holds the largest elephant population in Nepal. The population was functionally extinct in the early 1990s, but was rescued by immigrants from India within a short period of time in 1994. We carried out non-invasive genetic sampling to assess population size, herd structure and kinship. A capture-mark-recapture estimate suggested that there were approximately 50 individuals in the 280 km² study area of the park, which agrees well with field observations. Notably, our sample represented more males than females, 18 vs. 13. However, the sex ratio was male-biased only among sub-adult individuals where we found 10 males compared to only 2 females. This observation strongly suggests the presence of sub-adult male immigrants in the population, which was also supported by negative relatedness values between the adult females and many of the sub-adult males. Our data indicated somewhat reduced genetic diversity, which probably can be explained by a founder effect in 1994 and the presence of many related individuals among the founders. However, since immigration of sub-adult males seems to be quite common, there are good prospects for enhancement of genetic diversity. Further immigration is promoted by the corridors connecting Bardia National Park to other protected areas in Nepal and across the Indian border. Indeed, for long-term conservation of the Asian elephant in Nepal, it is imperative to conserve these natural corridors between core elephant habitats.

365229 BAMBOO GERMPLASM RESOURCES CONSERVATION IN CHINA**Guo Qi Rong**

System researched on Chinese and world bamboo species and those genetic resources collection, conservation, utilization, especially of moso bamboo.

314819 GENETIC DIVERSITY AND POPULATION STRUCTURE OF ROCK CARP (PROCYPRIS RABAUDI) BASED ON MICROSATELLITE ANALYSIS**Xiuyue Zhang, Zhaobin Song, Bisong Yue**

Rock carp (*Procypris rabaudi* (Tchang)) is an endemic and important commercial fish species in China, and distributed in upper reaches of the Yangtze River drainage. Due to over-fishing, dam construction and water pollution, the wild populations of it have rapidly declined in recent years.

Nine microsatellite markers were used to assess genetic diversity and analyze population structure for nine populations. Populations Wanzhou (WZ), Mudong (MD) and Hejiang (HJ) were from main stream of the Yangtze River, Tongjiang (TJ), Cangxi (CX), Beibei (BB), Tanghe (TH), Xishi (XS) and Wulong (WL) were from different tributaries. Average allele number per locus were 5.33-10.44, and average expected heterozygosities were 0.676-0.761 across populations. F_{ST} s (0.0243-0.0865) between tributary and main stream populations, and F_{ST} s (0.0480-0.1423) among tributary populations were greatly higher than that among main stream populations (F_{ST} s: 0.0050-0.0095).

The results showed that the genetic variation of rock carp is relatively abundant. Also, the results suggested that there is obvious population structure between populations of main stream and tributaries, and rock carp might not prefer to migrate between the main stream and the tributaries even if they might be closely connected. The population differentiation in rock carp was owing to the different habitats, but not the geographical distances.

305750 AN ANALYSIS OF GENETIC STOCK STRUCTURE OF PORTUNUS TRIBERCULATUS ALONG THE COAST OF CHINA**Zhiguo Dong**

Genetic diversity and stock genetic structure of the six swimming crab (*Portunus trituberculatus*) geographical stocks from China coast was analyzed using AFLP markers to assess genetic resource. Eight pairs of primer combinations generated 925 loci among the 85 individuals. High polymorphism at the AFLP markers was found within these stocks. ZZ, DY and DL have higher genetic variation than LYG, ZJ and ZS according to PPL, I and He together. To explore inter-stock differentiation, the pairwise F_{ST} results revealed there were significant different ($p < 0.01$) among the six stocks. Especially, genetic differentiation was remarkable among the six stocks whose the pairwise F_{ST} value all surpassed 0.1 besides to between DL and LYG (0.04418) and between ZJ and ZS (0.02633) and between ZZ and DY (0.03218). Gene flow N_m and G_{ST} across all stocks as a whole was 1.9354 and 0.2053, respectively. Generally, among the six stocks there existed high genetic variation and genetic differentiation. UPGMA Cluster found the six stocks belonged to three clades and the geographical

distribution and UPGMA Cluster tree was not exactly accordant. Neutrality test results revealed all have significant difference in the number of selection effect locus ($p < 0.05$). ZS, ZJ and LYG these three stocks faced a considerable selective pressure.

305416 DISTINCT EVOLUTIONARY LINEAGES IN THE SOUTH AMERICAN FUR SEAL, *ARCTOCEPHALUS AUSTRALIS*: INSIGHTS FOR ITS SYSTEMATICS AND CONSERVATION

Larissa Oliveira, Erika Hingst-Zaher, Patricia Majluf, Enrique Crespo, Claudio Venegas, Diego Rodriguez, Natalie Gooddal, Hector Pavés, José Nuñez, Monica Muelbert, Juliana Machado Ferreira, Lgnacio Moreno, Nádia Moraes-Barros, Eduardo Eizirik, João Stenghel Morgante

South American fur seals, *Arctocephalus australis*, occur along the Atlantic and Pacific coasts of South America, but despite their broad distribution, their systematics remains unsolved. Three subspecies have been suggested: *A. australis galapagoensis* for Galapagos Islands, *A. australis australis* for the Falkland Islands, and *A. australis gracilis* for the rest of South America, however, in 1971 *A. galapagoensis* was recognized as a full species. Here we report the analysis of 15 skull measurements (traditional morphometrics), 52 anatomical landmarks digitized on 754 skull images (geometric morphometrics) and 111 sequences of mitochondrial DNA (control region and cytochrome b) in eight populations of *A. australis*. Significant differences were observed between the Pacific and Atlantic populations, suggesting at least two distinct evolutionary lineages. The populations from Peru and northern Chile were highly distinct from the remaining areas, possibly comprising a separate species. Regardless of the resolution of taxonomic issues, important implications for conservation can be raised, especially given that this Pacific evolutionary unit has been listed since 1999 as endangered for the entire Peruvian coast. Financial support: FAPESP 2007/ 58728-9

315291 THE GENETIC RESCUE OF BLACK RHINOCEROS: REDRESSING TRANSLOCATION BIAS FOR LONGER-TERM META-POPULATION MANAGEMENT.

Rosalynn Marie Anderson-Lederer, Peter Ritchie, Wayne Linklater

As the black rhino species recovery progresses, it will be necessary for meta-population management priorities to change from an emphasis on population size and growth to population quality. In particular, a sustained recovery requires the maintenance of genetic diversity within reintroduced populations that is representative of source populations. Nevertheless, after 25 years of black rhinoceros translocation, we still do not know the degree to which capture is genetically biased or how many rhino need to be captured in order to translocate a representative genetic sample. In this talk, I will present my results to date from the analysis of one mtDNA marker and 10 neutral microsatellite markers in Hluhluwe-iMfolozi Park (source population) and founder populations (2004-2008). These results will eventually be used to conduct genetic sustainability analyses for founder populations of various sizes subject to supplementary releases of varying frequency and size using VORTEX software to recommend translocation strategies for genetic rescue.

315538 TIGERS REQUIRE EXTENDED PROTECTION: NON-INVASIVE GENETICS TO CONFIRM PRESENCE OF TIGERS AND SYMPATRIC CARNIVORES OUTSIDE TIGER RESERVES IN INDIA

Jyotsna Bhagavatula, Ashwin Naidu, Imran Siddiqui, Lalji Singh

Most tigers are now found in tiger reserves, areas designated for tiger conservation that receive a higher level of protection than wildlife sanctuaries and reserve forests that comprise sizeable blocks of potential tiger habitat in India. To develop a reliable method to check for tiger presence in wildlife sanctuaries and reserve forests, we conducted a pilot study in a 220 sq. km. dry-deciduous forest area of the Kawal Wildlife Sanctuary located in south-central India. We performed mitochondrial DNA analysis on 40 carnivore fecal samples collected between December 2006 and June 2007, and successfully identified 2 tiger (*Panthera tigris*), 18 leopard (*Panthera pardus*) and 12 dhole (*Cuon alpinus*) samples. Our sample size and identification success were reduced because of difficulty in finding carnivore feces and high degradation states of the feces. Heavy human interference in the sanctuary increased difficulty of locating fecal samples. We mapped locations at which tiger, leopard and dhole feces had been found, and proposed relocation of two human settlements present within a 5 sq. km. buffer area of the tiger sample locations and restricted use of a state highway within the sanctuary area. We intend this study to emphasize the applicability of non-invasive genetics in detecting tiger presence and extending protection to the remaining wild tigers outside established and well-protected tiger reserves in India.

315143 INBREEDING AND REPRODUCTIVE PERFORMANCE IN A LARGE CAPTIVE ASIAN HOUBARA POPULATION (*CHLAMYDOTIS UNDULATA MACQUEENII*)

Mark Gillingham, Olivier Leon, Olivier Combreau

Breeding wild endangered animals in captivity is often necessary to save a species from extinction. The eventual objective of such conservation breeding programs is to reintroduce a species into the wild. Typically the captive populations of these programs are founded from a small number of individuals. As a result captive populations of endangered species are particularly vulnerable to inbreeding depression. Theory predicts that the cost of inbreeding on reproductive performance can be substantial due to the increased expression of deleterious recessive alleles and the loss of favourable heterozygote genotypes. Here we analyse the effects of inbreeding on male and female reproductive performance in a captive population of 876 Asian houbara, *Chlamydotis undulata macqueenii*. Implications for the species' conservation breeding management are major: large scale genetic program, accurate pedigree and controlled mating.

315333 PHYLOGEOGRAPHY AND CRYPTIC SPECIATION IN THE FAMILY ALBULIDAE (BONEFISHES)

Elizabeth Wallace, Andrew Simons

A cryptic multi-species complex exists within members of the genus *Albula*. Apparently sympatric species co-occur in the Caribbean, Pacific coastal Americas, and the Hawaiian Islands. However, little is known about Albulids across much of their range. We have recently identified a novel species of bonefish

from the Caribbean based on genetic and morphological data. Mitochondrial and nuclear genetic evidence reveal well-defined, deep separations between this previously unreported species and the others in the complex. Genetic species identification (GSI) assays were conducted utilizing a highly conserved region of mitochondrial DNA. A bonefish-specific microsatellite library was developed to determine hybridization rates. Nuclear data revealed well-defined clusters for each species, and low levels of hybridization between some, but not all members of the Caribbean species complex. Genetic study of this genus allows us to understand the forces affecting speciation and distributions. This genus is highly sensitive to the pressures of coastal development and pollution. In some parts of the world, it is possible that species in this complex are threatened before we even know of their existence. We seek to identify the global species composition and distributions of this economically and ecologically valuable marine fish.

314857 POPULATION GENETIC STRUCTURE OF GREATER HORSESHOE BAT IN CHINA

Keping Sun, Jiang Feng

The greater horseshoe bat (*Rhinolophus ferrumequinum*) is the widespread species in the world. The populations of this species from UK are especially vulnerable to small population effects and fragmentation, but the population genetic structure of *R. ferrumequinum* in China is rarely clear. We report the population genetic structure of *R. ferrumequinum* based on nucleotide variability of the mitochondrial control region (HVI), and discuss the potential consequences for conservation in China. Our results indicate the nucleotide diversity and haplotype diversity are high within the total population, which is corresponding to the extensive distribution of *R. ferrumequinum* throughout Palearctic and Oriental Regions in China. Based on the results of phylogenetic analyses, distribution of diagnostic sites, haplotype network, and AMOVA hierarchical analysis, a northeast-central-southwest division of the whole *R. ferrumequinum* population could be observed. The significant genetic subdivision among those three groups is occurred, which provide important information for conservation.

314978 GENETIC DIVERSITY OF MITOCHONDRIAL DNA IN TAIHANGSHAN MACAQUES, JIYUAN, CHINA

Dongming Xie

As an endemic subspecies of Rhesus macaques (*Macaca mulatta*) in China, Taihangshan macaques (*M. m. tcheliensis*) distributed in the southern Taihangshan Mountains, North China, and are in endangered. To assess the genetic diversity within this species and its population structure, we sequenced 341bp of the hypervariable I (HVI) segment from the mitochondrial DNA control region (CR) for 22 individuals from 5 remnant patches throughout the fragmented distribution area. The 341bp hypervariable control region sequence of the mitochondrial(mt)DNA genome from 127 faecal samples (belong to 22 individuals from 6 populations) of Taihangshan macaques were collected from Taihangshan Mountains National Nature Reserve, Jiyuan, China.

Forty samples which belong to 22 different individuals were sequenced and population analysis was conducted to assess the level of genetic diversity. The results are as follows: 1) the length of the D-loop was 341bp and there are 11 polymorphic sites, 2) 9 haplotypes were identified from 22 sequences, 3) among the population of five geographical unit of the Taihangshan macaques, the Huanglianshu geographic region have higher numbers of base differences, most high of nucleotide diversity and most high of average number of

nucleotide differences.

365486 POPULATION DIVERSITY OF CHINESE SHAR-PEI INFERRED FROM MITOCHONDRIAL DNA SEQUENCES

Liu Qingshen, Su Yan-hua, Feng Ding-yuan, Eric Omura, Zhang Ya-Ping

The Chinese Shar-pei is one of the oldest dog breeds and once was regarded as one of the world's rarest dog breeds. Currently there are two types of Shar-pei based on overall phenotype: commonly known as bone-mouth and meat-mouth type. Bone-mouth type Shar-pei is the traditional type originated from Guangdong province of China and the population size is still very small in danger of extinction; on the other hand, meat-mouth type known to have bred in Hong Kong in the 1970's and subsequently popularized in the U.S. and spread to the world, but presently, it is prone to many hereditary problems. To investigate their genetic diversity level and history, 591bp of the control region of mitochondrial DNA were screened for both types from samples taken from its original province and Hong Kong. Phylogenetic result suggests that Chinese Shar-pei group is very ancient and two new haplotypes are discovered in a geographically restricted clade of previous study. Consistent with history records, bone-mouth type Shar-pei were introduced from Guangdong to the USA, and Hong Kong was the middle ground of breeding and trans-shipment. Meat-mouth type Shar-pei has unexpected high nucleotide diversity value, which suggests a maternal introgression in the process of breeding. Bone-mouth type Shar-pei has the highest genetic diversity, which suggests it being a predecessor of the meat-mouth. And, it is worthy to conserve such a precious endangered dog breed.

315178 USE OF NONINVASIVE GENETIC SAMPLES TO ESTIMATE POPULATION SIZE OF SIBERIAN TIGER IN RUSSIAN FAR EAST

Taro Sugimoto, Junco Nagata, Vladimir V Aramilev, Dale R McCullough

The Siberian tiger population in Russian Far East has been fragmented in three subpopulations, of which two are small and isolated from the main subpopulation and hence facing high extinction risk due to demographic, environmental and genetic stochasticities. To obtain ecological information such as population size, the present study used noninvasive genetic samples, such as feces, hairs and saliva, collected from one of the two isolated subpopulations in southwest Primorye Krai during three winters (2000-03). DNA was extracted from the samples and genotyped by microsatellite markers, and we identified 11 tigers (4 males and 7 females) and population size was estimated to be 12 (95% confidence interval: 9-19) from 2002-03 samples, which was comparable with the track count based estimation. Noninvasive genetic samples collected in winter of this region were frozen and kept in good quality. Therefore, these samples can be used as practical genetic materials for monitoring tiger population and assessing its conservation and management efforts such as developing corridor between the fragmented subpopulations.

315508 PHYLOGEOGRAPHY OF THE BLACKISH DEER MOUSE (*PEROMYSCUS FURVUS*): INTRASPECIFIC VARIATION INFORMS CONSERVATION UNITS FOR NEOTROPICAL RODENTS IN MEXICO

Jared B Lee

Conservation biology strives to conserve biodiversity at different levels including genetic diversity within species. A recent evaluation of *Peromyscus furvus* based on mitochondrial cytochrome b sequences revealed deep splits within the species. We sequenced 70 more individuals for cytochrome b and also sequenced a nuclear intron of the beta fibrinogen gene in 58 specimens representing populations throughout the entire distribution of *P. furvus* to more thoroughly assess the genetic diversity of this species. Our phylogenetic analyses of the nuclear sequences are concordant with the original results based on cytochrome b. We find that populations of *P. furvus* separate into three major groups that should be considered evolutionary significant units (ESUs). One ESU represents populations from the northern most part of the distribution around Xilitla, another ESU represents populations from intermediate parts of the range, and a third ESU from the southernmost part of the range that shows nearly 8% sequence divergence from the rest of the clades. Due to ongoing habitat destruction throughout the range of this species, we assert that such genetic diversity and ESUs can be used to manage and protect the remaining populations of this species and other small mammals endemic to Mexico.

317978 ANALYSIS OF GENETIC DIVERSITY AMONG ARMENIAN *PYRUS CAUCASICA* WILD POPULATIONS BASED ON ISSR DNA MARKERS

Aleksandr H. Yesayan, Nelli A. Hovhannisyan, Armen M. Danielian

Armenia is considered to be part of the centre of origin for many cultivars including pears. In Armenia there are 32 species of the genus *Pyrus* identified from, 12 from which are endemics. The mentioned data indicate an intensive speciation processes in the genus *Pyrus* in Armenia. The purpose of the present study was to investigate, through the use of ISSR markers, the genetic diversity in wild populations of *Pyrus caucasica*. Thirty individuals, randomly sampled from each population were genotyped at 10 ISSR markers, selected from a total of 52 ISSR ones for ISSR PCR amplification. 121 bands were amplified from 10 ISSR primers. The results obtained have shown that most of the genetic variation was partitioned between rather than within populations. Among these markers, 76 alleles were observed in wild populations of *P. caucasica*. Based on them, a Jaccard's genetic similarity matrix and a dendrogram for studied populations were established using SPSS 13.0 and MEGA 4 software. In this dendrogram populations of wild pear in Armenia could be divided into two distinct gene-pools. The present study shows that there is high diversity among the *P. caucasica* populations tested and indicates the potential of ISSR markers for genetic diversity analysis of wild plants. The study was supported by UNEP GEF Crop Wild Relatives Project in Armenia.

DISCIPLINES: Conservation medicine

309887 LOGGING CREATES UNANTICIPATED THREAT TO APE HEALTH AND CONSERVATION IN EQUATORIAL AFRICA

Thomas R Gillespie, David Morgan, Crickette Sanz, Kenneth Cameron

Selective logging is a dominant land use activity in forested areas of the tropics with the potential to provide a sustainable and profitable supply of timber while simultaneously ensuring biodiversity conservation. However, selective logging results in a suite of alterations in host ecology and forest structure that may alter infection prevalence and infection risk in resident populations. As part of a large-scale investigation of patterns of parasitism and infection risk for apes in logged and undisturbed forest, we collected 48 1-m³ vegetation plots from trees of species frequented by gorillas and chimpanzees in Republic of Congo. Half of these plots were within the Kabo Logging Concession and half were within the adjacent Goualougo Triangle, an undisturbed forest. We used a modified sedimentation technique to recover infective-stage parasites from vegetative plots for examination by compound scope for infective-stage individuals of nematodes with the capacity to infect apes and / or humans. Infective stage larvae of *Strongyloides stercoralis* were found in 25% (3/12) of ground vegetation plots in the Kabo Concession, but were found in none of the vegetation plots from Goualougo Triangle. This represents an unanticipated threat to ape health and conservation since *S. stercoralis* was not thought to occur in humans in Equatorial Africa and is associated with hyperinfections with the capacity for high mortality rates in apes and humans.

DISCIPLINES: Conservation psychology

366062 CHINESE WILDLIFE VALUE ORIENTATIONS: RURAL-URBAN DIFFERENCES

Xiangyou Shen, Harry C Zinn

Understanding public's attitudes toward wildlife is vital to conservation efforts, especially those that address human-wildlife interaction. As home to the world's largest population, China is among many developing countries that put tremendous pressure on natural resources. Identifying wildlife value orientations (WVO) among contemporary Chinese can help inform wildlife conservation policy and guide mitigation human-wildlife conflict. Using WVO dimensions developed by the Wildlife Values Globally project, we conducted sixteen semi-structured interviews in five cities/towns in China probing the common WVOs held by Chinese. Results revealed the existence of seven WVOs among participants: materialism, mutualism, caring, symbolic, human safety and security, attraction, and repulsion. Between rural and urban participants, stark differences were found in five dimensions, with mutualism and human safety exhibiting the strongest contrast. These results are discussed in light of the long-standing rural-urban division rooted in China's dichotomous social system and reinforced by the widening rural-urban gap resulting from two decades of aggressive economic reform programs. Although results are not generalizable, they suggest that conservation efforts may meet a strong orientation toward wildlife use among rural Chinese in contrast to an orientation toward wildlife protection among the urban population.

DISCIPLINES: Ecology restoration

315161 EXPERIMENTAL MANAGEMENT OF THE CRITICALLY ENDANGERED FLEURIEU PENINSULA SWAMPS, SOUTH AUSTRALIA: WITH PARTICULAR REFERENCE TO CLIMATE CHANGE IMPACTS

Rebecca Danielle Duffield, Alys Stevens

The Fleurieu Peninsula (FP) Swamps are a locally endemic ecosystem that is listed as critically endangered. Following the cessation of disturbance within FP Swamps, floristic and structural diversity significantly declines. The swamps are a water dependant ecosystem and highly susceptible to deleterious impacts of climate change, particularly drought conditions.

This research quantifies the response (floristics, structure, mode, productivity, regenerative strategies and organic carbon loss) of FP swamps subjected to controlled disturbance regimes and drought events.

A suite of techniques have been used that incorporates field and lab-based experiments. Data is collected from within quadrats, sub-plots, cells and at points, encompassing methodologies that provide information about compositional and functional traits.

Results indicate that controlled disturbance within FP swamps will initially result in structural, floristic and patch richness and that the relationship between productivity and diversity is variable. Furthermore, there is a difference in the response of vegetation burnt 12 years ago and that burnt recently which has been subjected to extreme droughts. The research will drive a community successional model and produce specific recommendations to manage and protect the biodiversity and conservation attributes of the of FP Swamps.

314982 DEMONSTRATION SITES FOR CORAL REEF RESTORATION AT KOH KOOD, THAILAND

Thamasak - Yeemin, Makamas Sutthacheep, Se Songploy

Koh Kood is located in the eastern part of the Gulf of Thailand, near Cambodia. It is developing to be a new hot spot for ecotourism. This paper provides lessons learned on demonstration sites for coral reef restoration at Koh Kood. The demonstration sites for coral reef restoration were carried out in limited areas where they can be easily controlled and managed for the benefit of ecotourism, education, raising public awareness, and research. Local administrative offices, government agencies, NGOs, local communities and private sector have participated actively in the planning, implementation processes and monitoring for their direct and indirect benefits from the demonstration sites. Coral fragments on coral reefs were used in order to increase the survival of natural coral fragments that might otherwise have had low survival because they were susceptible to being buried. A coral reef restoration method, additional substrates for coral recruitment and attaching coral fragments by using clusters of designed concrete blocks, was selected to show at the demonstration sites. The local administrative office of Koh Kood should be a key agency to encourage and strengthen collaborative management of the demonstration sites for long-term benefit.

315174 SPECIES CONSERVATION AND COMMUNITY RECONSTRUCTION PROMOTED BY WISE USE: A CASE STUDY OF RE-BLOOM OF OTTELIA ACUMINATA IN DIANCHI LAKE**Shu Shusen, Li Yuan, Chen Xiaoyong, Junxing Yang**

Excessive use is one of important reasons lead to species extinction, but wise use is probably a new way for species conservation. *Ottelia acuminata*, which is a second class state protected plant, was widely distributed in plateau lakes of China including Dianchi Lake. However, it disappeared from Dianchi Lake in 1980s by pollution, and alien species. The first successful replantation of *Ottelia* in Dianchi Lake was in 2007, then the total area of the field was less than 3,000m², however a set of planting and management techniques were developed. In 2008, *Ottelia* had been replanted into more than 100,000 m² (150 mu) of fish ponds in Dianchi Lake under cooperation of the scientists and local farmers. In the project, scientists are responsible techniques and seedlings, while local farmers offered land and input of labor and daily management. The stem of the flower and spathe were harvested every week and traded in market by local farmers. The farmers earned additional 1,000 yuan per mu from culture of *Ottelia* than that of fish, it will make more farmers take part in replanting of *Ottelia* in the next year. After disappeared for 30 years, it is certain that *Ottelia* will re-bloom in Dianchi Lake soon. Compared to old ways, our system has three major advantages, wise use of individual modular, exploitation of its economic value, and attractation local community to participate in replanting works. This new system to an new active way of conservational of macrophytes.

315396 POTENTIAL OF RESTORATION AND PHYTOREMEDIATION WITH PHRAGMITES AUSTRALIS FOR CRUDE OIL-IMPACTED COASTAL WETLANDS**Qianxin Lin, Irving A Mendelssohn**

Information and knowledge about the oil tolerance of native coastal plants are scarce, but are important for restoring and remediating oil impacted habitats. *Phragmites australis* is the dominant brackish marsh plant species. The crude oil tolerance limits of *P. australis* and its capability to phytoremediate crude oil in marsh sediments were investigated. *Phragmites australis* was transplanted into brackish marsh sediments with crude oil concentrations at 0, 40, 80, 160, 320, 640 and 960 mg/g in the sediment. Plant photosynthetic rate, stem density, shoot height, aboveground biomass and belowground biomass were analyzed periodically during a one-year plant growth cycle to determine the oil tolerance limits of *P. australis*. Most plant parameters were significantly lower at oil dosages ≥ 80 and 320 mg/g of crude oil in the sediment compared to the control. The tolerance of *P. australis* was estimated between 160 and 320 mg/g of crude oil in the sediment. Furthermore, phytoremediation with *P. australis* enhanced oil degradation; the concentrations of total petroleum hydrocarbons in the phytoremediation treatment with *P. australis* were significantly lower than those in un-vegetated sediments. The current study shows the promise of using native coastal plants for simultaneously restoring and remediating the oil-impacted coastal wetlands.

364730 ECOSYSTEM HEALTH ASSESSMENT IN THE LOWER REACHES OF THE TARIM RIVER, XINJIANG, CHINA

Aihong Fu

The purpose of this research is to analyze the feasibility of taking exergy(Ex), structural exergy(Exst), ecological buffer capacity($\beta(\text{popul})(\text{GL})$) and the diversity index(DI) as ecosystem health indicators and evaluate the state of ecosystem health in the lower reaches of the Tarim River, Xinjiang. In 2005 the Ex and DI were highest, the Exst was lower, the $\beta(\text{popul})(\text{GL})$ was lowest. This means that the state of ecosystem health in 2005 was relatively better; however, there were still some problems such as the disharmony of biological structure (too high arbor and shrub biomass and lower herbage biomass). In 2006 the Ex and Exst were higher, the $\beta(\text{popul})(\text{GL})$ was lower. This implies that the ecosystem in 2006 had problematic health. In 2002 the Ex and Exst were lower, the DI was higher, the $\beta(\text{popul})(\text{GL})$ was highest. This implies that the state of ecosystem health in 2002 was relatively worse comparing with other years. In 2003 the Ex and Exst were lowest, the $\beta(\text{popul})(\text{GL})$ and DI were lower. This means that the state of ecosystem health in 2003 was worst. A relative order of health states for the lower reaches of the Tarim River from good to bad can be derived: in 2005> in 2006> in 2004> in 2002> in 2003. The evaluation results are in conformity with the actual situation.

315204 HABITAT SELECTION AND FEATURE ANALYSIS OF WINTERING BLACK-NECKED CRANES GRUS NIGRICOLLIS IN DASHANBAO, YUNNAN, CHINA

Kong Dejun, Yang Xiaojun, Zhong Xingyao

Habitat transition has a great effect on wildlife and it is necessary for nature reserves to fully understand the habitat selection of wild animals. Dashanbao National Nature Reserve (DNNR), Yunnan, China recently began a policy to convert farmland back to grassland and forest, and in relation to this policy, we studied the habitat use and selection by Black-necked Cranes (*Grus nigricollis*) in DNNR during Nov. 2006 to Apr. 2007. The farmland (39.98%), grassland (12.37%), marsh (30.58%) and water area (17.07%) were selected by the black-necked cranes in winter, and no cranes occurred in Yunnan pinewood (*Pinus yunnanensis*) and the shrub of bamboo (*Bashania fangiana*). The black-necked cranes used the farmland and grassland as their main foraging site, while the water area was their main resting site, and marsh served as their foraging and resting site. During the whole winter, the black-necked cranes did not use every habitat proportionally. Bonferroni Tests showed that the black-necked cranes positively selected farmland, marsh and water area, but avoided the grassland. Descriptive analysis and principal components analysis showed that cranes used habitat close to their roosts and near to water with less human activity and less disturbance. Scientific habitat management that takes into account the habitat selection of black-necked cranes should be conducted at DNNR for effective crane conservation.

DISCIPLINES: Environmental anthropology

305503 FUEL WOOD DEMAND-SUPPLY DYNAMICS AND SPECIES RESPONSE IN MM HILLS RESERVE FOREST, SOUTHERN INDIA

Harisha Ranganahalli Puttahariyappa

This study examines the magnitude at which fuel wood supply and demand growing in the study site and fuel wood species responding to cutting patterns at different habitat in Male Madeshwara Hills (MM Hills) Reserve Forest. Household survey by questioners on fuel wood demand revealed Households, Hotels and Dabas largely (94%) rely on fuel wood (16.3 lacks tons/year) from forest. The head load census (140 bundles/day), fuel wood bundle analysis, and gender analysis explains (women livelihood) the fuel wood collection and selling is an immediate option for women to meet their immediate cash need. Transect survey in the fuel wood collection sites, in three habitat, provides a synoptic view (higher size class have poor coppicing and moist deciduous species are vulnerable to fuel wood cut) of species response, to cutting patterns in three habitat, in terms of number of individuals sprouting back, dying completely and species which are more frequently used for fuel. It definitely needs an interdisciplinary approach to understand the inter-reliant problem, and find the best solution for sustainable harvest and use of fuel wood. As part of conservation linked livelihood program the forest dependent community is provided space to establish a platform for stake holders to discuss and demonstrate sustainable use of fuel wood resources and various other natural resources from MM hills reserve forest.

DISCIPLINES: Environmental history

315562 EFFECTS OF MAYA CLASSICAL PERIOD (C. 200 TO 900) CITIES IN JAGUAR (PANTHERA ONCA) DISTRIBUTION IN SOUTHERN MEXICO, BELIZE AND GUATEMALA

Oswaldo Eric Ramirez Bravo

It is the general belief that the Mayas had little impact on their environment, however it has been discovered that they had significant impact along their geographical distribution. The latter affected especially jaguars *Panthera onca* by habitat lost, besides it has been discovered that jaguars or its parts were intensively used. This project aims to determine the extent of habitat loss and some of the impacts that Maya culture had on jaguar populations during the Classic Period during which great part of the jungle was devoted to agriculture. With a literature analysis and a GIS it is possible to determine the impact of this culture had over the specie. At the moment it is possible to say that during the classical period, human population density was higher than it is now in the area. Which generate massive habitat loss as shown from pollen studies as well as diminish in the large prey base as shown in diet studies. Results of this study are important as they can help understand the impact of ancient cultures over the environment, as well as it could help understand present jaguar distribution in the area.

DISCIPLINES: Environmental or ecological economics**304721 ENVIRONMENTAL BENEFIT OF RIPARIAN BUFFER ZONE GROWING SWITCHGRASS FOR CELLULOSIC ETHANOL PRODUCTION****Roy Ruochuan Gu**

Growing switchgrass in a riparian buffer zone can be one of future best management practices in agriculture. Switchgrass *Panicum virgatum*, which requires no fertilizers and less land and water, was found to be a good source of biomass. The cellulose switchgrass produces can be used to make cellulosic ethanol instead of corn-derived ethanol. In this study, Soil and Water Assessment Tool (SWAT) model was applied to a watershed to examine the effectiveness of buffer zones of switchgrass in reducing pollutants (nitrate) from crop fields to rivers or lakes. Numerical experiments were conducted to identify potential subbasins in the watershed that have high impact and to assess the effects of buffer size on pollution reduction. Simulation results showed that a buffer zone having 10%-50% of the subbasin area could lead to 55%-90% reduction in the loss of nitrate. The combination of buffer zone and switchgrass for bio-energy can become an emerging practice that is environmentally beneficial and an economically feasible solution to energy problem. The results of this study can be used for the evaluation of economic feasibility of growing switchgrass for bio-fuel in riparian buffer zones and assist in cost-benefit analysis and decision-making in best management practices for environmental protection.

315098 A REVIEW OF ECOLOGICAL AND ENVIRONMENTAL EFFECTS OF TOURISM IN NATURE RESERVES**Lu Zhang, Zhiyun Ouyang, weihua Xu**

For raising revenue and increasing employments, tourism is considered an important economic activity in nature reserves. But it will generate a lot of impacts on the ecology and environment. This article analyzes the whole process of tourism impacts in a way of tourism impacts sources analysis—ecological consequences analysis—process analysis, to give a comprehensive understanding of tourism impacts on nature reserves. Tourism products are divided into sightseeing, holiday stay, entertainment, education, exploration, cultural experience, and how they impact ecology and environment are depicted in detail. These activities will impact habitat and behavior, population size and structure, habitat use and physiological of wildlife; coverage, growth process, appearance, community structure, physiological structure, nutrient status of plant and enlarge species invasion opportunities; physical and biochemical properties of soil. consumption, disease-causing bacteria, toxic chemicals in water and make water eutrophication; quality of air; landscape diversity and leads to landscape characteristics constitute a material change. Finally, we discuss the process from tourism infrastructure construction, transport operations, travel and living waste, recreational activities and their ecological and environmental impacts on nature reserves. Tourism impact in nature reserves needs in-depth study which would help to produce more complete travel planning and management instruments.

DISCIPLINES: Environmental politics and policy

305536 ECOLOGICAL CAPABILITY EVALUATION TO LAND DEDICATING FOR ENVIRONMENTAL CONSERVATION, A CASE STUDY

Mahdi Reyahi Khoram

Before the beginning of development, it is better to select the suitable developing site in order to prevent reduction of natural resources, which may happen for the reason of illogical usage. Environmental conservation means the saving of biodiversity in terms of the genetic richness of populations, the species richness of communities, and the habitat or ecosystem richness of landscapes. This research is performed in Hamadan province is located in west of Iran. In the present research, the evaluation of studied area has been accomplished using Makhdoum's model. Therefore, at the first step, the Makhdoum's model is introduced, and then Hamadan Province, from environmental criteria point of view is evaluated. GIS was used for the mentioned purposes. The software used was Arc View (version 3.2a), with the UTM projection and scale was 1/250,000. In this research, twelve GIS data layers have been used to evaluate. According to the results, the suitable area for environmental conservation as protected areas and others was introduced, which was equal to 9.7 percent of Hamadan Province. Therefore, in development plans it is necessary to pay attention to these results.

315442 LESSONS FROM THE FPIC PROCESS: TWO COMMUNITIES, TWO CONTRASTING RESULTS

Wilfredo Vidal Alanguí

The 1997 Philippine Indigenous Peoples' Rights Act (IPRA) guaranteed among others the right of indigenous peoples to give Free, Prior and Informed Consent (FPIC) on projects and programs entering their communities. The National Commission of Indigenous Peoples (NCIP) was subsequently created to oversee the proper implementation of the IPRA.

This paper presents the experiences in 2008 of an inter-disciplinary research team from the University of the Philippines Baguio as it went through the process of obtaining FPIC for a biodiversity research project from two communities in the municipality of Tinglayan, province of Kalinga, in northern Philippines. These two communities belong to areas targeted for the construction of a Geothermal Plant covering critical forest resources in Tinglayan.

The role of intellectuals in indigenous communities, people's criticisms about the FPIC process and the NCIP, development projects in environmentally critical areas, respect for indigenous community processes, ensuring community participation and earning the people's trust are concerns again coming to light during the FPIC consultations which produced contrasting results as one community did not give its consent to the research. Conservation efforts in indigenous communities around the world might benefit from the lessons learned from the process and from the recommendations.

304610 COMMUNITY PERCEPTION OF BIODIVERSITY CONSERVATION AROUND PENDJARI NATIONAL PARK, BENIN

Fifanou Gbèlidji Vodouhe, Ousmane Coulibaly, Brice Sinsin

The commitment of local communities to protected areas is essential for conserving biodiversity. In Benin, a range of models have been used in National Park management. In contrast with former strategies, the current management regime attempts to give local populations greater involvement and control.

This study, carried out around the Pendjari National Park, investigated local people's views about ongoing park management activities, and assessed how different models influence their perception of biodiversity conservation. 164 local residents were surveyed using structured interviews in local languages. Stepwise Discriminant Analysis was used to analyze the data. The results indicate that the positive attitudes of local communities towards conservation of biodiversity are highly correlated with the current participatory management strategy, and with the respondents' educational level and ethnic origins. Respondents' perceptions of biodiversity conservation were significantly related to locally perceived benefits. Despite the fact that 89% of respondents are amenable to the concept of biodiversity management, the decision to ban agricultural activities on park land has increased negative opinions of the park management.

Understanding local communities' perceptions of conservation and taking their concerns into account is essential in developing effective National Park management strategies.

305617 PROTECTED AREAS AND ITS ECOTOURISM ATTRACTIONS; A CASE STUDY OF KHAN_GORMAZ PROTECTED AREA IN IRAN

Mahdi Reyahi Khoram

Ecotourism is economic activity that minimizes environmental impacts and at the same time, generates incomes for local communities. Ecotourism continues to become a management strategy for protected areas. Kham_ Gormaz protected area with about 10,000 hectares surface area is situated in Hamadan province in Iran. This research has been conducted during 2001 through 2008. To identify and define ecologic resources of the region, digital maps were used and on this basis the topology situations of studied area have been accomplished. Kham_ Gormaz protected area has different species of plants, mammals, reptiles and birds. The most mammal population belongs to wild sheep and the second abundance is related to wild goat. This region has 6 permanent springs and there are 14 villages around the region. All villages are located in the border area of the region. The main business of these villagers is related to farming, gardening and animal husbandry. Since management the Kham_ Gormaz protected area is very important, it is highly recommended that consultant of Khan-Gormaz protected area management plan should accelerate to complete and approve the guideline for the preparation of management plans for the studied area. The management plan should also set a carrying capacity for ecotourism.

314677 LEVERAGING BUSINESS FOR BIODIVERSITY: SUPPLY CHAIN MANAGEMENT METHODS FOR POSITIVE BIODIVERSITY OUTCOMES

Elizabeth Ann Baer, Bambi Semroc, Conrad E Savy, Christine Dragisic, John Buchanan, Justin Ward

Addressing biodiversity loss and climate change requires new approaches to encourage the adoption of best practices and provide the requisite incentives for the private sector to protect biodiversity. When evaluating and addressing the impact of their operations, most companies limit their assessments and action to direct impacts. However, negative impacts to species and ecosystems often occur through indirect impacts generated through the production, processing and extraction of raw materials in their supply chains. Biodiversity stands to benefit when companies establish standards for transparency and best practice among producers in a proposition that improves the ability of business and biodiversity to thrive in harmony. Many companies are implementing supply chain management systems to improve financial efficiency and ensure ethical labor practices are in place, but these methods do not always include efforts to maximize biodiversity conservation. Three methods for supply chain management are evaluated in theory and based on experience in high-priority regions for their ability to produce positive outcomes for biodiversity. Suitability of these methods -- certification schemes, questionnaires and decision-trees, and continuous improvement systems -- for avoiding and mitigating biodiversity impacts is discussed along with the pros and cons of each approach and a set of best practices for supply chain management aimed at biodiversity is presented.

DISCIPLINES: Indigenous knowledge and conservation

364892 LOCAL STORY OF WILDLIVES AND SACRED FOREST IN WESTERN SICHUAN PROVINCE, CHINA

Li-Juan Duan

Buddhism and local cultural traditions have long protected wildlife species and their habitats in Tibetan-dominated areas of western Sichuan, some of them based on the believe that killing life is a tabu. There is a need to better understand this relationship as long-standing lifestyles with resulting impacts on biodiversity. In Tibetan area, there are many local stories of wildlife and sacred forests, and they reflect the opinion that how local people look at the nature and may explain why local people conserve wildlife and sacred forest around their villages. In July-August 2008 and January-February 2009, 40 stories of wild life, and 10 stories of sacred forest were collected in Daocheng County, Sichuan province, China. They are correlated with local daily life, season change, local tabu, ditheism, history and religion, and they explained why some wildlife and sites are sacred and also regulate the behavior of local people on nature.

306342 LINKING HIMALAYAN AGRO-FORESTRY SYSTEM WITH TOURISM AND TRADITIONAL LIVELIHOOD: A CASE STUDY FROM SAGARMATHA (MT. EVEREST) NATIONAL PARK

Yubaraj Subedi, Bindu Shrestha

Subsistence agriculture and livestock rearing are the main source of livelihood for most of the Himalayan people of Nepal. Sherpas, the dominant indigenous nationalities in the Mount Everest region are engaged in Yak farming and cultivation of essential crops such as Potato, Millet and Maize for livelihood. The paper is based upon the study conducted in 3 buffer zone villages of Sagarmatha National Park (SNP), 45 households selected randomly. Semi structured questionnaires and observation were applied during information collection. Agricultural crops are planted in the terrace. In terracing method irrigation is well controlled and chances of soil erosion are less. Hedge row are planted with different varieties of cereal crops and forest crops that also curb erosion. Only one crop can harvest in one year. Yaks grazed in rangelands are the main source of milk, meat as well as skin. The prospering ecotourism is another important source of income. Locals including women are involved in business based on tourism. At present, earning from tourism is much higher than agriculture and animal husbandry. Almost 50 per cent youth are lured in tourism business. Himalayan farming system and Yak grazing has also become part of tourism now-a-days and contributes significantly on earning.

314878 ECOCULTURAL EDGES AND CONSERVATION OF BIOLOGICAL DIVERSITY: AN ETHNOECOLOGICAL STUDY IN EASTERN HIMALAYA, INDIA

Ranjay Kumar Singh

Ecological edges and traditional culture of Indigenous People of Eastern Himalayas, India has been playing the pivotal role in conservation of bio-cultural diversity and people's survival. Using participatory and conventional methods, 31 major eco-cultural edges were explored in the rainfed ecosystems that are dominated by Monpa community of West Kameng & Tawang districts of Arunachal Pradesh, India (Eastern Himalaya). Variability in ecological edges and cultural diversity, enhanced through cross ethnic relations, allow the Monpa for accesses of wide degree of foods & medicines and conserve biodiversity. For example- yak, finger millets, foxtail millets and tuber crops' diversity was more around Tawang, Sela-pas and Lumla eco-cultural edges, while a critically endangered tree mirangmose (*Gymnocladus assamicus* ex. P.C. Kanj), oak species and sheep diversity were more in numbers around Dirang eco-cultural edges. These diverse ecological edges are significantly affected by the ecological ethics of community who access and manage resources across the time and space. The eco-cultural edges are intermingled with socio-political and economic attributes of society and are affected by the community based management practices. These 31 location specific eco-cultural edges persist in rainfed ecosystems have profound role in deciding the sustainability of biodiversity, culture and survival of human being.

314506 SMALL CARNIVORANS FROM SOUTHERN BENIN: ASSESSMENT OF DIVERSITY AND HUNTING PRESSURE

Sylvestre Djagoun

In southern Benin, several protected areas exist but do not benefit from concrete conservation actions. Small mammals are tempting targets for hunters, especially with the current large game monitoring poaching which will inevitably increase pressure on less visible game. Given that small carnivorans are usual constituents of the game trade. For this study we made interviews, surveys of local markets and occasional field observations. Species were identified by proceeding to the nucleotide sequencing method. We provide an Index of Rarity, expressed as number of times a species is identified as 'rare' by interviewees/the number of time it is mentioned. Genets, *Crossarchus obscurus* and *Herpestes ichneumon* were from far the most sighted, prevalence of such ecologically versatile species confirming that southern Benin constitutes a disturbed "ecosystem". Mean incomes range between US\$ 2,5 and 5,4 per animal, with notable exception of *C. civetta* (US\$ = 14,6) and *H. maculicollis* (US\$ 33,7). Additional field surveys in Benin in order to test hypotheses of distribution and status built from hunters interviews are required. Better characterization of small carnivoran diversity, population history and ecology should enlighten our understanding of the Dahomey Gap as a key factor in the structuring of the West African fauna.

315647 ABUNDANCE AND USE OF HUNTING MAMMALS: THE TICUNA COMMUNITY CASE FROM SAN MARTIN IN THE AMACAYACU NATIONAL NATURAL PARK. COLOMBIAN - AMAZON.

Jenny Paola Gallo Santos

Hunting is an important survival strategy for indigenous Amazon, this activity has caused local extinctions of populations of wild mammals. Colombia is the impact on little-known mammals in the indigenous communities of the Amazon. Therefore the project "Jaguar" was evaluated for use in the game mammals Park Amacayacu.

A hunting trail path sampling was carried out so to determine the relative mammal abundance. Also periodical surveys were done to the hunters, which is how the rate of use of mammals was determined and the use of species in danger of extinction, further more the taxons and places that need a plan of use.

The estimate of sustainability based on the model of Robinson & Redford (1991) suggests that the hunting of wild mammals is not sustainable, but this settlement is not intensive extraction, stocks of *Cuniculus paca*, *Dasyprocta fuliginosa*, *Pecari tajacu* y *Tapirus terrestris* and are being severely depleted.

The obtained conclusion, recommends the establishment of close seasons of species and places, this information helped as a base to establish an internal use of the resources in the document "management plan" of the San Martin community and to direct actions in the conservation of the fauna of the protected area.

DISCIPLINES: Landscape ecology**304114 BIOTIC INTEGRITY OF CERRADO STREAMS FROM RIO CUIABÁ BASIN, MATO GROSSO, BRAZIL****Nadja Gomes Machado, Jerry Penha, Eduardo Venticinqu**

In the last 30 years, the Cerrado has been suffering severe anthropic impacts that provoke alterations in species composition and in the structure and functioning of aquatic habitats. Studies about impacts on the Cerrado are useful to prevent future damage and to restore environmental quality. The objectives of our study were: (i) to evaluate the biotic integrity of streams (first and second order) in the Rio Cuiabá Basin and (ii) to analyze if the Index of Biotic Integrity (IBI) follows changes in the environmental quality measured by the Index of Environmental Quality (IEQ). We sampled 26 streams in sub-basins of the Cuiabá River. In each stream, we closed a stretch of 50 meters with blockage nets. We used electrofishing to capture fish. To get a measure of environmental quality in sampled units we characterized the stream and its micro basin. For the analyses we used the Spearman Correlation, Kruskal-Wallis test and Analysis of Multiple Regression. We collected 697 individuals distributed in 6 orders, 15 families and 49 species. The IBI followed changes on environmental quality measured by IEQ. Natural and artificial barriers affected biotic integrity. The IBI was not sensitive to variations in mesohabitat structure. The IBI is certainly a reasonable instrument for evaluating changes in the environment, but we cannot ignore the fact that we were able to obtain the same result with any combinations of metrics. This makes its analysis and interpretation difficult.

315215 LANDSCAPE PATTERN CHANGES AT ZHALONG WETLAND IN HEILONGJIANG, CHINA**Zhang Yuhong, Su Liying, Zhang Shuqing**

We studied changes in landscape patterns at Zhalong Wetland using remote sensing, GIS techniques and analysis of a time series of satellite images from 1979-2006. Our results show that (1) the landscape pattern at Zhalong changed significantly. (2) The centroid of wetland shifted from northeast to southwest from 1979-2006, indicating the distribution of water changed. (3) The wetland is getting drier, especially from 1999 to 2006. About 100 km² changed from open water to other wetland types of land cover and 611 km² marshes changed to drier types of land cover. The area covered by alkalized soil has been expanding. The total alkaline soil area increased by 28.08 km², including increase in the core area. (4) The wetland has become more fragmented. The landscape connectivity decreased from 0.6054 in 1979 to 0.2630 in 2006. Other indices, such as the mean area of wetland patch, the largest patch index and the density of patch also changed significantly. Zhalong is a globally important wetland supporting the largest breeding population of Red-crowned Cranes and many other birds. This study of landscape changes is now helping to guide wetland restoration at Zhalong. Reserve management needs to address water supply and wetland fragmentation.

314990 A MODELING APPROACH OF MAPPING THE DISTRIBUTION OF GORSACHIUS MAGNIFICUS IN SOUTH CHINA: CRYPTICITY LEADS TO "ENDANGERMENT"?

Yang Liu, Fenqi He, Bofeng Cai

The White-eared Night Heron, *Gorsachius magnificus*, is distributed in the subtropical forest of southern China and northern Vietnam. Its nocturnal habit and cryptic behaviors make it probably the most endangered Ardeidae species in the world. The population status of White-eared Night Heron is poorly documented and its distribution is previously known in a scattered and spatially patchy manner. Little is known about its habitat requirements, other than the fact that it apparently relies on forests and wetlands. Here we present a preliminary study to analyze the habitat requirement and suitability of *G. magnificus*, using Ecological Niche Factor Analysis (ENFA). We pooled data on the heron's occurrence records and museum specimens, together with Ecogeographical Variables (EGVs) extracted from remote sensing data. We discussed the topographic, climatic, land-use and vegetation factors that could best explain the current distribution pattern, and identified suitable habitat conditions at the landscape level. We further generated habitat suitability maps for this species, which can be used to help determine sites with conservation priority and predict the species' potential occupied sites for further field surveys.

DISCIPLINES: Population dynamics

366174 THE POPULATION STATUS AND RESOURCES UTILIZE SITUATION OF CHINESE PÈRE DAVID DEER

Shumiao Zhang

The Père David deer is one special species deer in Chinese deer family, belong to 1st class protected animal, which had big contribution to our nation on ancient time (being hunted and providing food). Its antlers, fats, fleshes and bloods etc. have medical value. Since human being's irregular hunting and environment changing, Père David deer had been extinct on 1900. In the middle of 1980's, our country started Milu's reintroduction program. Our government have built three large protect reserves till now, such as Beijing Nanhaizi Milu Park, Da Feng Muli National reserve in Jiangsu province, Shi Shou Muli National reserve in Hubei province. Now, this program obtain succeeded in the world wide, and Père David deer's population in our country has already exceeded 2000. The Père David deer has thrown off endangers class step by step.

315269 ASSESS THE IMPACT OF LAND USE ON THE DYNAMIC OF KHAYA SENEGALENSIS, AFZELIA AFRICANA, PTEROCARPUS ERINACEUS IN THE NORTH BENIN

Laurent Gbenato Houessou

Some species conservation deserved particular attention due to their multipurpose uses. This study aims to quantify the impact of the use of *Khaya senegalensis*, *Azadirachta indica* and *Pterocarpus erinaceus* as fodder trees during the dry season by the cattle breeders and propose suitable strategies for their conservation. The vegetation survey based on line transect method has been performed either in protected area (W Reserve Biosphere) and none protected area (Agrosystem land). Plot of 100 m X 100 m has been systematically

installed at each 1 km along the transect.

The study revealed that the estimated abundance of the three species is higher in the protected area. Regarding the size-class distribution of the three populations' species, the coefficient of skewness showed normal distribution for the population species in the protected area and asymmetric distribution in the non-protected area where the species trees are most pruned for cattle feeding and the sampling and seedling of the species almost non-existent. Finally, we suggested that the protected areas conserve more *Khaya senegalensis*, *Azelia Africana* and *Pterocarpus erinaceus* species and strategies of conservation should be focused on the protected area.

320216 A PRELIMINARY ASSESSMENT OF THE BALE MONKEY IN THE HARENNA FOREST OF ETHIOPIA

Kumara Wakjira

Surveys were conducted in Dec 06-Jan 07 (dry) and in Aug 07 (wet) the Harenna Forest to provide a preliminary estimate of population size and distribution of the Bale Monkey. A total of 163 km of transects were surveyed in three habitats, bamboo forest, bamboo-mixed forest and non-bamboo forest. A total of 204 monkeys were observed, in 31 groups over an altitudinal range of 2200-3400 m asl. Group size ranged from 2-20 (median = 5) and was similar for the two survey periods. Monkeys were found only in bamboo and mixed-bamboo forest. A mean density of 9.6 (SE=8.8) and overall abundance of 1437 (SE=1315) were estimated. The high variability associated with these estimates is a consequence of small sample size and short sighting distance, a consequence of the terrain, climate, and dark and closed conditions in the bamboo forest. Repeated sampling of the site with a team experienced with the terrain and the species is needed to increase the reliability of the population estimates.

304520 CHANGE OF DISTRIBUTION AND SIZE OF ABIES GEORGEI FOREST IN NW-YUNNAN UNDER CLIMATE CHANGE

Hang Gi Wong

1. Treeline shift has been widely used for assessing the effects of climate change on mountain ecosystems, but it does not indicate the changes of forest structure, range and size, which are more important in conservation.
2. The changes of structure and distribution of *Abies georgei* at Yiyong were investigated with vegetation survey and tree-ring study. The rates of distribution shift were analyzed and the forest range and size by year 2100 were predicted.
3. The current forest is at 3600-4200m, regeneration has been reducing below 3900m. The upper species limit has been advancing upslope at an average rate of 11 m per decade, whereas the lowest limit of regeneration has been retreating upslope at 31.3m per decade.
4. Densities would increase at the upper elevations more rapidly on north-facing slopes, and basal area would reduce below 3900m more rapidly on south-facing slopes. By year 2100, the altitudinal range of forest would decrease by 13.6 - 25.9% and the forest size would decrease by 16.4 - 38.6%.
5. We have detected an increasing rate of advancement of the upper species limit and an even more rapid rate of retreat of the viable population from the lower species limit. The size of subalpine fir forest in the Baima Snow Mountain Nature Reserve is expected to decline by 16-39% in this century and even greater in the next.

As the major habitat of the Yunnan snub-nosed monkey, consideration should be given to habitat loss under climate change.

305351 CONSERVATION MANAGEMENT OF ANTILOPES IN KANHA NATIONAL PARK, INDIA

Ravi Shanker Kanoje

The Kanha National Park is the flagship of scientific management of protected areas in India. In 1973 Kanha was brought under Tiger Project for the conservation of endangered endemic subspecies Swamp deer *Cervus duvaceli branderi*. Kana National Park of 940 sq km together with its buffer zone of 1009 Sq. Km. constitutes Kanha Tiger Reserve. The mosaic of grasslands, wetlands and woodlands in the plains, forests in the rolling hills and vast expanse of meadows in the plateau constitutes a unique ecosystem. Kanha is rich in biodiversity 626 species of plants, 42 species of mammals, 11 species of reptiles and 268 species of birds have been identified. Black Buck Antelope *cervicapra*, Blue Bull *Boselaphus tragocamelus* and Four-horned *Tetracerus quadricornis* are the Antelopes of Kanha. The population of large carnivores and mammals are estimated annually but population dynamics of mammals except Tiger and Swamp Deer are rarely monitored. The populations of Black Buck from the year 1972 to 2003, and Blue Bull and Four-horned Antelopes for the year 1988 to 2006 were plotted with time. The Black Buck which was 92 in 1972 had gone vanished. Population of Blue Bull and Four-horned Antelopes drastically declined and latter on its population started increasing and shows rising tendency. The decline of population of antelopes may be due to occurrence of adverse ecological conditions. Favorable ecological condition suitable to specific species may be created through manipulation of habitat.

DISCIPLINES: Social Science

364672 SCALING UP COMMUNITY-BASED NATURAL RESOURCE MANAGEMENT IN CHINA'S VILLAGES: COLLABORATIVE LEARNING CONFRONTS INSTITUTIONAL POLI TICS

Sun Qiu

In the early 1980s, the Household Responsibility System replaced the rural communes. Arable land was contracted to households, but the collapse of institutional arrangements for common property natural resource management and the emerging confusion about ownership, created open access conditions for forests, grasslands, wetlands, and water resources, with commensurate degradation. Since 1995, a GAAS team has engaged in action research to redress this situation. New and effective multi-stakeholder institutions for CBNRM have emerged at village level. Since 2001, the team has sought to scale CBNRM out and up through learning-based activities that aimed to build CBNRM into the procedures and activities of Townships and Counties and line agencies. The paper reports on this experience. The reality in present-day China is that although interdependence is recognized in the abstract, local governments and line agencies have few incentives to collaborate with community-based capacity in sustaining resources or to respond to people's legitimate concerns at the village level when national policies are imposed. The paper concludes that sustainable NRM cannot be achieved unless more effective mechanisms are available to increase the accountability of local governments and line agencies to (organisations of) rural people.

315658 SURFING THE WEB, DIVING WITH SHARKS: CONSERVATION IMPLICATIONS OF SEEKING INTERNET-BASED RISK INFORMATION ABOUT SHARK DIVING

Meredith L Gore, Maria Lapinski, Bret Muter, Lindsay Neuberger, Brandon Van Der Heide

Human-shark interactions can impose fear and severe risks to sharks or people; reducing these risks and fear is a growing global conservation priority. Shark diving outfits that promote risk and fear as a means to experience pleasure or adventure can counteract this objective. How do shark diving websites simultaneously promote fear about sharks and positive emotions about diving with them? Adapting principles from sensation seeking and risk information processing models, we use a linguistic analysis program to analyze the content of 62 international shark diving websites and explore: a) the severity and susceptibility of risks to/from diving with sharks; b) promoted levels of self-efficacy of reducing risks; c) recommended responses to risks to/from sharks; and d) the message sensation value. We present descriptive statistics and characterize themes across website content. We then discuss implications to great white shark conservation specifically and to human-wildlife conflict management generally. Insight about how risk information seeking and processing models apply to wildlife conservation can aid understanding about why people intentionally seek out risk information about human-wildlife conflict yet engage in risky wildlife interactions.

381987 EVALUATION OF TRUNK THINNING FOR MULTIPLE-USE MANAGEMENT OF AN OAK FOREST IN NORTHERN ISRAEL

Didi Kaplan

Dense scrub forest (maquis) covers extensive upland Mediterranean areas. Overgrazing, wildfires and cutting are the main factors inhibiting the maquis to develop to woodland. We evaluated thinning of a mixed scrub forest of *Quercus calliprinos* and *Quercus boissieri* in the north of Israel as a way of promoting a woodland structure that would better serve multiple-use management goals. Trunk thinning was performed once in 1987/88 by local people in exchange for the wood yield and whose free-ranging cattle exploit the area. Treatments were: no (C), moderate (M), and heavy (H) thinning. Trunk circumferences and an index of stand transparency were measured annually over 17 years. Rate of increase in trunk circumference differed significantly among treatments for both species. For *Q. calliprinos*, the mean total increments were 11.6, 16.2, and 21.2 cm for treatments C, M, and H, respectively; corresponding values for *Q. boissieri* were 15.5, 18.8, and 29.0 cm. The index of stand transparency differed significantly among treatments, being 2.7, 4.6, and 6.3 m for treatments C, M and H, respectively. Sustainable management of open woodland can be achieved by a single thinning operation, which is both profitable for the local inhabitants and improves the recreational value of the landscape.

315579 MARINE CONSERVATION INCENTIVE AGREEMENTS: LESSONS AND BEST-PRACTICES FROM A REVIEW OF CASE STUDIES

Heidi Gjertsen, Eduard Theodorus Niesten

Conservation incentive agreements are negotiated contracts by which resource users forego destructive activities in exchange for benefits provided by conservation investors based on conservation performance.

Although this tool is increasingly used in terrestrial settings, applications in marine contexts have yet to receive systematic review. We examine nine conservation incentive agreements to assess performance of the approach in different marine contexts. Data were collected from secondary sources, in-country collaborators, and site visits in Mexico, Ecuador, Palau, Indonesia, the Solomon Islands, and Tanzania. Case studies were analyzed with respect to implementation effectiveness and conservation results, and generated recommendations to inform project design and implementation. We discuss variation of key elements across settings, for example, contracting parties and their rights and responsibilities, criteria for assessing contract compliance and sanctions for non-compliance, timing and nature of benefits (cash, social services, management support), and conditionality of benefits on conservation performance. We consider which components of the approach are necessary and sufficient, and how context variables affect design and performance. Results suggest that the flexibility of incentive agreements lends itself readily to replication in a variety of contexts, and that this tool is well-suited to specific site- and species-based interventions.

ECOSYSTEMS: Conservation at the land-water interface

315375 ASSESSMENT OF ENVIRONMENTAL CHANGE AND PREDICTING WATER INFRASTRUCTURE IMPACTS IN WETLANDS OF THE TRANSBOUNDARY ARGUN-ERGUNA RIVER BASIN

Evgeny Simonov, Lgor Glushkov

The Argun River wetlands on Russia-China border is an Important Bird Area, it has pronounced natural climate cycle with a span of 30 years. Proposed water transfer to Dalai Lake may lead to degradation of both River and Lake wetlands, but the project's EIA claims that river floodplain is more resilient to drought than Dalai Lake. To check validity of this statement we compare recent changes in wetlands. Wetland change in 2000-2007 was assessed on 5700 sq. km, and 20 year changes assessed on model plots. Project used Landsat imagery, SRTM-relief model and botanical survey data. Methods included geo-referencing, classification of vegetation cover and change analysis by combined non-supervised and expert methods, verified by data from botanical transects, statistical analysis.

In 2000-2006 Dalai and Argun both have similar 30% of wetlands undergoing drying. The leading change process for lakes is dropping water level with halophytic vegetation colonizing new bare substrate. For floodplains leading process is desiccation of dense meadows and reed beds, reinforced by fires and overgrazing. In 15-20 years period drying trend also is prevalent, but habitats in areas most affected by flooding and meandering processes often shift to more humid conditions. Argun has similar degree of change during drought as Dalai Lake, but persistence of its floodplain ecosystem is more dependent on flooding dynamics, which could be altered if water infrastructure projects continue.

ECOSYSTEMS: Desert Conservation

320395 REVERSAL OF DESERTIFICATION IS ASSOCIATED WITH A LOSS OF ISLANDS OF FERTILITY AND CHANGES PHYSICAL AND CHEMICAL PROPERTIES IN THE SOIL

Ginger R.H. Allington, Thomas J. Valone

Conceptual models of desertification predict desertified shrublands are in a stable state, and grass recovery is

unlikely. Positive feedback loops involving fertile islands under shrub canopies or insufficient water infiltration rates have been hypothesized to prevent the return of perennial grasses to desertified sites. However, current models cannot account for recent reports of reversals of desertification following long-term livestock removal. We analyzed soil nutrient concentrations and water infiltration rates at a desertified site where native perennial grasses are recovering inside a 50-year livestock enclosure. Soil nutrient levels and water infiltration were elevated inside the fence and fertile islands were not detected. We postulate that, in the absence of livestock, there is a slow release from compaction that results in an increase in water infiltration and a concomitant decrease in erosion, which promotes nutrient accumulation in the soil. The increased water infiltration and soil nutrient levels eventually create an environment conducive to perennial grass re-establishment. Our model unifies previous hypotheses, accounts for the timescale of reversal of desertification and thus more comprehensively describes the dynamics of vegetation in arid systems. Our work suggests that given sufficient time and removal of livestock, soil properties at desertified sites can improve sufficiently to support the re-establishment of perennial grasses.

ECOSYSTEMS: Disturbance ecology

307086 COMPOSITION AND ABUNDANCE OF MACROBENTHOS OF MAJIDUN RIVER, LAGOS STATE.

Imeh Kokoette Esenowo

The study of the composition and abundance of macrobenthos of majidun river, lagos state was carried out monthly from May to October 2008. Six study stations were selected along the river course (three upstream and three down upstream). The result for the physico-chemical parameters showed air temperature values ranges from 24OC to 35OC, water temperature ranges from 25OC to 34OC, depth varied from 0.5 to 6.8m, pH varied from 6.30 to 7.70, TDS was between 51 to 673, conductivity was between 108.7 to 1325 homs/cm, free CO₂ ranged from 13.mg/l to 14mg/l , Alkanility was between 26 to 40.. Hardness was between 22mg/l to 32mg/l, chloride was between 18 to 34mg/l and DO was between 4.0mg/l to 7.0mg/l. Macrobenthos taxa were collected from trhe six sampling stations. The analysis showed that the overall density of fauna differed significantly among the stations. These preliminary data suggest that anthropogenic activities such as human and animals waste, laundering, car washing, wood waste and sand minning have becomes threatening factor to the quality of water

368279 EVALUATION OF THE CONSERVATION STATE OF A NEW TAXÓN PRIMATE OF GENUS CALLICEBUS (PITHECIIDAE, PLATYRRHINI) OF THE CAQUETA DEPARTMENT, COLOMBIA.

Javier García Villalba, Thomas Richard Defler

Thanks of a description of Moynihan (1976) the existence of a new taxon of the genus Callicebus in Caqueta Department, Colombia, was known. In August 2008 was found this new taxon, which is related to Callicebus ornatus and Callicebus discolor to the north and south of the holotype locality (between Caqueta and Orteguzza rivers). The distribution of taxon was determined through interviews with local communities and its presence was confirmed by direct observations, a map of distribution and abundance in Google Hearth gave us the real location. Surveys to people about economic situation and whether they had any historical

perception of the abundance of the populations of this taxon were carried out in order to identify the threats. Also was a revision of a historical archive of aerial photographs and satellite maps to assess the decrease of the original vegetation of the area, this was found in an advanced state of fragmentation, where the coverage is relegated to small original primary forest, caused in a higher proportion by extensive ranching and illegal crops. We propose this taxon should be considered as Critically Endangered, CR B1a, b (iii) and suggest the government give special attention because this taxon is endemic.

ECOSYSTEMS: Forest conservation

306710 INDIGENOUS KNOWLEDGE AND POPULATION STATUS OF SCLEROCARYA BIRREA (ANACARDIACEAE) IN KARIMAMA DISTRICT NEARBY W NATIONAL PARK (BENIN)

G rard Nounagnon Gouwakinnou, Kindomihou Valentin, Brice Sinsin

The sustainable management of the W Regional Park and its peripheral areas is based on a trade-off between conservation and the generation of livelihood means for local populations. This work is a study of the potential of a local edible fruit tree (*Sclerocarya birrea* [A.Rich] Hochst) to contribute to the sustenance of local people by assessing its local uses and population status, by its size class structure in agroforestry systems versus the protected area. An ethnobotanical survey was carried out with 159 respondents randomly selected in all socio-cultural and professional groups around the protected area (Benin). Dendrometric parameters were recorded on individual trees in temporary plots in both types of land uses and abundance estimated. Result show that the whole plant (bark, fruits, kernel, leaves, root and wood) is used as food, medicine and animal husbandry supplies. The largest trees were found in agroforestry systems where saplings are scarce. The species density is about nine times higher in the protected area than agroforestry systems where it regenerates naturally and successfully but faces human threats mainly for agricultural purposes. This study of how communities use this forest species, the nutritional, medicinal and cultural benefits they derive from it, is an important preliminary as to its propagation in agroforestry systems and its domestication.

365287 LAND SNAIL ASSEMBLAGE OF OWABI WILDLIFE SANCTUARY, GHANA

Ishmael Nyarko, William Oduro, Mac Elikem Nutsuakor, Antonio de Winter

The rapid decline of the tropical forest have led to a malacological conservation crises in tropical Africa and information on their biodiversity patterns remains poorly understood. The situation is no different in Ghana at Owabi Wildlife Sanctuary (OWS), one of the smallest conservation areas in the Upper Guinean rainforest of Ghana. The goal is to provide baseline data on the abundance and diversity of molluscs of OWS of the different forest strata of the reserve. Molluscs were sampled using a combination of direct searching (1 hour) and fixed-volume litter sieving techniques in approximately 20m x 20m plots. EstimateS was used to compute for species richness, diversity and composition within the two flora communities (secondary forest and plantation forest). 244 individuals belonging to 16 species in 15 genera and eight families were observed during this investigation. Subulinidae family recorded five species with Maizaniidae, Veronicellidae, Achantinidae, Urocyclidae, and Planorbidae recording one species each. Species accumulation curve could not reach asymptote, suggesting that most species remain un-sampled. There were no significant differences ($p > 0.05$) between the species abundance in the different forest types. Most of the species could not be identified to the species level as a result of insufficient reference specimen.

315157 CAPTURE-RECAPTURE POPULATION AND DENSITY ESTIMATION OF TIGERS IN A POPULATION WITH KNOWN PARAMETERS

Rishi Kumar Sharma, Yadavendradev Jhala, Qamar Qureshi

Conservation of large carnivores requires accurate and precise estimates of abundance. These estimates for wide ranging, rare, and intelligent species can be biased due to inappropriate estimator models and study design. We evaluate population-density estimators in the context of tigers in Kanha Tiger Reserve, India, using camera traps in conjunction with telemetry (n=6 tigers) in a known population of fourteen tigers. An effort of 462 trap nights over 42 days yielded 44 photographs of 12 adult tigers. Least biased and precise population estimate (SE) was obtained by Mh JK1 (14(1.89)). Tiger density (SE []) per 100 km² was estimated at 13(2.08) when effective trapping area was estimated using the half mean maximum distance moved (½ MMDM), 8.1(2.08) using the home range radius, 7.8(1.59) with the full MMDM and 8.0(3.0) with the spatial likelihood method. At simulated low tiger densities camera density of 50 per 100 km² with an effort of 8 trap nights per km² provided 95% confidence coverage, but estimates lacked precision. Density estimates using spatial likelihood and home range radius provided unbiased estimates while traditionally used ½ MMDM overestimated tiger density by 69%. This result may have serious conservation implications as most tiger estimates in South Asia are based on ½ MMDM model.

315209 LAND USE AND CONSERVATION VALUE FOR BIRDS IN MOUNTAIN REGION OF YUNNAN, CHINA

Wu Fei, Yang Xiaojun

Forest loss and degradation is one of the major threats to birds in mountain region of Yunnan, China. There is an urgent need to understand the value of degraded habitats for conserving the avifauna in this region. Because relating information is scarce, we conducted point counts and mist netting to sample bird community in primary forest, pine plantation forest, firewood forest, and rural area in the Ailao Mountains situated on central of Yunnan Province, China. Overall bird species richness for both methods and overall bird population density for point counts showed a decreasing trend from primary forest and firewood forest to pine plantation and rural area. And for point counts, primary forests contained the highest species richness and population density of insectivores and forest- interior birds, when rural area was only benefit to open-land species. Our study shows that although the primary forest is the best habitats for montane bird communities, the firewood forest can also be useful if anthropological disturbance is reduced and do not undergo further degradation. By contrast, the conservation value of pine plantation forest for montane bird communities is limited, and the conservation value of rural area is litter.

315701 THE EFFECT OF FOREST FRAGMENTATION ON BIODIVERSITY AND SPECIES COMPOSITION OF FOREST REGENERATION IN THE CENTRAL AMAZON

Elaine Rosamond Hooper, Douglas Daly, Pierre Legendre

Fragmentation of tropical forests is a major cause of global biodiversity loss, however the effects of forest fragmentation on neotropical forest regeneration are poorly understood. We hypothesized that forest

fragmentation negatively affects the diversity of regenerating neotropical forests and alters species composition of tree and shrub regeneration and tested these hypotheses at the Biological Dynamics of Forest Fragments Project site, located in the Brazilian Amazon. We compared tree and shrub seedling species richness and composition in continuous forest controls to forest fragments of different sizes (1, 10, and 100 ha) and also at different distances from forest fragment edges to determine whether area and edge effects respectively affect forest regeneration dynamics. Species richness was significantly lower and species community composition significantly different in forest fragments compared to continuous forest. Species richness was significantly lower and species composition was significantly different closer to forest fragment edges, especially less than 10 m from the edge. We discuss which species characteristics are most vulnerable to forest fragmentation, and the relative contribution of abiotic (light, soil moisture, temperature, humidity, and edaphic factors) and biotic (seed rain, seed predation, herbivory) factors driving these biodiversity losses and species compositional changes in forest fragments.

ECOSYSTEMS: Freshwater conservation

305628 COMMUNITY COMPOSITION OF FRESHWATER FUNGI ON SUBMERGED WOOD FROM DIFFERENT STRAMS AND LAKES IN LIJIANG, CHINA

Jing Wang

Freshwater fungal communities in China are poorly understood. To quantify and describe fungal communities inhabiting submerged woody substrates, I sampled two rivers and two lakes in Lijiang, Southern China. Two-hundred submerged wood samples were randomly collected from Chongjiang River, Sancai River, and Sancai Lakes 1 and 2. Among sites, I recorded a total of 91 taxa, including 13 ascomycetes, 77 anamorphic taxa, four discomycetes and one basidiomycete. Highest species diversity was recorded in Chongjiang River. Anamorphic fungi were the most frequently detected fungus in all habitats, and the most common anamorphic genera from all habitats were *Helicodendron* and *Spirosphaera*. I observed a higher ratio of discomycetes in these habitats, when compared to similar fungal communities from other temperate and tropical regions. The average number of species identified from each sample in Chongjiang River and Sancai River was 3.2 and 1.04, respectively. In Sancai Lakes 1 and 2, the average number of species was 0.73 and 0.52, respectively. My results will contribute to establish baseline data and habitat conditions that are important for conserving maximum fungal community diversity in freshwater ecosystems.

320527 WATER MONITORING PROGRAM AS A TOOL FOR WETLAND RESTORATION AT ZHALONG, CHINA

Guojun Zhang, Hao Feng

Water is one of the basic elements for maintaining wetland ecosystems. Currently, water management at Zhalong lacks any scientific basis. Zhalong is one of the well known wetlands in Asia and provides breeding and migratory stopover habitat for Red-crowned Cranes and many other birds, but is seriously impacted by changes in hydrology. Since 2005 we have started a monitoring program that includes both hydrological and meteorological items, such as changes in water level, flow, rainfall, and evaporation. Because of human activities, the water source of the wetland is under serious threat, while water diversion projects have destroyed the natural water pattern and distribution of the wetland. Meanwhile, regional drought has made

the water shortage situation worse. Through the four years of monitoring, we learned the water paths, and have understood inflow and outflow processes, and water level changes in the core area of the wetland. This knowledge forms a basis for restoring Zhalong and safeguarding its benefits for wildlife and people.

367798 STABLE ISOTOPE ANALYSIS AS A TOOL IN CONSERVATION BIOLOGY

Eugenia Zandona, Susan Kilham, Catherine Pringle, Michael Marshall, Rana El-Sabaawi, Piet Verburg, Steven Thomas, Alex S Flecker, Matt Whiles, Karen Lips, David Reznick

Natural abundance stable isotopes are widely used in ecological studies, as they express an organism's diet integration over time. They are also a useful tool to investigate the impact of anthropogenic disturbance. Here, we provide examples of how natural abundance $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ signatures can be used to assess changes in neotropical stream communities which have experienced species loss. We assessed the isotopic niche width represented by the area occupied by all species in the δ -space of stream communities in Trinidad and Panama, by plotting $\delta^{15}\text{N}$ against $\delta^{13}\text{C}$. We sampled streams with intact biotic communities and also streams where key biotic assemblages (shrimp in Trinidad and larval anurans in Panama) had been lost. Data from Trinidadian streams show that when shrimp are present, the $\delta^{13}\text{C}$ range of the community is bigger, probably due to higher resource diversity. In Panamanian streams, after tadpole extirpation, basal resource $\delta^{15}\text{N}$ signatures became lower and the isotopic niches of invertebrate grazers changed significantly, a possible consequence of the loss of a major competitor. Our data illustrate the utility of natural abundance stable isotopes as a tool to investigate effects of species loss in stream communities.

ECOSYSTEMS: Grassland conservation

315695 THE EFFECTS OF GRAZING MANAGEMENT ON MONITORING OF BIOLOGICAL DIVERSITY: A CASE STUDY IN SOUTH OF MASHHAD, IRAN

Hamid Reza Akkafi

The goal of all types of monitoring programs is the protection of the environment and its resources. Sheep grazing was introduced as a vegetation management option in dry ecosystems and the effects of grazing on environmental factors must be considered at all times. This study discusses effects of sheep grazing on species diversity and evenness in two areas of the Torogh Basin that one is a completely protected area. The data used to monitor changes in richness and evenness derived from 228 and 233 1m² plots respectively from grazed and ungrazed site. The results proved that the grazing and trampling could shift the conditions of the area. The analyses of ecological diversity indices and diversity profiles revealed correlations between intensity of grazing and species distribution, a higher diversity profile in the whole range of scale parameter in the ungrazed site and an environmental disturbance factor dominates in grazing site. Based on our results and literature data, we hypothesize that intermediate grazing increases the number of rare species. It could be interpreted in different ways and will be discussed in more detail.

315448 SHARKS OF SOUTHERN CHINA - PAST & PRESENT

Vivian Yan Yan Lam

Shark fisheries have declined globally, and Southeast Asia is no exception. It is critical to understand the historical changes determining population trends and evaluate the current status of sharks in Hong Kong and Southern China, to conserve these rapidly declining species. The shark industry in Hong Kong declined since the 1970s, reflecting a similar trend in many ports in Southern China. Given that there has been little formal documentation of shark fisheries in the region, it is important to collect local ecological knowledge from the fishing community before historical information retained by fishermen is lost forever. A retrospective approach to evaluation is used - combining fragmented information from historical literature and anecdotal data and accounts, in addition to scientific information, from previous fisheries surveys and current market surveys to generate information on the species of concern. This study confirms the serious declines that have occurred in shark numbers and biodiversity in the northern sector of the South China Sea and provides useful baseline information for the management and conservation of sharks in Hong Kong and Southern China, some of which may be considered to be vulnerable to extinction.

ECOSYSTEMS: Marine conservation

Cryopreservation of Trumpet Shell, *Charonia sauliae* Veliger Larvae by Vitrification

Kyoung Ho Kang, Zhi Feng Zhang, Zheng Hong Sui, Eun Kyung Heo, Renata Brzozowska

Trumpet shell, *Charonia sauliae*, a kind of gastropod, belongs to Cymatiidae. Cryopreservation of trumpet shell, *Charonia sauliae* trochophore larvae was optimized and a two-step cryopreserving protocol was utilized in this experiment. Four kinds of cryoprotectants, dimethyl sulfoxide, glycerol, ethylene glycol and 1,2-propanediol were determined to perform the cryopreservation at two usually used concentrations, 1.5 M and 2.0 M. dimethyl sulfoxide at a concentration of 1.5 M proved to be the best cryoprotectant and 2.0 M the better, while other three cryoprotectants provided far worse protective effect than dimethyl sulfoxide. Survival rate of thawed larvae decreased as time elapsed and that of the control group also decreased a lot. After various storage periods, 1 day, 7 days and 15 days, survival rate exhibited no significant difference in the same group. The storage of frozen sperm, eggs and embryos will benefit for shellfish aquaculture research; as well as maintenance and protection of threatened genetic strains.

365298 IMPACT OF PAIR-TRAWLING ON BIODIVERSITY LOSS - TAKORADI WATERS AS A CASESTUDY.

Abdul-Azim Mahamud Baba

The mouth of the boat is kept open by the lateral pull of the individual vessel, since otter-boards are not required. By utilizing the towing power of two boats without otter boards, a larger net may be worked than would otherwise be possible.

The major negative impact of pair trawl on the environment is related to the capture and frequently

discarding of non-target sizes and species.

This trend calls for a review and revision of national legislation and regulatory framework; strengthening and enhancement of integrated monitoring control systems including satellite monitoring systems.

315677 SEA TURTLE CONSERVATION DURING THE NEXT 100 YEARS: A SPATIAL ANALYSIS OF NESTING BEACH VULNERABILITY

Alfonso Lombana

Climate change is a major threat to wildlife, habitats, and human populations and will manifest itself in coastal and marine ecosystems through rising seas, elevated water and air temperatures, changing ocean currents, and greater storm intensity. These consequences have the potential to be especially perilous for sea turtles, which rely on stable beach morphology and narrow temperature envelopes for successful nesting and reproduction. Already, human population growth and development along shorelines encroach on turtle nesting beaches and soon rising sea levels will apply pressure from the other direction as well. Scientists at World Wildlife Fund, along with academic and NGO partners have quantified this coastal vulnerability for hawksbill turtles at 10 field sites throughout the insular Caribbean Sea. We used spatial modeling, GIS, remote sensing, and primary field data to predict which beaches and islands will be most susceptible to rising sea level, higher temperatures, and altered currents. These results should serve as a road map for sea turtle conservation in the Caribbean by pointing to those nesting habitats that are most threatened and setting the foundation for climate adaptation and mitigation work. This research can be modified for conservation of other species of sea turtle and in other regions of the world and may prove an important component of coastal planning as communities living near the sea increasingly face climate change-related impacts of their own.

ECOSYSTEMS: Savanna conservation

366278 FOOD HABITS OF JAGUAR AND PUMA IN A NATURAL CERRADO BIOME AND THE SURROUNDING AGRICULTURAL MATRIX

Julie Kay Betsch, Carly H Vynne, Leandro Silveira, Samuel K Wasser

Evaluation of the feeding ecology of the jaguar *Panthera onca* and puma *Puma concolor* in and adjacent to Emas National Park, Brazil is critical for understanding the prey requirements of these wide-ranging species in a natural and a disturbed area. The landscape surrounding the park is dominated by large-scale monoculture and ranchland. This study compares the diets of puma and jaguar within species, inside and outside of the reserve, to determine if there is a difference in the prey consumed in these habitats. Additionally, the diets of the two species are compared to each other to investigate resource partitioning. Diet is determined from analysis of 106 scats, located using scat detector dogs. The donor species of each sample is confirmed by DNA analysis prior to examination of its contents. Differences in the microstructure of guard hairs in the scats reveal prey species when examination of other contents is inconclusive. The results of this study will help make predictions about how these endangered predators cope with large-scale habitat conversion, as well as inform land management decisions outside of the park.

ECOSYSTEMS: Wetland conservation

314605 BIRD AND ANURAN METRICS IN MITIGATED AND NATURAL WETLANDS

Ann M Anderson, Tristan Gingerich, James Thomas Anderson

Wetland mitigation is intended to replace the structure and function of natural wetlands converted to other uses. The purpose of this study was to determine if avian and amphibian communities were similar between 3 mitigated and 3 reference wetlands in the Central Appalachians, USA. Birds were surveyed using point counts and amphibians were assessed using call and dip net surveys. Water wells were placed in mitigated wetlands to confirm wetland hydrology. All 3 mitigated wetlands had saturated soils, within 30 cm of the soil surface, for greater than 50% of the growing season, confirming hydrology. We surveyed 492 birds (mitigated: 289; reference: 203), representing 58 species. Avian species richness, diversity, and abundance were similar between mitigated and reference wetlands. Waterbirds were more prevalent on mitigated than natural wetlands. Yellow warblers (*Dendroica petechia*) were most abundant. We surveyed 9 anuran species (mitigated: 8; reference: 9). Northern spring peepers (*Pseudacris crucifer*) and green frogs (*Rana clamitans*) were the only species that occurred on all wetlands. Anuran species richness was similar between mitigated and reference wetlands, but individual species abundance varied. Reproduction was not confirmed in all mitigated or natural wetlands even though anurans were heard calling. Evidence suggests that most avian and anuran community metrics are similar between mitigated and reference wetlands.

304616 DIMINISHING FAUNAL DIVERSITY OF SAMBHARLAKE: AN IGNORED RAMSAR SITE OF ASIA

Brij K Sharma

The study deals with documentation of the faunal diversity of Sambharlake: an extensive wetland in Rajasthan state and a recently declared conservation reserve of India. Three field surveys in every season were conducted during 2006-08. Species count method was used for avifauna. Important faunal species observed in the catchment area were- Insects: locust, moths, honey bee and variety of aquatic beetles; Vertebrates: rana and bufo, eryx, bungarus, naja, python, gecko, chameleon, varanus, hemidactylus, flamingos, black-winged stilts, ruffs, eurasian thick-knee, yellow-wattled lapwing and some aquatic birds; blue antelope and domestic cattle, gerbils, hedge-hog and a large colony of flying fox pteropus. No fish was observed. A significant reduction in the overall fauna especially the aquatic beetles and migratory avifauna is alarming. Currently, the lake is having very low water level and facing many potential threats like Illegal salt extraction, formation of large number of anicuts and rising temperature and above all ignorance by the authorities. Immediate conservation measures are a high priority to save this Ramsar site.

ISSUES: Alien and invasive species

319148 EXOTIC PET ANIMALS INFLUENCING BIODIVERSITY IN ASIA

Koichi Goka

Intentional introductions of alien species as pet animals and biological agents have world-widely increased. Notably in recent Japan, it is a great boom to breed exotic animals and a lot of alien species have been imported from various countries, which cause many ecological problems, too.

For example, we are importing over 1 million stag beetles as pet animals every year, mainly from South-East Asian countries. This great beetle trade has caused ecological risks against the Japanese native species through competition and genetic introgression between the naturalized alien species and native species. Furthermore, over exploitations of beetles for exporting to Japan from tropical rain forests have caused rapid decrease of natural populations.

For another example, we have found the invasion of chytrid fungus *Batrachochytrium dendrobatidis* into Japan, at the end of 2006. The fungus was attached with the pet frogs imported from South America. As the chytridiomycosis by the fungus has been proposed as the agent causing worldwide declines of wild frog populations, we fear that this discovery of fungus will be an introduction of extinction of Japanese native frogs. We should consider to control exotic animals commercialization for conservation of biodiversity in Japan and in the world.

305741 JACKFRUIT IN ATLANTIC FOREST, BRAZIL: DENSITY AND NEGATIVE EFFECTS ON SMALL MAMMAL COMMUNITY, SEED DISPERSAL AND SOIL AGGREGATION

Helena Godoy Bergallo, Daniel Santana Lorenzo Raíces, Mariella Camardelli Uzêda, Carlos

Frederico Duarte Rocha

Jackfruit, *Artocarpus heterophyllus*, was introduced in Brazil in the 1800s and nowadays is distributed all around the country. The objectives of this study were to estimate jackfruit density in Ilha Grande, an island covered with Atlantic Forest in Southeastern Brazil, and to determine its effects on the small mammal community, seed dispersal and soil aggregation. Ilha Grande presents a sandy soil where organic material is the main cement agent for soil aggregation and responsible for availability of nutrients for the establishment of plant species. In grids with different jackfruit abundances, live traps were opened monthly to capture small mammals. Weighed average diameter of aggregates was used to assess the stability of soil aggregates. Local distribution of jackfruit is bunched. The density estimated by point transect method in trails around the island, is higher in the east part of the island where human density is also high. Multidimensional scaling analysis followed by ANOVA showed that small mammal community differed among grids with and without jackfruit ($F=5.380$, $p=0.034$, $N=18$). Total amount of native seeds dispersed in faeces by small mammals decreased significantly in grids with high densities of jackfruits ($r=0.605$, $p=0.008$, $N=18$). The presence of jackfruit changed small mammal community and affected the role they play in seed dispersion. In addition, soil aggregate stability tended to decrease in jackfruit areas preventing native plants to establish.

315179 GENETICALLY MODIFIED TREES AS ALIENS -EFFECTS OF LITTER CHEMISTRY CHANGES ON AQUATIC INVERTEBRATE COMMUNITIES AND DECOMPOSITION

Petter Erik Axelsson

The application of genetically modified (GM) plants may introduce novel traits into pristine environments and could have similar effects on the environment as alien species. As the targeted trait of the modification, as well as unexpected changes in non-target traits may effect biotic interactions, ecosystem function, and diversity we hypothesizes that modifications could have unforeseen effects. We conducted leaf-litter decomposition experiments and biodiversity surveys in natural streams using litter-bags, examining whether modification of lignin characteristics influenced the decomposition process or the composition of colonizing invertebrate communities. Further we addressed potential unexpected biochemical changes in the litter by quantifying the concentration of secondary substances. GM litter scored highest concentrations in 15 of the 21 substances identified and compared to the wild-type GM litter showed an up to 6% reduction in the amount of litter lost during the decomposition. We show that effects of GM trees can expand beyond the lifetime of a leaf and may affect ecosystem functions. The implication for the invertebrate fauna is, however, contradictory. Secondary substances are indisputably important for many invertebrates which also are indicated by our decomposition results, but the effects on the invertebrate community were nevertheless quite small.

315710 ALIEN SPECIES IN AGRI- AND AQUACULTURE: WHAT CAN REALLY HAPPEN?

Volodymyr Maltsev

Today the question: How the influence of certain alien species on the local biodiversity of the territory of its acclimatization (for agricultural/aquacultural purposes) can be predicted? - seems very important.

Analyzing consequences of aquaculture development in Former Soviet Union countries we can formulate following statements:

1. Species dwelling at the contiguous territory can be recognized as are environmentally safe for territory of acclimatization because this territory is in the zone of their ecological pessimum.

2. Species dwelling under condition of geographically remoteness from the territory of acclimatization can be environmentally dangerous if 2 following conditions take place simultaneously:

2a) alien species has violent living strategy (high fertility, active praying, high trophyc activity);

2b) territory of acclimatization is the zone of ecological optimum for this alien species.

These statements can be used as criteria for prediction of influence of certain alien species on local biodiversity. Example: according to them *Ctenopharyngodon idella* (China) is safe for Ukrainian inland waters (temperature limits in spawning time - restriction according criterion 2b), but dangerous for North America.

315177 HABITAT USE BY BREEDING BIRDS AT SALTMARSH OF CHONGMING DONGTAN (EAST CHINA): IMPLICATIONS FOR THE IMPACTS OF *SPARTINA* INVASION

Yinting Cai, Xiaojing Gan, Chi-yeung Choi, Zhijun Ma

The exotic Smooth Cordgrass (*Spartina alterniflora*), hereafter "*Spartina*" have spread rapidly on

the east coasts of China and completely changed the native saltmarsh vegetation over the past three decades. In order to understand the impacts of *Spartina* invasion on the breeding birds, we compared the species number and abundance of breeding saltmarsh birds and their use of four habitat types (two native habitats: *Phragmites* and *Scirpus* habitats; two *Spartina* invaded habitats: *Spartina-Phragmites* and monoculture *Spartina* habitats) at Chongming Dongtan (East China) in 2008. A total of 27 bird species were recorded in the four habitats, including 14 in *Phragmites*, 14 in *Scirpus*, 19 in *Spartina-Phragmites* and 13 in *Spartina* habitats. Bird densities were 3.40 ± 0.75 ind./ha, 1.88 ± 1.04 ind./ha, 3.54 ± 0.57 ind./ha, and 1.91 ± 2.17 ind./ha in the four habitats, respectively. Of the eight common bird species, six species preferred *Spartina-Phragmites* habitats while no species preferred monocultures of *Spartina*. Although the perching birds might be less affected by the invasion of *Spartina*, the invasion of *Spartina* has largely reduced the habitats of breeding waders. Because the *Spartina* outcompetes native plants with forming monoculture vegetation, it is emergent to control the spread of *Spartina* and restore the native vegetation to provide habitats for birds.

ISSUES: Climate change

315500 GLOBAL YOUTH CLIMATE CONFERENCE IN NEPAL - EDUCATION AND MITIGATION CONCERNING GLACIAL LAKE OUTBURST FLOODS

B. K. Dalit, William Forbes

Climate change is increasingly recognized as a threat to the mountainous countries like Nepal, yet relative lack of research and preventive measures are in place to lower risk to vulnerable communities and species. One example is risk of Glacial Lake Outburst Floods affecting aquatic, forest, soil, and human communities downstream. Most glacial lakes still lack mitigation measures, including Imja Tsho, one of the twenty-four most potentially dangerous glacial lakes in Nepal, which could damage Sagarmatha National Park, a World Heritage Site located in the Mt. Everest region. Team for Nature and Wildlife (TNW) Nepal seeks to increase education about such risks. TNW is planning to organize a global youth climate conference on World Environment Day 2010 to explore and mitigate adverse impacts of climate change in Nepal and other regions.

318224 SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF CLIMATE CHANGE IN KILOSA AND MOROGORO; TANZANIA

Mercy Mwanikah Ojoyi

Tanzania is experiencing significant climate variability. The adverse impacts of climate change are already having their toll in the livelihoods of the local people and the economy of the country. The recent severe droughts, which hit most parts of the country, have led to severe food shortages, food insecurity, hunger and acute shortage of power. This research paper is structured in maximising the ex-ante assessment approach by integrating potential impacts in the vulnerability context, which address multidisciplinary questions underlying already felt impacts in two case study regions namely; Kilosa and Morogoro. All the three sustainability dimensions (socio-economic and environmental) have been taken into account by different groups of decision makers (farmers, scientists, local politicians and local experts) out of which the final output of all stakeholder opinions have been linked to the development of good and sustainable climate change practices. Scenario development has been used as an excellent tool in identification of solutions that farmers

can derive from their own knowledge and action-led expertise.

307067 TAXON DIVERSITY OF PTERIDOPHYTE FLORA OF UDAWATTEKELE TROPICAL RAINFOREST IN SRI LANKA: CONSERVATION IMPLICATIONS

Rajapaksha Haddokara Gedara Ranil

Pteridophytes are sensitive to environmental changes than the Angiosperm. Due to inadequate information it is difficult to prove such hypothesis. Udawattekele forest of Sri Lanka is the one of best place where information having colonial era. Twenty seven Pteridophytic taxa collected by European Pteridologists during the period from 1888-1954 and 23 taxa by Karunaratne in (1986) whereas 36 taxa by the present study. However, out of 27 taxa recorded by European Pteridologists, only nine taxa were recorded during the present study. Seven species had not been recorded even in other parts of the Sri Lanka during the last 50 years. Out of the seven species, two rare taxa namely, *Pronephrium articulatum* and *Christella hispidula* × *C. parasitica* had been recorded once over the last century again only from Udawattekele. Compared to previous studies, 16 additional Pteridophyte taxa were identified from the present study. Interestingly, 19 taxa recorded by European Pteridologists have not been recorded in the present study. Change of climate especially increasing of temperature and variability of rainfall and habitat loss due to invasive species and their combined effects have been suggested as possible reasons for changes of taxon diversity of Pteridophytes in the Udawattekele forest.

ISSUES: Conservation in hotspots

314995 LAST POPULATION OF EREMIAS ARGUTA TRANSCAUCASICA

Anna Vardanyan, Marine Arakelyan

The racerunner *Eremias arguta transcaucasica* Darevsky, 1953 is the rarest and most endangered taxon of all endemic reptiles in the Caucasus. The population of lizards found in the basin of Lake Sevan in eastern Armenia is the only one in the world. In framework supported by RSG grant we are getting the first-hand knowledge on ecology, distribution and abundance of the racerunner. Our preliminary study has shown the number of individuals is high only on very restricted territory, which adjoins to a village and is under strong human impact. It is our hope that our studies will provide a good starting point for future conservation management of *Eremias arguta transcaucasica* in territory of Armenia.

306452 ESTABLISHING EQUATORIAL GUINEA'S FIRST BIOLOGICAL FIELD STATION

Gail Walker Hearn, Heidi E. Ruffler, Demetrio Bocuma Meñe

The first biological field station in the Central/West African country of Equatorial Guinea was established in 2008 by the Bioko Biodiversity Protection Program (BBPP), an academic partnership between the National University of Equatorial Guinea (UNGE) and Drexel University (Philadelphia, USA). The new field station is located along the northern border of Bioko Island's Gran Caldera and Southern Highlands Scientific Reserve. This 510 km² protected area extends from the black sand nesting beaches of four species of sea turtles through an unspoiled tropical monsoon forest inhabited by seven species of rare monkeys to volcanic peaks

more than 2000 m above sea level. The field station originated with BBPP's project to protect wildlife, especially the monkeys (drill, black colobus, red colobus, red-eared monkey, crowned monkey, putty-nose monkey, and Preuss's monkey) and their habitat. It now consists of two buildings (education/research center and staff house) and a 24-km system of eight marked trails. Daily weather measurements, local tree phenology, and ongoing surveys on the distribution and abundance of selected plants and animals are maintained by trained local research assistants. Targeted educational outreach to the ex-patriot oil community was influential in obtaining the ExxonMobil Foundation funding responsible for this new research station.

377371 ON THE POLLINATION BIOLOGY OF LEPTOCEREUS SCOPULOPHILUS (CACTACEAE)

Luis Roberto Gonzalez Torres

The genus *Leptocereus* is a Caribbean genus composed by a dozen of species most of them endemic to Cuba. In this work, we characterize the flower structure, describe its functioning considering the opening process and the dynamics of nectar quality and production, we identify the flower visitors and species pollinator, and the variation on visit frequency; we also determine the mating system and the pollination effectiveness. The inner diameter of the flower is 1.84 ± 0.20 cm, the length of the flower tube is 2.16 ± 0.18 cm and the nectar chamber is 0.62 ± 0.15 cm deep. The flower opening is synchronic in the whole population and takes place on the sunset. Nectar production begins between 21:00 and 22:00 and continues till 04:00. During this period the sugar concentration in the nectar does not differ significantly. The flowers are mostly visited by hummingbirds (*Chlorostilbon ricordii*) and bees (*Apis mellifera*) during the day and by bats (*Monophyllus redmani*) and cockroaches (*Eurycotis opaca*, *Cariblatta* sp.) at night. Its pollinator is *M. redmani*. This species is hermaphrodite and self-incompatible. The pollination effectiveness is 51.5%. Our study remarks the importance of conserving bat populations and their habitats for cacti conservation and management in the region.

METHODS: Adaptive management and monitoring

367018 HYBRID ASSIMILATION IN SPARTINA: RE-EVALUATING CONSERVATION GOALS

Ingrid Britt Hogle, Peggy Olofson, Drew Kerr, Erik Grijalva, Laura Feinstein, Debra Ayres, Don Strong

Hybridization between native and introduced species of *Spartina* (cordgrass) have significantly altered wetland habitats and created challenges for conservation in locations around the world. Since the hybridization between introduced smooth cordgrass (*Spartina alterniflora*) and native Pacific cordgrass (*S. foliosa*) was first documented in the San Francisco Bay, California, USA, in the early 1990s, we have witnessed the population explosion of invasive hybrids and the development of a genetically variable hybrid swarm. The California Coastal Conservancy's San Francisco Estuary Invasive *Spartina* Project (ISP) has systematically removed plants with obvious hybrid morphology or ecology as they work to eradicate invasive *Spartina* from the San Francisco Estuary. In the course of monitoring eradication efforts, we use genetic testing to determine the parentage of hundreds of cordgrass samples each year. The results of these genetic tests show that highly backcrossed hybrid plants, with no obvious morphological characteristics to distinguish them from natives,

are "hiding" in the marshes of the Bay. Through the process of adaptive management, the ISP and the conservation community must now evaluate the extent of these "cryptic hybrids" and set realistic conservation goals based on the current and projected extent and consequences of hybrid assimilation.

319106 DEVELOPMENT OF EFFICIENT RAPID BUTTERFLY BIODIVERSITY ASSESSMENT PROGRAM FOR MONITORING FORESTS IN AFRICA

kwaku Aduse-Poku, William Oduro, Samuel Kwabena Oppong

Butterflies owing to their ease of capture and relatively stable taxonomy are conveniently used as a target group in rapid biodiversity assessment (RBA) programs. Although RBA may cost-effective, the choice of inappropriate or insufficient sampling strategies can nullify the value of the mission. We tested RBA against a larger survey and evaluated two potential biases (due to temporal variation and vertical stratification) likely to affect the reliability of butterfly RBA results. We compared fruit-feeding butterfly assemblage at different layers of forest (canopy and under-storey) along temporal gradient using banana fruit-baited traps. Both individual abundances and species richness were about three times higher in the understory than in the canopy traps. The species compositions at the canopy and understory were strikingly different at all taxonomic levels with only 10% overlap in species diversity between the two communities. Overall, the study justified the importance of taking into account the effects of seasonality and vertical stratification when using butterflies as bioindicators in RBA in African forests. We offered useful recommendations to minimize the problem of precision associated RBA.

METHODS: Conservation capacity building

315317 BUILDING NATIONAL CAPACITY FOR PROTECTED AREA MANAGEMENT IN LAO PDR

Madhu Rao, Arlyne Johnson, Kelly Spence, Anhsany Sypasong, Nora Bynum, Eleanor Jane Sterling

The National Protected Areas (NPAs) system of Lao PDR established in 1993 has an important role to play in conserving the nation's rich biodiversity. To address the need to strengthen NPA management, the Network of Conservation Educators and Practitioners (NCEP), an international capacity building initiative and the Wildlife Conservation Society have been working in collaboration with the National University of Laos (NUoL) since 2003 to improve the capacity of faculty to teach topics in conservation biology and of NPA managers to better manage NPAs. In Phase-I (2003-2005), a total of four faculty development workshops were conducted to train 12 faculty and nine NCEP modules were adapted to the Lao context and translated to the Lao language. The modules were used to teach 706 students (Bachelor of Science) and 1416 students (Bachelor of Forestry) within the two faculties. 82 % of faculty respondents agreed that the workshops met their expectations and were effective in introducing module content. Evaluations (N=12) revealed that modules facilitated lecture preparation (88%) and provided comprehensive background information (92%) to faculty. The paper will provide an analysis of the lessons learned and the challenges that define the design and implementation of the ongoing Phase II of the project.

315713 DEVELOPING APPROPRIATE TRAINING TOOLS FOR CAPACITY BUILDING TO ENHANCE BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT IN MADAGASCAR

Ony Malalaniaina Rabearivololona, Jonah Ratsimbazafy, Nora Bynum, Eleanor Jane Sterling

Madagascar is one of the 7 megadiversity countries but its biodiversity is still threatened by human pressures. Capacity building and environmental training play an important role in biodiversity conservation. However, in developing countries like Madagascar, there is a lack of appropriate tools for the context (low level of education, low livelihood level and poor management of the natural resources). Since 2004, REPC-MD (Network of Conservation Educators and Practitioners to Madagascar) has developed free teaching modules as training tools to help professional and educators in conservation activities. During the first phase of REPC-MD (2004-2007), 10 of the 19 modules focused on biodiversity conservation. In the current second phase, 80% of available modules have been oriented to sustainable development. This decision was taken after evaluating the needs of the beneficiaries and also corresponds with the national policies of the government's Madagascar Action Plan. Preliminary studies indicate that 75% of the REPC Network uses the modules regularly during teaching. The high usage of modules and the mix of conservation and development indicate the importance and utility of these tools in furthering conservation and sustainable development in Madagascar.

METHODS: Conservation GIS

366974 STRATEGIES FOR LANDSCAPE RECOVERY AND GIANT PANDA CONSERVATION IN THE 2008 SICHUAN EARTHQUAKE REGION, PR CHINA

Janet Silbernagel, Yang Le, Weihua Xu

On May 12, 2008 a devastating earthquake struck Sichuan province, PR China and led to immense losses of human life and livelihood, infrastructural damage, and serious environmental effects. Students at the University of Wisconsin, advised by the 1st author, worked in small groups to conduct regional analyses and design conservation strategies for the Giant Panda in the context of ecosystem services and other regional recovery needs. We began with initial assessments of environmental effects of the Wenchuan earthquake and its subsequent geo-disasters, prepared by the State Key Laboratory authors, including effects on giant panda habitat. Land cover and habitat characteristics before and after the earthquake were analyzed from TM images taken pre and post-earthquake and previous research in this region. From these, students evaluated the changes in land cover patterns, conducted suitability analyses, and considered ways to enhance and connect core areas of habitat for giant panda and biodiversity protection, while balancing needs for infrastructure, ecosystem services, and ecotourism. We present three possible strategies based on conservation science principles, ranging in spatial and temporal focus, and in prioritization between conservation and redevelopment. Meanwhile, our team continues this work with six month and one year post-quake landscape recovery evaluations.

METHODS: Conservation modeling

315540 CORRELATING PHYTOSOCIOLOGICAL ATTRIBUTES OF TEMPERATE FOREST OF KINNAUR REGION IN WESTERN HIMALAYA WITH SATELLITE MULTISPECTRAL DATA

Ashwani Kumar Thukral, Amit Chawla

District Kinnaur comprises of vegetation types ranging between dry moist temperate forests to cold desert patches. IRS - 1D and P6 LISS - III sensor multispectral data were used for analysis. ERDAS Imagine 8.6 software was used for satellite image processing. The height and crown cover of the dominant forest tree species were regressed on DBH. It was found that all the species displayed significant positive correlation between the tree parameters. Linear multiple regression of diversity indices with the three bands showed highly significant correlations ($p < 0.001$). Beta regression coefficients reveal that spectral reflectance in red band explain the maximum variability in species diversity, followed by green band. The NIR band has the least effect on the species diversity. Species diversity is negatively regressed with red band but positively with green band. Multiple regression analysis was carried out using tree canopy cover, tree GBH and tree density on spectral reflectance in three bands. DN values of the green band explained maximum variability in the tree canopy cover and tree density. GBH was regressed negatively with the DN values of NIR and green bands but, positively with the red band. The NIR band explained most of the variability.

METHODS: Conservation on private lands

315476 REESTABLISHING ARACAURIA FOREST LANDSCAPE CONNECTIVITY IN SMALL TOBACCO FARMS THROUGH CROSS-SECTORAL PARTNERSHIPS

Marilia Borgo, Sandro Coneglian, Philipp Stumpe, Carolina Ximenez de Macedo, Cynthia Pinheiro Machado, Monica F B Harris, Marcelo Gonçalves de Lima

Mixed Ombrophile Forest (MOF), in the Brazilian Atlantic Forest Hotspot, was once widespread in southern Brazil. It is characterized by the presence of the endangered Brazilian Pine (*Araucaria angustifolia*) heavily logged in the past 200 years, along with other important plant species, also endangering associated fauna. Large forest tracts have given way to small forest fragments and exotic crops such as tobacco which is a major and traditional income for small, local farmers. Through conservation planning and environmental awareness a cross-sectoral consortium of NGOs, tobacco company and local stakeholders aim to zero the use of native species in the tobacco production process and enhance landscape connectivity in MOF areas. 119 small properties in Paula Freitas municipality were visited, socioeconomic questionnaires applied and land cover data collected to feed a GIS. Different scenarios restorations were proposed using satellite imagery and the Brazilian Environmental Legislation as the framework. Results show that landscape permeability to natural ecological processes can be much improved through cross-sectoral collaboration, agricultural good practices, connecting smaller fragments via linear forest remnants along watercourses acting as corridors and that the logging of over 900 hectares/year of native forest can be avoided through alternatives such as: eucalyptus and the use of invasive exotic species from protected areas as firewood in the tobacco leaf drying process.

METHODS: Ecological restoration and reconstruction

367882 PHASED, EXPERIMENTAL WETLAND AND GRASSLAND RESTORATION IN THE ANATOLIAN STEPPES OF EASTERN TURKEY: THE KARS-IGDIR BIODIVERSITY PROJECT

Sean Anderson, Cagan H Sekercioglu, Mehmet A Kirpik, Onder Cirik, Emrah Coban, Sedat Lnak, Yakup Sasmaz

As part of our Kars-Igdir Biodiversity Project's long-term biodiversity inventorying and sustainable development efforts in the eastern borderlands of Turkey, we are actively restoring an array of riparian, wetland, and grassland communities. These areas include Important Bird Areas harboring both resident and migratory birds flying between northern Europe and northern Africa. Our phased, experimental approach to restoration is initially focusing on excluding livestock from the overgrazed periphery of these wetlands. In addition to being designed to measure potential ecological responses to restoration alternatives, our experiments have also been designed and located so as to showcase drastic changes in plant height and conspicuous animal activity to local residents. This twofold approach advances both our ecological understanding of the system and community stakeholder buy-in for future restoration efforts. Results to date show orders of magnitude greater biomass of plants and insects within grazer exclusion areas. In addition, small mammal activity (*Microtus* sp.), amphibian abundance (*Rana* spp.), and bird nesting activities all increase relative to our control zones experiencing traditional, unmanaged grazing. These results are now being used to design large-scale exclusions of grazers from Kuyucuk Lake, a candidate site for Ramsar status.

METHODS: Ecosystem / conservation area management

315512 THE DISHARMONY IN THE FORESTS OF INDIA - CHANGING CLIMATE AND CHANGING FOREST COMPOSITION IN THE WESTERN GHATS OF INDIA

Rahul Ramesh Rao Mungikar, Sameer Punde, Jayant Sarnaik

Climate change is now considered the largest global environmental problem. Impact of climate change on biodiversity includes studies of changing species distribution and predicted extinctions however; change in ecosystems is relatively understudied. This research presents a hypothesis and some evidence to prove that forests are transforming into drier regimes based on data collected in 2 forest landscapes in the Western Ghats of India. Evidence was collected based on sampling of species composition and regeneration patterns within forest fragments of different sizes. The landscapes under study viz. Ratnagiri and Sindhudurg are dominated by fragments of deciduous forests which are mostly protected within sacred groves. The invasion of certain plant species guilds within these fragments suggests transformation of moist deciduous to thorny scrubs with loss of ground cover species. This may not only be due to fragmentation but also climate change and disruption of function such as loss of seed dispersers. As a result, this snapshot study of forest fragments predicts ecosystem change. Further temporal studies will confirm this hypothesis. In conclusion, this study suggests that in the wake of climate change, conservation should be directed beyond mere protection towards "enrichment based management."

315370 LOSING LESS AND WINNING MORE: PROJECT STRATEGIES TO NEGOTIATE BETWEEN CONSERVATION AND DEVELOPMENT IN THE LOWER MEKONG**Luke Daniel Preece, Barbara Carmen Herrero Cangas, Ramadhani Achdiawan, Terry Sunderland, Manuel Ruiz Perez, Bruce Campbell, Natasha Stacey**

Conservation organisations multitask between protecting forests, developing local livelihoods and strengthening institutions. The aim here is to analyse the strategies employed by organisations to implement conservation and development, and to assess how project progress is improved by project operations. This paper analyses 42 projects working in 15 conserved forest sites in Laos, Cambodia and Vietnam. We use multivariate techniques on a large set of variables to explore patterns between sites, project activities and management. The major threats to biodiversity are perceived as hunting and logging. Site-level conservation projects focus significantly on law enforcement, but also use developmental and institutional building tools to reduce pressure on conserved areas and improve sustainability of outcomes. Although achieving the combined goals of conservation and development is necessary in most situations, tradeoffs, however, exist between these two goals and integration can compromise conservation outcomes. Many organisations collaborate with government and non-government organisations and use participatory and consultative approaches with local people to achieve their objectives. We conclude that while integrating conservation and development is often necessary, tradeoffs must be acknowledged because they influence project outcomes. Partnerships and consultation with multiple interest groups can greatly improve the effectiveness of project implementation.

304932 ECOTOPS RANKING IN SHADEGAN INTERNATIONAL WETLAND BY BIOSAFE MODEL FOR CONSERVATION AND MANAGEMENT PLANNING (KHUZESTAN PROVINCE: IRAN)**Seyed Mehdi Amini Nasab, Maryam Ghahraman Pouri**

Shadegan International Wetland is consisting of four Ecotops: intertidal ecotop, freshwater ecotop, khooremoosa and islands, riparian and other lands. These are important for conservation and management planning for natural environment in Shadegan International Wetland. BIOSAFE is a management model for harmonic suitable strategic in conservation of nature in land use planning. For this study PTB, PTE, TEI, ATB, TBS, ATE, TES, ATEI indices were determined. The maximum PTB index was 2250.75 for birds; the maximum PTE index was 1052.75 for intertidal ecotop. The maximum ATB index was 1852.25 for birds. The maximum TEI index in freshwater ecotop for amphibians, in intertidal ecotop for birds, in khooremoosa and islands for reptiles and in riparian and other lands for mammals is determined. The maximum ATE index was in freshwater ecotop for amphibian, in intertidal ecotop for birds, in khooremoosa and islands for reptiles and in riparian and other lands was determined for mammals. The maximum TES index was 87.68 in riparian and other lands, The maximum ATEI and TES indices for birds in freshwater ecotop were 17.68, 57.46, respectively. This index for fishes in khooremoosa and islands was 9.56, 28.43, respectively. For mammals in riparian and other lands was 2.802, 10.43, respectively. For reptiles in khooremoosa and islands was 5.16, 9.25 and for amphibian in freshwater ecotop 1.28 was determined.

304307 THE SCIENCE OF MOUNTAIN BIKING IMPACTS - A REVIEW OF RECENT RESEARCH**Mike Vandeman**

To know how to properly manage mountain biking, land managers seek information on the relative impacts of mountain biking and hiking. The best tool for answering this question is the experimental study, where these two modes of use can be compared while all other impinging factors are controlled. (I reviewed such studies in a previous paper.) The latest research on this issue has instead used the survey method. In these studies, two different sets of trails are compared (hiking trails vs. mountain biking trails). But in such a study there is no way to know whether the similarities and differences found are due to differences in the type of use (hiking vs. mountain biking), or differences in terrain, soil composition, weather, amount of use, length of use, hikers using the mountain biking trail, mountain bikers using the hiking trail, or other factors. Thus, some of the conclusions drawn by these studies (e.g. that mountain biking and hiking impacts are equal) are not justified by the data.

315633 HUMAN-JAGUAR CONFLICT SURVEY WITHIN THE TAMBOPATA NATIONAL RESERVE BUFFER ZONE (TNR) IN SOUTHWESTERN PERU**Alicia Kuroiwa, Daniel Abugattas, Fernando Nishio, Oscar Butron, Javier Ramirez**

The main cause to land conflicts between humans and jaguars rests upon the insertion of livestock activity within jaguar territories. These conflicts result in changes to the feeding habits of these felids, livestock predation and, consequent hunting and diminishing of the original jaguar populations. This study aims to generate for the first time in Peru, baseline information about the Jaguar - Human conflict, in order to seek alternative management strategies for livestock ranching in 4 communities within the Buffer Zone of the Tambopata National Reserve. Information gathered included, mapping of ranches; frequency of jaguar sightings; direct observations of livestock predation; estimates of economic loss due to jaguar predation; local livestock breeding management strategies; and, local population attitudes and behaviors towards jaguars. At the same time, jaguar signs and tracks were mapped around ranches, and livestock carcasses were sought for in order to verify jaguar predation. With the aforementioned information, a general view of livestock predation by jaguars in southeastern Peru was generated and solutions to the conflicts are proposed. Livestock predation by jaguars was confined within these 4 communities to ranches bordering forest fragments. Furthermore, the livestock extensive breeding and ranching strategy used in this region increases predation risk by jaguars, by leaving livestock unattended and free to wander into the forests bordering the ranches.

METHODS: Inventory and monitoring**315550 DESIGN OF A IMAGE CLASSIFICATION SYSTEM FOR JAGUAR (PANTHERA ONCA) AND PUMA (PUMA CONCOLOR) TRACK RECOGNITION****Carlos Andres Martinez Ortiz, Osvaldo Eric Ramirez Bravo, Carlos A. Lopez Gonzalez**

Jaguar *P. onca* tracks can help in different studies on big felid research. However, tracks can be

confused with those of pumas *P. concolor* making it difficult to determine priority areas. There has been some attempts to obtain a formula to differentiate between the two species however this can be time consuming and requires some experience. We propose the use of a computer based image processing system in order to facilitate studies with these species. A set of 44 footprints from jaguar (23) and puma (21) was obtained in Sonora.

These footprints were used to generate a program based in a Generalized Linear Model (GLM) that uses two shape descriptors (a boundary based orientability measure and boundary length) to classify the footprints. From the existing data set, the GLM was able to classify the footprints with an accuracy of 75%. A larger data set is expected to increase the classification accuracy. Additional shape descriptors may be added for further improvement. This will provide a method of easy access to carry further studies at a really low cost.

314902 EVALUATING THE STATUS OF TIGERS IN INDIA

Yadvendradev V Jhala, Qamar Qureshi, Rajesh Gopal

We estimate tiger occupancy, individual population extent, size, and connectivity in 17 Indian states. All forests were surveyed at approximately 20 km² (beat) resolution using 88,000 personnel working for 10 days (Nov. 2005 - March 2006) for quantifying carnivore signs on trails, prey encounters on transects, anthropogenic pressures, and habitat parameters. Twenty layers of information were generated in a GIS from remotely sensed and attribute data on landscape characteristics and the "human footprint". Tiger density using camera traps and ungulate abundance using distance sampling were estimated at 29 sites. Indices of tiger abundance and covariate data were then regressed against tiger densities to predict tiger abundance in a double sampling framework. Tiger occupancy and density were determined by prey abundance, human impact, landscape and habitat characteristics. From 300,000 km² of potential tiger habitat 93,700 km² was occupied. The Shivalik-Gangetic Plain landscape had 9 tiger populations with 5177 km² occupied by 259-335 tigers. Central Indian and Eastern Ghat Landscape had 19 populations with 48,600 km² occupied by 486-718 tigers. The Western Ghat Landscape has 6 populations with 34,100 km² occupied by 336-487 tigers. The North Eastern Hills and the Brahmaputra Flood Plains has an occupancy of 4,230 km², while Sunderbans has a tiger occupancy of 1586 km².

METHODS: Land use planning for conservation

306063 CHALLENGES FOR CONSERVATION: ADDITIONAL ISSUES IN DEVELOPING STRATEGIES AND ACTIONS FOR CONSERVING BIODIVERSITY

Carlos Frederico Duarte Rocha, Helena Godoy Bergallo, Elaine C. C. Fidalgo, Maria Alice S Alves, Marta B Costa, Monique Van Sluys, Mariella Camardelli Uzêda, Thomaz C.C. Costa, Marcos A Santos, Antonio C.R. Cozzolino

World Biota and environments have experienced a high erosion of biological diversity due to human actions. In the last decades, criteria to identify priority areas for conservation have been refined based on the cumulative body of knowledge, which drove conservation strategies and actions to protect biological diversity. In many cases these strategies were predominantly based on the occurrence of remarkable local species richness and/or occurrence of endemics or threatened species. Here, we describe our experience as an

additional way of thinking conservation which focuses on the fact that regions of a political unit differ in socioeconomic and biological aspects, which in turn, should generate specific sets of conservation strategies. Our target was Rio de Janeiro State, Brazil (an area with high biological diversity under extreme human pressure). Our approach was based on how defining strategies and actions for conservation is a quite complex process which should involve a large set of aspects, that must be considered together, including biological, sociological, ecological, geomorphological, climatological, hydrological, economical and the actual landscape status among others. Along three years we gathered georeferenced data on all these aspects, complemented by biodiversity inventories in the field. The dataset were interrelated showing that the nine regions differed remarkably among them and, generated a different set of strategies to accommodate regional realities.

METHODS: Population viability analysis

315144 A NOVEL APPROACH TO HABITAT MODELING SPECIES VIABILITY

Mark R. Lethbridge

In fluctuating environments such as semi-arid areas, herbivore populations respond directly to fluctuations in food resources. Such fluctuations are principally determined by rainfall. Thus it is often useful to model annual herbivore population growth rates directly with rainfall. Bioclimatic envelopes and regression approaches, which relate species occurrence to environmental variables, have traditionally been used to construct species-specific habitat models. In this study the Ivlev numerical response model was used to model the annual population growth rates of the threatened Yellow-footed Rock-wallaby (*Petrogale xanthopus xanthopus*) with rainfall. Positive growth rates were found to be associated with higher rainfalls, while negative growth rates were associated with lower rainfalls. In a novel approach, the long-term population growth rates were then interpolated across the landscape in a GIS using rainfall gauge information to create a habitat model. This model was used to test a range of climate change scenarios on the future viability of this threatened species. These models suggest that in the absence of threat abatement, this species is likely to decline in areas where there is a predicted future decrease in rainfall

METHODS: Protected area planning and design

314924 ESTABLISHING A COMMUNITY-MANAGED WILDLIFE SANCTUARY ON CALAYAN ISLAND, NORTHERN PHILIPPINES

Cynthia Adeline A. Layusa, Carl H. Oliveros, Noreen Marie G. Follosco

The island of Calayan in northern Philippines is exceptional, retaining forest that covers 60% of its 196 sq km land area. It harbors an island-endemic species of forest bird, the Calayan Rail, and most likely, other undescribed endemic taxa. However, it is under pressure from timber poaching, slash-and-burn farming and land conversion. The unique forest on this island currently does not have any protected area status. The establishment of a locally-managed wildlife sanctuary was initiated to offer protection to the island's watershed and wildlife resources. A participatory approach was employed to ensure the involvement of the local community: a Participatory Resource Mapping (PRM) of important physical, socio-cultural and economic features within the proposed site, SWOT analysis of local capacity, and a meeting with legislators and key local government agencies to get legislative support. As a result, a list of rules and regulations, volunteer wardens,

proposed location, and stakeholder capacity needs were identified by the community. From these, recommendations essential in crafting a municipal ordinance and management plan for the sanctuary were provided to all stakeholders. The initial process sets the groundwork for a community-managed sanctuary that will aid local legislators in crafting an ordinance with sound basis and community support.

366529 ASSESSMENT OF ILLEGAL WILDLIFE CRIME: A QUANTITATIVE APPROACH

Mohammad Khalid Sayeed Pasha

Illegal wildlife trade has been identified as one of the most severe threats to the global wildlife today. It has led to overexploitation of the targeted species, to the point where the very survival of these species is becoming difficult.

In India, illegal wildlife trade continues unabated. Today the conviction rate of wildlife offences in India is less than 2% which is by far lower than for any other crime. In India the four wildlife crime control regional offices have reported a total of 215 cases of illegal wildlife trade between 2005 and 2007.

It is attempted is to present a methodical analysis of wildlife enforcement. Two indices, the intelligence index and the enforcement index have been developed to assess relative efficacies in intelligence gathering and law enforcement. These indices provide a scaled measure of intelligence and law enforcement.

Another layer to this is the measure of the offences in relation to a particular species. Wildlife offence species index (WOSI) is a ratio value of wildlife offences related to a specific species in an area and the overall wildlife offences detected in that particular area.

The enforcement and wildlife species offence indices are discussed in this paper in detail. These indices will become as a handy tool for the field managers for effective species management within their Protected Areas and also strengthen, clarify, and consolidate legislation and improve performance of detection and prosecution.

365951 ASSESSING REPRESENTATIVENESS OF GEOPHYSICAL AND BIOLOGICAL FEATURES IN PROTECTED AREAS OF NEPAL

Uttam B Shrestha

Planning of protected area system (PAs) is effective only when it represents every important geophysical and biological features of a region. However, the protected areas Nepal has been established in an ad hoc basis thus one or more of important features are overlooked. Inclusion of geophysical and biological features in PAs is analyzed to assess representativeness by using Geographical Information System (GIS). The PAs coverage in High Mountain region is high, nearly half (48.29%) of the total area of PAs but the PAs coverage in Hill region is very low (0.81%) despite their highest share in entire country's physiography. The altitudinal zones below 500m and between 4500-6000m are well represented in PAs compare to the other altitudinal zones. Out of 118 ecosystems of the country, PAs incorporates only 80 ecosystems and excludes the rest. The country has 36 vegetation types, of which the PAs accounts for 31. The Deciduous Maple-Magnolia-Sorbus forest, which covers 0.1% of total land of the country, is confined only to the PAs. More than 90% of the Temperate Juniper forest, Larch forest and Trans-Himalayan Lower Caragana steppe are found inside the PAs. It is also revealed that significant number of flora and fauna are excluded from the current protected area system.

314793 SETTING HOTSPOTS AND GAPS FOR BIODIVERSITY CONSERVATION BASED ON SYSTEMATIC CONSERVATION PLANNING METHODOLOGY: A CASE STUDY IN NORTHEAST AREA OF CHINA

Xiaofeng Luan, Diqiang Li

According to the research on biodiversity in the northeast of China, the irreplaceability (Ir) values of conservation planning units are calculated by using systematic conservation planning methodology and software C-plan. Four hotspot areas are identified, including Changbai mountain area, northern Daxinganling mountain area, the transitional area between western grassland and Daxinganling forest mountain, and the wetland around the center of Songnen plain. Based on the results of hotspot analysis, a GAP for biodiversity conservation has been conducted in this region. The results show that there are three evident protection gaps between the priority planning area and the existing national Nature Reserve. Based on our results we provide suggestions for establishing new PA's and eco-corridors in Northeast China.

314755 BRIDGING THE RESEARCH-IMPLEMENTATION GAP: IMPLEMENTING SYSTEMATIC CONSERVATION PLANNING IN A DEVELOPING COUNTRY

Alvaro Soutullo, Paola Mejía, Mariana Nin, Lucía Bartesaghi, Lorena Rodriguez-Gallego, Mariana Rios

Systematic conservation planning (SCP) comprises three types of activities: systematic assessment, planning, and management. Systematic assessment includes activities as gap analysis and reserves selection and design. Planning links assessments to the process of developing an implementation strategy with stakeholders. Management comprises activities undertaken "on the ground" to protect biodiversity. These activities are often conducted independently, with guidelines from systematic assessments rarely translated into implementation strategies, or considered when managing areas. Here we present a case study on the application of SCP for the design, implementation and management of a National System of Protected Areas (NSPA). Uruguay is currently creating its NSPA, which provides a unique opportunity to integrate these activities into a coherent strategy. The need to advance in creating and managing areas before a systematic assessment is finished, has fostered a close interaction among scientists, politicians and other stakeholders. While the country has already identified conservation targets for the system, mapped the distribution of valued biodiversity, and conducted a preliminary gap analysis, it has also advanced in designing and incorporating the first two areas to the system. Results from the systematic assessment have played a chief role in defining these areas' conservation objectives and limits, and are currently guiding the development of their management plans.

315307 MEASURING THE COST-EFFECTIVENESS OF BETTER MAPS OF NATURAL RESOURCES: SCALE, BENEFITS, COSTS AND OUTCOMES FOR CONSERVATION

Tatjana Good, Robert L Pressey, Mal Ridges

Conservation planning is always limited by biodiversity data but few studies have addressed the costs and

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

METHODS: Recovery of endangered species

366029 STUDY ON THE FACTORS AFFECTED THE SURVIVE OF THE INFANTS OF MILU (ELAPHURUS DAVIDIANUS)

Zhenyu Zhong

This research aimed to survey the factors which could affect the survive of the infants of Milu (Elaphurus davidianus) . The survival rate of the 224 infants that were born during 1999-2006 is 81.7%, and the dystopia rate is 1.8%. We studied the 41 dead infants, and the results showed the major factors caused the death were stillbirth, weak fetus, starve and dystopia etc. For the research of the correlation between the birth weight and the infants' death, there were significant difference between the two variables ($P=0.000<0.001$) which means the heavier infants could survive easily. In fact, if the birth weight of the infant is less than 8.00 kg, it can't survive. We studied the regular patterns of the death of the infants, and hope to find the factors affected the survive of the infants, thus we could take some measures to improve the management of the Milu.

315421 FEMALE TIGER HOME RANGE SIZE AND PREY ABUNDANCE WITHIN FEMALE HOME RANGES PROVIDE MANAGERS WITH A DIRECT MEASURE OF TIGER CARRYING CAPACITY

Saksit Simchareon, Achara Simchareon, Peter Cutter, James L. David Smith

The land base that supports tigers is highly fragmented and under heavy pressure from human populations. As a consequence many current tiger populations are threatened due to prey depletion, poaching and stochastic processes associated with small population size. The objective of this research was to determine female home range size and use it as a measure of habitat carrying capacity. Female tigers are territorial and they raise their young from food they acquire within their territories. We hypothesize that smaller home ranges indicate higher ungulate density and thus increased carrying capacity. Female tigers were radio collared with GPS satellite collars to determine home range size. Tiger prey abundance was estimated using fecal accumulation and prey estimates were converted into a standardized measure of equivalent number of sambar, *Cervus unicolor*. Female home range size at our western Thailand study site ranged from 76-85 km² and mean prey abundance was 26 sambar units/km². Elsewhere in southern

Asia female tiger home range size ranges are as low as $<15 \text{ km}^2$ and prey abundance is 58 sambar units/ km^2 . Close monitoring of changes in prey abundance can serve as an indicator of change in the carrying capacity of tiger habitat. This relationship between prey biomass and female home range size is important because it provides managers with explicit management goals that can be functionally linked to tiger carrying capacity.

302133 NEST SITE SELECTION BY PLESKES GROUND JAY

hadi Radnezhad

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

365200 PATTERNS OF GROUP ASSOCIATIONS IN REHABILITATED JUVENILE ASIAN ELEPHANTS (ELEPHAS MAXIMUS) IN THE UDAWALAWA NATIONAL PARK, SRI LANKA.

Deepani Jayantha

Post-release group associations of eight juvenile Asian elephants rehabilitated at the Elephant Transit Home, Udawalawa and subsequently released to the Udawalawa National Park (UNP) in March 2004 were studied. Focal and scan sampling were carried out on three radio-collared individuals and five non-collared individuals until May 2006. Direct observations were carried out from 0600-1800 hrs using a pair of binoculars (8x40). Total observation time of approximately 11,000 minutes, was obtained from 14 consecutive days of sampling per month. The juveniles showed four distinct patterns of group associations. The first pattern of association, No. 42 interacting with an adult female having a male calf since June 2004 was continued through the study period. Second, the No. 39 was observed having transient associations with different cow-calf groups since September 2004, without making a long term association with any particular group. Third, the young tusker (No. 41), was rarely recorded in cow-calf or bull groups from August 2004 to May 2006, but remained in juvenile groups of released individuals. The non-collared individuals showed the fourth unique pattern of group association through the study period to interact with different cow-calf groups while being in the juvenile groups. In general, majority of the released individuals were observed closely gathered in juvenile groups even when they associate with cow-calf or bull groups.

365388 CONSERVATION BREEDING OF THE YANGTZE GIANT SOFTSHELL TURTLE RAFETUS SWINHOEI

Gerald Kuchling

The Yangtze giant softshell (*Rafetus swinhoei*) is arguably the largest freshwater turtle in the world, and the most critically endangered. A major threat for its survival is exploitation for food. By 2008 only two live individuals of *R. swinhoei*, originating from Lake Tai Hu, remained in China, a male that was already in Suzhou Zoo in 1949 and a female that lived in Changsha Zoo since 1949. Surveys in Yunnan in 2007 and 2008 did not find indications that any wild specimens were recorded since the turn of the century. In May 2008 the female was transported from Changsha to Suzhou to attempt to breed the last two known specimens in China to recover this species. After some mating activity the female produced two clutches of a total of more than 100 eggs in May and June 2008. Even though many of the eggs were fertile, a proportion was not properly shelled and all fertile eggs died during early development. Due to an insufficient diet of the female (mainly pork and chicken meat) some yolk components may have been inadequate to allow the completion of the embryonic development. This was not unexpected and after repeated advice the diet of the turtles was gradually improved. The breeding attempts continue in 2009. The goal is to establish a captive assurance colony with any progeny before planning will start to re-introduce the Yangtze giant softshell turtle back into the wild.

315659 MAKING CONSERVATION DECISIONS FOR VERY-POORLY KNOWN SPECIES: THE SAOLA PSEUDORYX NGHETINHENSIS

Nicholas Wilkinson

Poorly-known species are often most in need of help but how can science offer clear guidelines to decision-makers in such cases? Rules of thumb based on minimum viable population size or maximum sustainable yield have been widely discredited. Nonetheless decisions must be made; frequently they must be made fast.

The Saola, *Pseudoryx nghetinhensis*, a critically endangered ungulate from Vietnam and Lao, was discovered in 1992. Almost nothing is known for certain about its ecology and local people's reports provide the only recent information on its distribution. According to IUCN guidelines, its presence cannot be confirmed anywhere. WWF has raised government support for Saola conservation and begun action against the probable main threat (snaring) in what we believe are the key areas. We have also invested considerable time and effort in developing a survey method for the species. While this effort will continue, by the time we have the capacity to adequately census the population, the result could already be zero.

Simulation-based modeling, decision theory and uncertainty analysis present an opportunity to apply lessons learned from other species and determine the most likely best course of action. We also use these tools to question what knowledge about the Saola's ecology and status is truly essential for conservation. We present our experience to date as a starting point for discussion on the validity of these approaches for species conservation in the developing world.

METHODS: Scientists and managers: bridging the gap

365288 LINKING HUMAN DEVELOPMENT TO CONSERVATION - DOES HDI REFLECT ENVIRONMENTAL INDICATORS?

Sue Mainka

The most recent Human Development Report presents information on trends in the Human Development Index across all countries from 1980 to 2006. Overall the average trend across all regions is increasing however several countries stand out as having much greater rates of increase than others - namely, China, Egypt, Nepal, Libya, Iran and Indonesia. All of these countries have a greater than 0.2 increase in HDI over those 26 years which is more than double the average. The list includes two megadiverse countries and several countries which have also suffered from conflict and political upheaval during these years. Keeping this in mind, how has this increase in HDI been achieved? What are the consequences for the environment and conservation? Looking at complementary indicators such as Adjusted Net Savings (World Bank) and Environmental Sustainability Indices (CIESIN and others) there appears to have been a simultaneous and large environmental cost as development progressed in these countries. Most are now recognizing the potential longer term impacts of this degradation and taking measures to resolve them - eg. China's harmonious society. The report finishes with identification of countries showing more recent (200-2006) HDI increases that are more than double the average (Tunisia, Ethiopia, Cambodia) and discusses potential measures needed to avoid longer term impacts.

METHODS: Spatial Ecology and Conservation

315155 SPATIAL THEORY AND METHODOLOGIES FOR SPECIES DISTRIBUTION MAPPING USING GEOGRAPHIC INFORMATION SYSTEM - A CASE FROM SOUTH INDIA

Kavitha Anjanappa, Harisha Ranganahalli Puttahariyappa

The theory of spatial heterogeneity claims that there might be a general increase in environmental complexity as one proceeds towards the tropics. In tropics, due to high spatial heterogeneity, species accommodate themselves in a myriad niches. According to this theory two distinct subcategories exist, one at a macro, and the other at a micro scale.

We tested this hypothesis by establishing sample plots in a forest. Using GIS techniques plot wise species diversity and distribution was marked on the forest map. Our results revealed 59 tree and 119 shrub species in a 2700 ha sampled, indicates the high species richness despite its small area and high disturbance due to proximity to a big city. The similarity of species among adjacent plots is high among shrubs than that of trees indicating the factors that determine the species distribution for these two types of species are different. This pattern suggests that the explanation for high tropical diversity due to spatial heterogeneity was found to hold for trees, but not for shrubs. Thus measuring spatial distribution of species using GIS reveals patterns that are not easily observed, which in turn helps planners and decision makers in evolving sustainable strategies for forest management and conservation.

314920 A ECOLOGY AND CONSERVATION OF COMMON BENTWING BAT (<I>MINIOPTERUS SCHREIBERSI</I>) IN REPUBLIC OF ARMENIA AND NAGORNO-KARABAKH

Stghik Ghazaryan, George Papov, Vadim Harutyunyan, Eduard Yavruyan

Armenia and Nagorno-Karabakh are among Earth's 25 most endangered hotspots, where dwells <i>Miniopterus schreibersi</i>, one of the seven vulnerable (IUCN Red List) bat species listed in Red Book. By 2005 very little was known about ecology and distribution of this species in Armenia and Nagorno-Karabakh, and even that information was just based on literature and other insufficient sources. Beginning from 2005 we started gathering information about the places the mentioned species dwells, exact height of its location, places where it is mostly caught by people. Since then we have known much about types and climate of the habitats, size, sex, as well as physiological condition and behavior of that species. We captured 5 bats from each place and after measuring, ringing the bats we released them. We found 7 more places where common bentwing bats can spend their winter or summer. All these places are rocky. In cooperation with the Armenian and Nagorno-Karabakh Ministries of Nature Protection, we have closed the entries of some caves, which are frequently visited by people. Besides the government, local people also have their big participation in realization of plans and works, to prevent illegal capturing of bats and destroying the habitats.

315050 UNKNOWN CONSERVATION STATUS OF ARMENIAN VOLES

Tigran Hayrapetyan

The biodiversity of Armenia is a unique center of endemism, genetic fund, rare and declining species; one of the biggest centers of interaction and merger of various animal geographical kingdoms. Among the threatened biodiversity of Armenia are also species of voles (7 poorly known species, <i>Muridae, Rodentia</i>) that even baseline data on the geographic distribution and systematics, crucial for effective conservation management, are lacking. The latest few, sporadic literature dates on 3 common species of voles arise until 1987, where other 4 rare species almost neglect. That is why it is extremely important to identify rare species, describe their distribution, identify key habitat, evaluate the level of anthropogenic pressure, and recommend measures protect Armenian biodiversity.

TAXA: Amphibian and reptile conservation

368310 "BOOK OF ENVIRONMENTAL EDUCATION" A STRATEGY FOR THE CONSERVATION OF AMPHIBIANS IN COLOMBIA.

Victor Fabio Luna, Oscar Gallego Carvajal, Alonso Quevedo Gil, Javier Garcia Villalba

A form of protection and conservation of wildlife is through its knowledge, in this way, is intended to counter the growing decline of worldwide populations of wild flora and fauna specially in an important group to the balance of ecosystems such as Amphibians . The book Pedagogic Environmental Education is a new strategy at national and global level that integrates elements such as: environmental education, social work, conservation, and scientific research, creating strategies that target the use and management of natural resources, becoming the Falan municipality like a "Pilot Center of Biodiversity Conservation at the National

and World." This is evidenced by the realization of the first reserve of amphibians in the world "Amphibian's Reserve Gold frog" conducted by the union of national and international organizations: IUCN, Amphibian Specialist Group, Conservation International, Dendrobatidae Nederland and Fundación ProAves, home of threatened amphibian species like *Ranitomeya Tolimensis* (EN) and *Ranitomeya dorisswansonae* (CR), two new species of poison dart frogs for science endangered. In this way, we propose that environmental education books are a useful tool for generating scientific knowledge disseminated to local communities.

306402 BREEDING SEASON SURVEY AND CONSERVATION OF TWO ENDANGERED MUSTACHE TOADS IN GUIZHOU, CHINA

Ben Han

Vibrissaphora leishanensis and *V. boringiae* are two poorly studied mustache toads endemic to southwestern China, known for its keratinized spines on upper lips during breeding season and now considered to be endangered. During 2007-2008, we performed a survey to assess current population status (both adults and tadpoles) by methods like call counting, radio tracking, drift fence and bucket trapping. We also re-evaluated all threats including Bd disease and conducted awareness education among local communities. The study has found negative Bd occurrence. Males rarely move once proper breeding sites were found to attract females and thus became extremely vulnerable to human harvest. The species do hibernate in tree root holes or mud holes near streams, but exception of over-wintering aggregation under rocks in the stream was also observed. Tadpoles in stream sections close to roads and villages suffer heavier human harvest compares to remote sections. Adult number is undergoing rapid declines due to human harvest. It is concluded that human disturbance poses a major threat to the species survival, re-rank of its IUCN level is needed and two species should be at least listed into China's national second-class wildlife protection inventory to promote control of human harvest with stricter in-situ conservation and habitat management, human-assisted recovery plan should also be considered if possible.

307353 IMPLEMENTATION OF CONSERVATION MEASURES FOR THE DAREVSKY'S VIPER (VIPERA DAREVSKII) IN ARMENIA

Levon Aghasyan, Aram Aghasyan

The Darevsky's viper has a very limited range and is listed in the 2008 IUCN Red List of Threatened Species as critically endangered (category CR C2b). Its range spreads over the south-eastern part of the Javakheti Ridge in north-western Armenia, up to the border with Georgia and north-eastern Turkey. We have captured 28 individuals of *V. darevskii* and marked them by identification system (AVID FriendChip™, USA), for radio-tracking to study their movements, distribution and habitat use.

The key habitats of the viper are subalpine meadows at 2300-3000 m a.s.l. where scattered flat stone plates create optimal microclimate for this snake. Land use for agriculture and high selectivity of habitats are the principal threats to this species. We have obtained the first-hand information essential for assessment and development of conservation measures aimed at mitigating the conflicts with local land-users. The awareness-raising campaigns were carried out. The documentary, brochures and booklets were produced. New watering points for livestock were established and the viper haunts were fenced off. The key habitats were mapped, studied and proposed for inclusion to the Arpi Lich National Park which is to be established in

the Shirak Province due to financial support provided by KfW.

315719 THE GHARIAL OF KATERNIAGHAT: CONSERVATION STATUS OF A CRITICALLY ENDANGERED CROCODILIAN

Laurel Converse, Abhijit Das, Dhruva Basu, Subir Chowfin

Gharial (*Gavialis gangeticus*) were saved from near extinction in the 1970's, but now only 200 breeding adults remain in India and Nepal. One of three known breeding populations exists in India's Katerniaghat Wildlife Sanctuary (KWS), on the Indo-Nepal border. Despite a continuing captive breeding/restocking program, KWS surveys in '02 indicated low population recruitment. In June '08 floods destroyed the primary gharial nesting habitat in KWS, prompting suggestions for habitat restoration. In order to devise conservation and management strategies we investigated the population status, habitat and threats to gharial in KWS. From Dec.'08-Jan.'09 we conducted daytime visual counts/size estimation of gharial and habitat surveys. Using maximum daily count indices our results indicate a 64% increase in total population and 34% increase in adults since '02. However the source of new recruits and effectiveness of gharial restocking remain in question. We found natural potential nesting habitat still exists. Thus we advise against habitat restoration until gharials' response to recent habitat loss is evaluated through monitoring of nesting and hatching, which we will conduct from March-June. Gharial in this region face threats including dams, fishing, livestock, limited habitat and floods. Indo-Nepal collaboration to investigate connectivity of Indian and Nepali gharial populations and to tackle cross-border threats to gharial will be vital for future gharial conservation.

TAXA: Bird conservation

314799 HOUBARA BUSTARD CAPTIVE BREEDING : DATA AND FIRST EXPERIENCE, IN IRAN

Shirin Aghanajafi, Mahmoud-Reza Hemami, Fatolah Heydari

Populations of houbara bustard have been declining throughout its range. Beside in situ conservation activities, captive breeding of this species has been suggested as an effective conservation measure. Captive breeding of houbara has previously been conducted in a few countries. However, it is the first time that such effort is taken in Iran. Eggs detected in houbara's breeding habitat were transferred to standard incubation systems in the Harat captive breeding centre. Chicks were fed by vegetation protein and flour yellow beetle. Of the 9 eggs transferred to incubation system, 8 were successfully hatched. Comparing the weight of adult captive bred houbara bustards) with captured ones from the wild showed significant difference between these two groups ($t = 5.03$; $P < 0.001$). In contrast, adult houbara bustards kept in the captive breeding centre for a year showed an increase in their weight compared to their initial weight at the time of capture (paired $t = 6.43$; $P = 0.008$).

315349 COMMUNITY PARTICIPATION IN THE CONSERVATION OF THE CUNDINAMARCA ANTPITTA, COLOMBIA.

Sergio Omar Pulido Barrera

The colombian birds are the most diverse and represents approximately 19% of the world's species, its constitute an invaluable biological heritage that must be preserved, unfortunately the destruction and fragmentation of habitats, pollution and hunting have contributed to the deterioration of the conservation status of many species, among them the Cundinamarca Antpitta, it is endemic bird in the department of Cundinamarca, Colombia, its considered globally listed as Vulnerable, and Endangered in Colombia. This research focused on the design of an environmental education program to inform and engage effectively to the community in the municipality of Guayabetal, establishing the perception of local communities about birds populations through the development of social-mapping, report on the ecological importance of Cundinamarca Antpitta through workshops, identifying mechanisms that facilitate community awareness of the municipality through the consolidation of information obtained through interviews, and developing and disseminating information to allow effective conservation initiatives birds, strengthened environmental groups in the municipality of Guayabetal through the donation of library materials relating to the conservation and sustainable use of natural resources in addition to training in field of new birders, in this sense the processes of environmental education are especially important because they generate ownership and a change of attitude toward the resources and their potential.

315381 IN SITU CONSERVATION OF TWO CRITICALLY ENDANGERED GYPS VULTURES (GYPS TENUIROSTRIS AND G. BENGALENSIS) IN ASSAM, INDIA

Kulojyoti Lahkar, Mridu Paban Phukan, Tushar Saikia, Bornali Dutta, Tarun Gogoi, Anwaruddin Choudhury, Robert W. Risebrough

Since the mid 1990s, a sudden and sharp decline in three species of Gyps vultures' population was noticed in South Asia. Recent studies revealed that the major cause of sudden and phenomenal decline of Gyps vultures was use of diclofenac, a non-steroidal anti-inflammatory drug (NSAID), used to treat livestock. To know the status and to initiate a long term conservation process for two Critically Endangered vultures (*G. tenuirostris* and *G. bengalensis*) found in Assam, we initiated a survey in 2003 and thereafter surveying and monitoring regularly. From our studies in first two years (2003-04 and 2004-05), we found that vultures in Assam are threatened by some local factors such as destruction of nesting trees and nests, scarcity of food, persecution and poisoning of food sources other than diclofenac and their survival had become critical. We intervened for their conservation in the form of awareness campaign to protect nesting trees, nests, nestlings, to use safer drugs instead of diclofenac and not to poison vultures' food sources. We also carried out total counts at nesting and roosting sites, and nest monitoring to estimate population size and measure breeding success. The result shows that both species of vultures are gradually increasing in wild in Assam and the rate of breeding success is 63.4% (44.2 - 72.95%) over the last 4 years.

366518 HABITAT MODEL OF GREY-FACED BUZZARD ENCOURAGES THE RESTORATION ACTIVITY OF PADDY FIELD IN SATOYAMA LANDSCAPES OF TOYOTA CITY, CENTRAL JAPAN.

Hiroshi Hashimoto, Eri Nakama, Youko Yamamoto, Koji Oohata, Toshiya Matsuura

Grey-faced buzzard *Butastur indicus* is a vulnerable raptor nesting in Satoyama landscapes, the traditional small-scale rural agricultural landscapes in Japan. The buzzard prefers the areas near woods and paddies along valleys dissecting into uplands, hills and low mountains for their nest sites because of the efficiency for foraging. Recently, the population of the buzzard nesting in Japan has been estimated to be declining due to the rapid abandonment of the small-scale rice paddies in the valley-floors. Under this situation, Toyota Nature Sanctuary started a paddy field restoration project with local volunteers to call the buzzard back. In this project, the volunteers maintain the wet environment in the abandoned paddies in the sanctuary by cutting grasses and plowing. But how large abandoned paddies should we restore for the buzzard habitat effectively? To answer this question, we conducted a habitat survey of the buzzard and estimated the potential habitats of the buzzard with the logistic regression model using three vegetation maps at present, 30 and 60 years ago. The potential habitats were estimated in a large area in 30 and 60 years ago, while they drastically disappeared at present except the restoration site and some areas where small-scale rice farming are still conducted. This result indicates the importance of both the on-site restoration activity in the sanctuary and the conservation planning of the remaining rice-paddies at the regional scale.

315646 EFFECTS OF HUMANS ON ISLAND-NESTING SEABIRDS ALONG ZHEJIANG COAST EASTERN CHINA

Shui-hua Chen, Zhong-yong Fan, Gang-song Chen

Zhejiang coast holds the richest islands of 3061 accounting for 43.9% of the total island number in China, but had received poor ornithological survey previously. From June to August of 2003-2008, we conducted the surveys of breeding seabirds along Zhejiang coast. We aimed to document the species, populations and distributions of breeding seabirds and the threats to them. 5 species of terns and one species of gull with 49 colonies were recorded breeding at 26 islands. The results showed that the breeding seabirds in this area were facing a severe survival pressure from the effects of humans. These effects included food shortage caused by overfishing and seawater pollution, habitat loss by island development, disturbance by fishery activities and tourism, and direct mortality by hunting and egg collection. Among them, egg collection was the biggest threat that had badly affected the breeding seabirds in Zhejiang. Egg collection was thought as a traditional yield in this area. But the situation had extremely deteriorated with the rapid economic development and the relief of military tension across the Taiwanese Strait in recent years. As a result, the total population of breeding seabirds decreased 50 percent in 2007 compared with that in 2003. Human effects also led to the changes of breeding behavior including nesting at steepy cliffs, shifting breeding sites between different seasons, etc. In short term, urgent measures can effectively remove most human-induced threats.

314994 THE EFFECTS OF FOREST MANAGEMENT ON WOODPECKER COMMUNITIES IN SHOREA ROBUSTA-DOMINATED FORESTS OF WESTERN HIMALAYAS.

Raman Kumar

Woodpeckers form a specialized bird group adapted to obtain arthropod prey from woody substrates. They build tree cavities that provide habitat to many other animals. With strong affinity for wooded areas, they are sensitive to forest modification. Hence, forest management has an impact on the woodpecker community. These impacts have not been adequately studied for tropical Asia. The moist deciduous forests of Western Himalayas are dominated by Sal (*Shorea robusta*). The sal forest ecosystem has a history of modification via forestry operations e.g. logging, systematic manipulation and planting exotics. The region supports over 15 woodpecker species and ideal to study the woodpecker communities vis-à-vis forest modification. We chose 8 sites representing 4 management-based strata: old managed sal, young managed sal, teak plantations, and natural sal. At these sites we surveyed woodpeckers using ~2-km-long line transects, each site being surveyed 20 times over 2 years. Natural sal and teak plantations respectively showed the highest and lowest values for woodpecker density and richness. Woodpecker community structure was significantly different between strata. Some species showed affinity for natural sal; certain chose managed sal but avoided teak. This study highlights that forest management significantly affects woodpecker communities, and modified forests (especially teak plantations) have a limited capacity to conserve the natural woodpecker assemblage.

315273 SAVING THREATENED DRY FOREST BIODIVERSITY

Jorge Enrique Parra, Marcela Beltran, Sandra Valderrama, Alexandra Delgadillo

The Critically Endangered *Thryothorus nicefori* and *Amazilia castaneiventris* habit on remnant dry forests. To protect these birds and their habitat, our aim was to describe the ecological requirements and behavior for both species and to clarify their taxonomic status. We conducted 6 explorations in the Chicamocha Canyon, recording songs, describing behaviors, and characterizing their habitat. As a result, we obtained 13 new geographical records of *T. nicefori* and 9 of *A. castaneiventris*.

T. nicefori is dependent on riparian forest between 700 and 2100 m.a.s.l. where couples defend territories of 1 hectare approximately and produced coordinated vocal duets. In addition, the taxonomic relationship between *T. nicefori* and *T. rufalbus* was studied through a discriminant analysis. We confirmed that the Niceforo's Wren is a valid species.

A. castaneiventris defends territories with flowering trees between 850 and 2045 m.a.s.l., and we described a migration phenomenon during the stronger dry season on the Chicamocha Canyon. Additionally, we found that human pressures from goat and cattle farming are destroying the habitat of both species.

In conclusion, our observations suggest that these species are restricted of the dry forest which implies the need to conserve the Chicamocha canyon. Besides, there are a great potential to use behavioral studies to determinate the ecological and taxonomic status of bird species.

365306 THREATS AND SUGGESTED AMELIORATIVE MEASURES FOR THE CONSERVATION OF THE CRITICALLY ENDANGERED JERDON'S COURSER RHINOPTILUS BITORQUATUS AND ITS HABITAT

Panchapakesan Jeganathan, Asad R. Rahmani, Rhys Green, Ken Norris, Loannis Vogiatzakis, Chris Bowden, Deborah Pain

Jerdon's courser *Rhinoptilus bitorquatus* is a nocturnally active cursorial bird that is only known to occur in a small area of scrub jungle in and around Sri Lankamaleswara Wildlife Sanctuary, Cuddapah district, Andhra Pradesh, India, and is listed as Critically Endangered by the IUCN. Jerdon's Courser prefers a specific type of scrub jungle composed of native species with open areas, and there is considerable pressure from human use of apparently suitable habitats. Although major threats to the survival of the Jerdon's Courser have been identified, there was previously no quantitative information available. During our study (2000 - 2008), nine specific threats to the survival of the Jerdon's Courser and its habitat were identified. Habitat destruction and alteration is the major threat among them and its most immediate cause, for the only known population of the Jerdon's Courser in the world, is the construction of the Telugu-Ganga Canal around the Sri Lankamaleswara and Sri Penusula Narasimha Wildlife Sanctuary. The presence of the Jerdon's Courser was detected in three new locations in and around the Sri Lankamaleswara Wildlife Sanctuary, and one of these sites was destroyed due to the canal construction. We suggest several ameliorative measures for the conservation of the Jerdon's Courser and its habitat.

315419 EFFECTS OF INVASIVE SPARTINA ALTERNIFLORA ON THE HABITAT USE OF WINTERING SALTMARSH BIRDS AT CHONGMING DONGTAN

Xiaojing Gan, Chi-yeung Choi, Yong Wang, Zhijun Ma, Jiakuan Chen, Bo Li

The exotic *Spartina alterniflora* (hereafter "Spartina") have spread rapidly on the east coasts of China and completely changed the native saltmarsh vegetation over the past three decades. We conducted bird surveys using mist-netting in the exotic *Spartina* and native *Phragmites australis* (hereafter "Phragmites") habitats at Chongming Dongtan (East China) in the winter of 2004 and 2005, and related bird capture rate to their habitat structure and food abundance. Results indicated that the *Spartina* habitats were composed of lower and denser vegetation and provided fewer foods of seeds and arthropods for birds than the *Phragmites* habitats. Bird capture rates were significantly lower in *Spartina* than *Phragmites* habitats. Best-fit models indicated that both habitat structure and food abundance have significant effects on the bird capture rates. One-way ANOSIM also suggested that the food composition for birds was similar to the potential food in *Phragmites* habitats, no matter the birds were captured in *Phragmites* or *Spartina* habitats. These suggest that the alternation of habitat structure and decrease of food resources are the proximate causes for the decrease of bird communities in the exotic *Spartina* habitats. Because the spread of *Spartina* has negative impacts on the local bird communities, it is critical to control the spread of *Spartina* and restore the native vegetation to provide habitats for birds.

315402 THE HABITAT USE OF THE RED-CROWNED CRANE IN SPING AT ZHALONG, HEILONGJIANG CHINA

Sha Jianbin, Li feng

In Zhalong Nature reserve, we did study on the habitat use of Red-crowned crane from March to May in 2007 by radio tracking, GPS, plot sampling and the T-test, F-test, factor analysis, GIS. The individual birds we followed are 2 released and 3 wild birds. Among the wild birds, two of them are subadults. The results are: Red-crowned Cranes were non-randomicity about nest-site habitat and use reed marsh for nest site (100%); water depth is the mainly restrictive factors in nest-site habitat selection; the territorise of wild crane is much large than released cranes.

171 315718 IS PROTECTED AREA SYSTEM PROVIDING A SAFE HEAVEN FOR SRI LANKAN RESTRICTED-RANGE BIRD SPECIES? A CASE STUDY OF SRI LANKA MAGPIE

Chaminda Pradeep Ratnayake, Sarath W. Kotagama

Sri Lanka, together with Western Ghats, is considered as one of the biodiversity hotspots. Majority of Sri Lankan endemic biota is harbored in tropical wet zone forests under severe threat. Several measures have been taken by the state authorities and appending many tropical wet zone forests patches under protected area (PA) system. Here we use, the Sri Lanka Magpie (*Urocissa ornata*): a cooperative breeding threatened bird, an umbrella species to represent the 33 restricted-range birds confined to wet-zone forests, to examine the adequacy of such measures. We used DISTANCE sampling method to determine population sizes, within and outside the PA system. Results showed that the species occupy in 38 wet-zone forest patches with total population size of 10,800 (CI 7,800- 15,000). Out of these, 60% of the population distributed in 'proposed forest reserves' (42%) and 'other-state forests' (18%), potentially out site the PA system and remaining 40% of the population found within the PA system. This indicates that the 'other- state forests' and 'proposed forest reserves' needs to be elevated to appropriate PA category with the concurrence of two state authorities, as an immediate action to ensure the long term survival of the species and the other restricted-range bird species.

315137 SPATIAL USE AND HABITAT PREFERENCE OF AN ENDANGERED POPULATION OF BLACK-NECKED CRANE WINTERING AT NAPAHAJ WETLAND, YUNNAN

Liu Qiang, Yang Xiaojun, Zhao Jianlin, Yu HongZhong

Habitat loss and degradation have become the most important class of threats to the world's cranes. One of the most endangered populations of black-necked crane (*Grus nigricollis*), the central population, is also suffering from these threats, but little is known about their spatial use and habitat preference. In this study, we examined the spatial use and habitat preference of black-necked cranes through the whole winter period between 2007 and 2008 at Napahai wetland where approximately 300 black-necked cranes or 90% of the total central population gather in wintering aggregations. Spatial use was estimated by a new local nearest-neighbor convex-hull construction method (LoCoH), and habitat preference was analyzed by Euclidean distance analysis. Our results indicated that core use area (50% isopleths) and 100% isopleths use areas only accounted for 1.2% and 28.2% of the study area, respectively. Feeding sites were closer to marsh

and wet grassland and farther from dry grassland and farmland. We recommend that habitat protection efforts prioritize blocks of land that have abundant patches of marsh and wet grassland to maintain preferred feeding habitat. Our results contribute to the understanding of spatial use and habitat preference by black-necked cranes and provide specific information on nature reserve management.

320512 IMPACT OF ANTHROPOGENIC ACTIVITIES ON BIRD DIVERSITY AND HABITAT ECOLOGY AROUND BIOSPHERE RESERVE OF PENDJARI POOLS IN BENIN

Emeline Sessi Pelagie Assede, Méryas Dègbémabou Kouton, Brice Sinsin

Birds are one of the most important species of the Pendjari Reserve pools. The vegetation around these reserve pools that forms bird habitat are usually cleared for agriculture. Pools receive run-off from surrounding lands where fertilizers and pesticides are applied. This probably affects bird diversity habitats. This work aims to study the impact of anthropogenic activities on bird diversity and the ecology of their habitats around 36 pools in the Reserve and its land use. We inventoried birds within 50m distance around the pools. 10m×10m plots were established for floristic inventories. Some physical and chemical parameters were measured. The relation between birds diversity and vegetation modification was done by Principal Component Analyses. A descriptive analysis was done for diversity, physical and chemical data.

In land use areas, the birds' habitat are characterized by plant species of disturbed zone such as *Commelina erecta*, *Setaria pumila* and *Mariscus alternifolius* with the most acid pH (5.67) and high organic matter dissolved rate (29.17). There is an absence of shrub strata. The vegetation in the Reserve is typically undisturbed with a predominance of *Andropogon gayanus* and the richest bird species: 71%. Although pools habitats are rather well preserved in the Reserve, pesticide use regulation in farmlands could have at long time negative impact on birds and their habitat.

315153 HABITAT MANAGEMENT, ENVIRONMENTAL STOCHASTICITY AND POPULATION VIABILITY OF THE GREAT INDIAN BUSTARD

Sutirtha Dutta, Yadavendradev Jhala

We review the status of Great Indian bustard (*Ardeotis nigriceps*, GIB) and assess the current conservation strategies, impacts of habitat manipulation, and stochasticity in rainfall on GIB conservation. There are currently eight populations in six states of India. The largest population (100-150 birds) exists in Rajasthan. The remaining populations number less than 35 birds each. The current GIB conservation strategy concentrates on providing secure breeding areas by legislation and enforcement. Unfortunately, this preservationist approach along with ill-informed habitat management has negatively affected GIB populations even resulting in local extinctions. Our three year population monitoring programme in Gujarat shows that GIB responds to erratic changes in precipitation on small spatial scales by changing its lekking and nesting areas, thus negating the benevolent effect of small conservation refuges. Population viability analysis shows that a typical GIB population (≤ 35 birds) has a fair chance of persistence only if nesting and fledgling mortality is kept below 40%, poaching of adult birds is totally controlled and the potential carrying capacity is at least 75 birds. Landscape conservation inclusive of controlled traditional land uses is the viable strategy for GIB conservation. The rate of decline of the species necessitates the commencement of a captive breeding program for ensuring species recovery.

365382 LINKING BREEDING SUCCESS WITH MIGRATION AND MOULT SCHEDULES OF THE CURLEW SANDPIPER.**Yahkat Barshep, Anders Hedenstrom, Clive Minton, Leslie Underhill**

The link between breeding success (determined by predation pressure and June temperatures) with timing of migration and moult in the curlew sandpiper *Calidris ferruginea* was investigated using ringing data spanning 60 years from Sweden, South Africa and Australia. Results show that adults migrated earlier in years of high predation pressure compared with years of low predation pressure. Adult birds also started their moult earlier in years of high predation pressure. When clutches are predated on, birds leave the breeding grounds earlier compared with years when breeding attempts were successful. This result in an earlier migration of birds and, consequently, earlier start of moult. On the other hand, moult started earlier in years when June temperatures were colder. Hatching success could have been influenced through, for example, freezing of eggs, snow covering the nest and preventing incubation, or reduced fertility from influence of wind. This study demonstrates the carry-over effect of events happening on the breeding grounds on the schedule of other life-history strategies. We might be able to model how effect of climate change on future weather patterns might influence the schedule of life-history strategies.

TAXA: Conservation of migratory taxa**314360 MOVEMENTS OF SEA TURTLES FROM THE PALMYRA ATOLL NATIONAL WILDLIFE REFUGE, CENTRAL PACIFIC: INSIGHTS FROM SATELLITE TELEMETRY AND GENETIC ANALYSIS****Eugenia Naro-Maciel, Eleanor Jane Sterling, Katherine Holmes, Katherine McFadden**

Highly migratory organisms protected in one area may face threats when moving to other localities; understanding the linkages between groups in protected areas and outside them is therefore key to effective conservation. Little is known about the movements of globally endangered sea turtles of the remote Palmyra Atoll National Wildlife Refuge (PANWR), Central Pacific, hindering comprehensive management and conservation efforts. We therefore initiated research focusing on the relationships of sea turtles found at Palmyra Atoll to other groups. We used cutting-edge genetic analysis (n=41) and tracking of sea turtles via satellite telemetry (n=6), along with traditional tagging methods (n=41), to investigate the movements of green sea turtles sampled in August, 2008. To date, satellite transmissions reveal that all turtles remain at the PANWR. The genetic analysis indicates that this is a mixed-foraging stock drawn from various regional nesting areas. This information will be included in a management plan, and also applied to conservation through a freely available educational exercise. The study will provide research required for the effective management of sea turtles and their ecosystems at the Wildlife Refuge, significantly increase knowledge of regional population distribution, and advance federal recovery objectives.

TAXA: Fish conservation

315329 BREEDING PROGRAM FOR GOLDEN-LINE FISH, SINOCYCLOCHEILUS GRAHAMI: BASED ON POPULATION CONSERVATION ACTIVITIES

Pan Xiaofu, Li Zaiyun, Chen Xiaoyong, Junxing Yang

The aim of this study was to set up a breeding program for golden-line fish (*Sinocyclocheilus grahami*), which based on population conservation activities. Breeding program to achieve this goal should focus on long-term biological, ecological, and sociological solutions. To avoid high inbreeding rates, either crossbreeding or purebreeding methods, or combination of both were selected. There were three populations used on the program in Endangered Conservation Center, Kunming Institute of Zoology, Chinese Academy of Sciences. A practical program relied on knowledge of all related aspects, including life history, stated management objectives, criteria and methods of defined success and assessment. It should emphasis on minimization of negative genetic effects and disease control. Cultured gold-line fish as recruitment released to the wild is a challenging work. Cultured fish can also be provided for consumption by people. Tracing parentage, keeping broodstock size large, and frequently replacing brood fish with new wild individuals were necessary to the success of hatchery. We learned from practice of the program, to avoid problems of domestication selection, disease, and behavioral aberrance, emphasis should on genetic diversity, keeping low density, and simulating natural conditions.

TAXA: Invertebrate conservation

377554 THE VOYAGE OF AN INVASIVE SPECIES ACROSS CONTINENTS: GENETIC VARIATION OF WORLDWIDE ARGENTINE ANT POPULATION

Maki Lnoue

Alien ants are considered to be among the more damaging of invasive insects. Five ant species are ranked among the 100 world's worst invaders by the IUCN. Within the introduced regions, they displace or disrupt the local arthropod fauna, cause agricultural damage by protecting plant pests, and even affect human health. The Argentine ant, *Linepithema humile*, has successfully spread from its native range in South America across much of the globe. This species is highly polygynous and possesses a social structure, called unicoloniality, whereby individuals mix freely among separated nests.

In Japan the Argentine ant, first noted in 1993, is now found in several regions of Japan. Early detection and rapid response systems as well as control measures are required to prevent further expansion of the species. A vital component of this prevention is the identification of pathways of introduction into new locations.

Here, we attempt to demonstrate the genetic structure of the Argentine ant for understanding the dispersal history of the Argentine ant worldwide. Sequencing of the mitochondrial DNA from the Japanese and overseas populations resulted that one haplotype is shared among different populations widely distributed across the continent: USA, Europe, Australia, and Japan.

315006 40 YEARS ON, THE IMPACT OF LOGGING STILL EVIDENT ON HERBIVOROUS FAUNA OF KIBALE FOREST, UGANDA

Sini Maaria Savilaakso, Jenny Koivisto, Timo O. Veteli, Jyrki Puseenius, Heikki Roininen

In Africa, where biodiversity research is scarce, management decisions in the protected areas have rarely been based on scientific information of the area. Furthermore, the effectiveness in achieving conservation goals has seldom been evaluated. Here we present data of the influence of logging on the faunal community of herbivorous lepidopteran larvae and its temporal dynamics after 40 years of forest regeneration. We collected samples of larvae from the leaves of *Neoboutonia macrocalyx* Pax. between April 2006 and March 2008 from natural forest and three differently managed forest compartments in Kibale National Park, Western Uganda. We found that herbivory, larval abundance, and species richness were significantly lower in the logged compartments than in the natural forest, and community composition differed significantly between the compartments. Species richness and diversity varied seasonally and synchronously in all the compartments while larval abundance experienced seasonal, but not synchronous, variation. In addition, we observed changes in the community composition during different seasons in all the compartments. We conclude that the lepidopteran community has not recovered from the impact of logging despite the time passed. Natural regeneration does not seem to be efficient way of management in regard to herbivorous insects, and hence we recommend restoration activities to help to return the logged areas closer to the natural state.

301411 IDENTIFICATION OF EARTHWORMS SPECIES IN SARI TOWNSHIP ,2007-2008

Mina Ramezani, Zabihollah Yousefi, Seyyed Khalil Akbari Mohammadi, Masoomali Movahedi, Masoomeh Eslamifar

Earthworms are members of the phylum Annelida which have 3100 known species. Functional importance of earthworms is ever-increasing because scientific investigations are shown their functional worths, including: soil reformation, compost production, forest conservation, sewage sludge stabilization and so on. The aim of this study is identification of earthworm species gathered from kinds of geographic regions of Sari township. Samples fixed by

formaldehyde and alcohol solution in several stages, and placed into formalin tubes(5%). After recognition, analysis of obtained data was performed using SPSS with statistical tests (chi square, ANOVA). From 644 gathered samples, 345 adult samples were recognizable and identified. Five species were recognized, including: *Eisenia fetida*, *Dendrobaena byblica*, *Allolobophora caliginosa*, *Allolobophora kaznakovi* and *Allolobophora jassyensis*. Between eachone variables of weight, length, and number of segments with kind of species were statistically significant relation($p < 0.05$). The most weight, length, and number of segments was belonged to *A.caliginosa*. This study showed that the dominant species in Sari township with 34.8% amplitude (120 samples) was belonged to *E.fetida*.

TAXA: Mammal conservation

305136 LONG-TERM RESEARCH ON SICHUAN SNUB-NOSED MONKEYS (RHINOPITHECUS ROXELLANA) IN THE ZHOUSHI NATIONAL NATURE RESERVE, CHINA

Dapeng Zhao, Baoguo Li

The Zhouzhi National Nature Reserve (ZNNR) (107°33′-108°2′E, 33°33′-33°56′N) in the Qinling Mountains of China provides the habitat for one of the world's threatened primates: the Sichuan snub-nosed monkey (*Rhinopithecus roxellana*). The recent census estimated the total population at 1,100-1,200 in the ZNNR. The *R. roxellana* in the ZNNR was faced with deforestation and habitat fragmentation, which caused by both the commercial logging and local villagers' daily activities. Various research has been undertaken in the ZNNR, systematically since the late 1980s, on this Chinese endemic primate species. Aspects of its taxonomy, ecology and behavior have been reported by many researchers and those knowledges is critical to their conservation. A long-term comprehensive conservation and research project is imminently required for *R. roxellana* in the ZNNR, which should include periodic population survey, status investigation in severely degraded forests, comparative socioecology analysis between monkeys in the ZNNR and that in other Nature Reserves. Meanwhile, it is urgent that increasing development of local ecological tourism in the ZNNR should be effectively managed by both the national and local administrations related.

379736 IS IT A USEFUL CONSERVATION STRATEGY TO REINTRODUCING MAMMALS? ---- THE TEST OF REINTRODUCING CHINESE WATER DEER TO SHANGHAI

Min Chen

Chinese water deer (*Hydropotes inermis inermis*) is an endangered species, ranked as LR/nt in IUCN red data book. The distribution of it in China has declined rapidly and its distribution is fragmented.

In order to decide the conservation strategy, the cytb, D-loop and 12SrRNA of mtDNA were sequenced from the samples collected noninvasively from Zhejiang, Jiangsu and Jiangxi province. The results show that Chinese water deer have high genetic diversity and the population in Jiangsu is the highest. The population from Jiangxi should be ESU and worthy of conservation consideration. There are no clear diverging between the populations from Zhejiang and Jiangsu. Another conservation suggestion is reintroducing this animal to the area where Chinese water deer existed before.

Assessing the feasibility for reintroduction based on textual research of the deer populations in the history, survival condition, investigation of public attitude and local condition. We have tried to reintroduce the deer to suburb area of Shanghai. A group of Chinese water deer have been released into a Park on the round-the-city greenbelt area of Shanghai in 2007, after monitoring of this population for 2 years, we tried set free the deer to more open areas around the city in 2009. It is a test for reintroducing mammals, it need monitored continuously to evaluate the strategy.

306443 CONSERVATION STATUS OF MONKEYS ON BIKO ISLAND, EQUATORIAL GUINEA, ONE YEAR AFTER A PRESIDENTIAL DECREE BANNING THE HUNTING OF PRIMATES

Drew Timothy Cronin, Reginaldo Aguilar Biacho, Wayne A. Morra, Gail Walker Hearn

The seven monkey species of Bioko Island are being sold and consumed as commercial bushmeat through the illegal practice of shotgun hunting in Bioko's two protected areas. During the 11 years since October 1997, 126,000 bushmeat carcasses for sale in the Malabo market have been recorded through a partnership between la Universidad Nacional de Guinea Ecuatorial and the Bioko Biodiversity Protection Program (Drexel University). The evidence collected indicates that, as a result of rising prices for bushmeat, shotgun hunting has intensified, reducing primate numbers in easily accessed areas to a level that increasingly forces hunters to go farther afield to find monkeys to hunt; the Gran Caldera & Southern Highlands Scientific Reserve, once a haven for threatened fauna, now appears to be a main source of bushmeat coming to market. The government of Equatorial Guinea signed into law a Presidential Decree on October 27th, 2007, which banned the hunting, sale, and consumption of primates, punishable by prohibitive fines. However, despite initial results, in which primate hunting nearly ceased, this legislation has done little to stem the tide of unsustainable hunting, with increasing numbers of primates in the market and the apparent development of a clandestine market for their sale. These results indicate that without enforcement, the hunting ban alone will not be enough to stop the illegal shotgun hunting of monkeys.

365312 LARGE MAMMALS IN THE SOUTHERN WESTERN GHATS, INDIA: DISTRIBUTIONAL DYNAMICS, SPECIES RICHNESS AND THREATS TO PERSISTENCE

Rajeev Pillay, M D Madhusudan, AJ T Johnsingh, R Raghunath

Effective landscape level conservation strategies for large mammals hinge on a spatio-temporal understanding of ecological and anthropogenic correlates of range dynamics. This study aimed to identify large-scale patterns in range contractions, expansions and persistence of large mammals (body size ≥ 3 kg) across the southern Western Ghats and underlying drivers of change. Recent historical and present distributions of 18 species were assessed by questionnaire surveys involving key informant groups. Species were recorded as present/absent within sampling units based on direct sightings and/or indirect evidences. Closed-model occupancy estimation and spatially explicit mapping allowed unbiased estimates of proportion of area occupied. Carnivores like tiger, leopard, sloth bear, golden jackal; ungulates like gaur and Nilgiri tahr and endemic primates like Nilgiri langur and lion-tailed macaque have undergone significant range reductions over 30 years. Asian elephant distributions remain relatively stable. Range contractions are positively correlated to poaching, habitat loss and other anthropogenic threats. The results bridge a significant gap in our understanding of the regional level distribution of large mammals in the southern Western Ghats. Identification of important habitat corridors and new protected areas and formulation of effective management strategies for long-term large mammal conservation in this biodiversity hotspot are potential conservation implications.

315401 THE BAT FAUNA OF CAT BA BIOSPHERE RESERVE, NORTH VIETNAM

Pham Duc Tien, Hans-Ulrich Schnitzler, Annette Denzinger, Paul J. J. Bates, Neil M. Furey, Vu Dinh Thong

Cat Ba Biosphere Reserve in north Vietnam is internationally renowned for its important biodiversity and spectacular tower-karst landscapes. We conducted field research and other activities to determine the diversity and status of bat populations at the reserve and to promote their conservation. As a result, 24 bat species belonging to 12 genera and four families are now recorded at the site. Several new species records were made during the field surveys, including the recently described Khouay leaf-nosed bat (*Hipposideros khaokhouayensis*) and Fairy tube-nosed bat (*Murina tiensa*), which are currently known only from Lao PDR and Vietnam. Since a number of areas within the Reserve have still not been adequately surveyed, it is also probable that additional unrecorded bat species may well be present. As the reserve supports a wide range of forest and non-forest karst habitats including numerous cave systems, it provides ideal roosting and foraging conditions for a variety of bats. However, the increasing development of caves as tourist attractions may threaten species that depend upon these sites for maternity roosts. This paper presents data on the bat fauna of Cat Ba Biosphere Reserve and factors influencing its status. Conservation solutions for potentially threatened species are suggested.

314964 THE ELEVATION DISTRIBUTION AND HOME RANGE OF TAKIN DURING THE OVERWINTERING IN TANGJIAHE NATIONAL NATURE RESERVE, SICHUAN, CHINA

Ge Bao-ming, William McShea, Yanling Song

Some researches have been done on habitat selection and habitat use of takin at Qingling region and Tangjiahe region, however, few information on the winter habitat selection from November to March next year have been available. In our research, we attached 8 GPS collars to Takin since October 2006 to collect the GPS locations. The GPS collars recorded the locations of animals 4 times a day at 0300, 0800, 1500, and 2000 hours. 2 GPS collars had worked for two winters of 2006 and 2007 and totally 3017 overwintering locations were recorded. The collared takin distributed at the elevation between 1300-2200 m above sea level. The locations and size of home range for each takin was different overwintering. The average winter home range size was $6.88 \pm 1.14 \text{ km}^2$ (Mean \pm SE, n=8). The size of home range and the SD (Standard Deviation) of the elevation distribution had significance positive correlation ($y=0.015x+0.4445$, $R^2=0.2868$, $p<0.001$). The results indicated that the takin resided at an intermediate-altitude range during winter in Tangjiahe National Nature Reserve. The distinction between average monthly and overall winter home range sizes provided the evidence that takins moved continually to changing habitat during overwintering.

315013 STUDY OF RELATIONS AMONG LIVESTOCK, FENCING AND SURVIVAL OF PRZEWALSKI'S GAZELLE

Lu Zhang, Zhi Lu, Dajun Wang, George Schaller, Biao Yang, Jiazi Liu, Li Zhang, Yonglin Wu, Kejia Zhang

The critically endangered Przewalski's gazelle (*Procapra przewalskii*) experienced severe population decline and habitat loss during the past century. Among the factors which are believed to affect gazelle's survival, livestock and fencing were highlighted by many investigators, yet few researches have been conducted to quantify them and measure their impact. We intended to study the relation between livestock and gazelle survival, as well as the relation between fencing and gazelle survival. Gazelle population density and structure were obtained in our three population surveys. Livestock density and stocking rate were collected through household interviews. Rangeland biomass and plant species composition data were obtained using double-weight sampling method. Dietary overlap between livestock and gazelle in each distribution area will be analyzed using micro histological analysis of feces. These data will be used to analyze the relation between livestock and the survival of gazelle. Fence distribution, type and height, and gazelle feces locations were recorded on transects. Our result showed there was negative correlation between fences location and gazelle distribution, yet more work need to be done to examine whether fencing affect gazelle survival. The result of the study will contribute to ongoing conservation project and public education of the gazelle.

315023 ECOLOGY AND CONSERVATION OF SMALL FELIDS IN THE BRAZILIAN SAVANNA

Marcelo Juliano Rabelo Oliveira, Joaquim de Araújo Silva, Edsel Amorim Moraes Junior, Guilherme Braga Braga Ferreira, Flávio Henrique Guimarães Rodrigues

The Brazilian savanna known as Cerrado is a global biodiversity hotspot where Protected Areas (PA's) covers only a small area of the ecosystem. To evaluate the effectiveness of these PA's a research project on small felids is being developed in Grande Sertão Veredas National Park and Veredas do Peruaçu State Park, both located in the Cerrado of South-eastern Brazil. The tiger cat (*Leopardus tigrinus*) listed by IUCN as vulnerable and the ocelot (*Leopardus pardalis*) classified in the Brazilian red list as vulnerable are the target species of this study because they can be used as focal species to plan the conservation in natural areas. Individuals of both species are being captured and monitored by radio-telemetry and camera-traps to estimate home range, use of habitat, density and population size. The results with cameras traps shows a high densities of *L. tigrinus* (0.29 - 0.67 individuals/km²) and low densities of *L. pardalis* (0.02 - 0.04 individuals/km²) were found in the study areas. *L. tigrinus* density is much higher than those found in other areas showing the study area importance for the conservation of this threatened species. Because of the consequences of fragmenting these ecosystem, the establishment of new protected areas in the region is suggested since it would safeguard populations of these cats, especially tiger cats, as well as protect the Cerrado ecosystem as a whole.

314593 MICROHABITAT USE OF A NATIVE RODENT AS INFLUENCED BY EXOTIC PLANTS**James Thomas Anderson, Holly M. McChesney, Jennifer A. Edalgo**

Exotic plant species have invaded many natural areas and may affect microhabitat use by native rodent species. To test this, we quantified microhabitat use by white-footed mice (*Peromyscus leucopus*) in forests and old-fields occupied by Morrow's honeysuckle (*Lonicera morrowii*), an invasive shrub from Asia. We compared 10 microhabitat characteristics between trails used by mice (n = 124) and randomly selected trails (n = 127) using fluorescent powder tracking at Fort Necessity National Battlefield, Pennsylvania, USA. The % cover of exotic herbs was the most important microhabitat variable for separating white-footed mouse trails and random trails. Indeed, 76% of all used trails had less than 22% cover of exotic herbs, whereas 62% of random trails contained greater than 22% cover of exotic herbs. White-footed mouse trails had a greater % cover of trees and shrubs (specifically Morrow's honeysuckle) and a higher % cover of coarse woody debris. Random trails were correlated with % cover of native and exotic herbs and overall herb richness. Our study indicates that white-footed mice do not use microhabitats randomly and prefer areas of high structural complexity. Moreover, exotic herbaceous vegetation has more of an impact on white-footed mice microhabitat use than exotic honeysuckle shrubs.

315124 A SURVEY OF THE JAVAN GIBBON (HYLOBATES MOLOCH) IN CENTRAL JAVA, INDONESIA**Arif Setiawan, Tejo Suryo Nugroho, Yohannes Wibisono, Djuwantoko**

Javan gibbon (*Hylobates moloch*) is one of the most endangered lesser apes in the world has been heading to vanish due to forest degradation and massive devastation on their natural habitat. Between December 2007 and February 2008, we conducted Javan Gibbon field survey in Central Java, Indonesia. The objectives of this study were to determine the current geographic distribution and conducting population study in Mt. Slamet. We used line transect method to estimate population density in Mt. Slamet and GIS software was used to map their current distribution in Central Java. Totally 33,434 km transect in eastern slope of Mt. Slamet we found two animals/km², 22 individuals belongs to 12 groups of gibbon. We found the distribution of Javan Gibbon scattered in the remnants forest among human habitat utilization. Due to threats the survival of Javan gibbon in Central Java, conservation initiative ensuring their protection in fragmented and unprotected forest habitats is critically important. The result of this study might have implication in strengthening the importance of maintaining primate populations for forest conservation that is important not only for the survival of Javan Gibbon but also for humans, who utilizes forest resources to live.

315276 BCONSERVATION ASSESSMENT AND MANAGEMENT PLAN FOR MEXICAN PRIMATES**renda Solórzano-García, Ernesto Rodríguez-Luna, Aralisa Shedden-González**

The Conservation Assessment and Management Plan workshops (CAMP) are tools designed by the IUCN's CBSG-SSC groups, to evaluate the species status and to propose mechanisms for their conservation. In 2006 the second CAMP for Mexican primates took place, finding that the 4 taxa in the country were in a risk

category of the IUCN Red List. Habitat lost and fragmentation were identified as the main threats, caused by changes in the land use, triggered by the application of inadequate public policies, the high poverty and marginalization of rural communities, and the lack of conformity between the conservation and development policies. Although Mexican primates are well studied, there are significant gaps in information relevant to determine the degree of threat that these organisms are facing, then it was recommended to run research about demographic trends and the effect of the various threats in primate population dynamics. The conservation proposals arising from the workshop were linked to governmental conservation initiatives to achieve greater support and likelihood of success. In this second workshop the CAMP-IUCN methodology was analyzed suggesting to do some modifications in order to address the multi-causal origin of the threats, and to integrate the conservation strategies with national policies, with the aim of seeking the accordance between natural and social systems, increasing the viability and implementation of the recommendations developed in such workshops.

315702 A CONSERVATION PLAN FOR GIANT PANDA HABITAT IN SOUTH MINSHAN AFTER THE MAY 12 EARTHQUAKE IN WENCHUAN, CHINA

Weihua Xu, Zhiyun Ouyang

The May 12 Wenchuan earthquake not only caused tremendous loss of human life and property, but also resulted in the destruction of ecosystems and species such as the giant panda (*Ailuropoda melanoleuca*). In order to understand the effect of the earthquake and subsequent geo-disasters on panda habitat, we analyzed habitat loss and fragmentation of panda habitat across South Minshan Mountain using TM images and field data collected before and after the earthquake. Results show that 354 km² (23.04%) of the panda habitat in this region was lost after the earthquake. The remaining habitat was seriously fragmented by landslides and mudflows, which may increase the existing threats to the panda's long-term survival. In addition, although 515 km² (43.6%) of the remaining habitat was protected inside reserves, the mean patch size of panda habitat inside reserves was only 23% of that outside, indicating much higher habitat fragmentation inside reserves compared to outside. In order to provide guidance for conservation of the giant panda and its habitat in this region, we identified three key areas and two corridors outside the reserves as central to ensuring the exchange of pandas between isolated habitat patches.

367924 EVALUATING HABITAT USE OF A REINTRODUCED GIANT PANDA USING GPS TELEMETRY

Hemin Zhang, Pengyan Wang, Desheng Li, Guiquan Zhang, Rongping Wei, Yan Huang, Xiaoping Zhou, Chunxiang Tang, Jinyan Huang, Shiqiang Zhou, Yahui Zhang, Bin Liu, Rengui Li, Wei Liu

Habitat use of the first reintroduced giant panda (*Ailuropoda melanoleuca*), named Xiangxiang, was studied using GPS telemetry in Wuyipeng area of Wolong Nature Reserve in Sichuan, China between late April and early December of 2006. Overall and monthly home ranges of the panda were calculated using minimal convex polygon (MCP) method. The overall home range of the panda in the eight months was 802 hectares, which is a little larger than known home range sizes of male wild pandas studied in the same areas in 1980's.

From May to November of 2006, the panda's monthly home range declined consistently from about 300 hectares to below 100 hectares, and the daily linear movement distance decreased from over 500 meters to below 250 meters. The panda did not show clear altitudinal movement across the seasons, which differs from known habitat use pattern of the wild pandas in the same area. Observations data of the panda and scat survey of wild pandas in the same area showed that, besides habitat suitability, territory competition with wild pandas also significantly affected the habitat use of the reintroduced panda. We suggest that population status and habitat use of wild pandas at the reintroduction site should be carefully assessed in future giant panda reintroduction efforts.

TAXA: Plant conservation

307068 REPRODUCTIVE BIOLOGY AND VARIATION OF ENDEMIC CYATHEA SINUATA HOOK. & GREV.: WORLD'S ONLY SIMPLE LEAVED TREE FERN

Rajapaksha Haddokara Gedara Ranil

The endemic and endangered *Cyathea sinuata* is the only tree fern species worldwide known to have simple leaves. Information on its habitat, distribution, morphological variation and reproductive biology are scanty. Consequently, a long term study was initiated to provide such information for its conservation and utilization. The distribution was limited to a few areas of spray zone of stream banks within the two lowland rainforest. Cluster analysis resulted three groups: (i) *C. sinuata*; (ii) its close relative *Cyathea hookeri* and (iii) suspected hybrid of them which is tentatively named as *Cyathea x sledgei* Ranil. *C. sinuata* shows two sub groups or probably two morphotypes. Thirty four percent of spores were germinated after 7-10 days after spore sowing (DAS). Antheridia and archegonia were observed 55 and 65 DAS, respectively. Sporophytes were not observed. In natural habitats, *C. sinuata* shows substantial regeneration indicating that environment in laboratory condition may not to be suitable for fertilization process. This indicate that reproduction under the natural conditions is successful although distribution is limited a few localities. The variation of leaf characters may be due to outcrossing which need to proof under experimental conditions. These results indicate that existing isolated populations should be monitored and conserved in situ for conservation of *C. sinuata* in Sri Lanka.

315250 "MEDEMIA ARGUN; LONG HISTORY AND UNSECURED FUTURE"

Mohamed Ahmed Ezat

Medemia argun is a mysteries and little known palm species. It is endemic to the Nubian Desert of southern Egypt and northern Sudan. It was discovered as sub-fossil material in Pharaonic tombs back to 2500 BC. *Medemia* had culture significant in Ancient Egypt. It is listed in the IUCN Red list 2006 as critically endangered species. Nubian Oases represented the last remains of the vegetation which was covered the Great Sahara during the wet period. These habitats are endangered due to potential threats of human activities and climate change.

Explorations the Nubian Desert had been done, especially places which had been reported by previous studies or mentioned by Bedouin. Detailed study for the main *Medemia* population in Dungul Oasis had been done, including collection of seeds and germination protocols.

These efforts lead to discover two sites of *Medemia* in Eastern desert and to confirm the existing of *Medemia*

in Nakhila Oasis after 50 years of the discovery of *Medemia* there. An *ex_situ* garden had been established for conservation and educational purposes. More efforts should be done to accelerate the declaration of the Nubian Oases as protected area before we lose a historical and natural heritage of Nubian Desert.

367098 CONSERVATION OF REMNANT AND RARE MAPLE POPULATIONS IN CLOUD FORESTS OF TROPICAL AMERICA

Yalma Vargas-Rodriguez, William J. Platt, Jose Antonio Vazquez-Garcia,

Acer saccharum subsp. *skutchii* is the most southern representative of sugar maples. We investigated floristic and structural characteristics of cloud forests in Mexico and Guatemala containing remnant populations of sugar maples in protected ravines. We identified what cloud forest site deserving top priority for conservation and *in situ* preservation by assessing tree species richness, number of endemic vascular plants, number of species with protection status, and presence of relict tree species. We also placed tree species richness and floristic composition of maple forests from Mexico and Guatemala in a world context, comparing them with 110 forests throughout the world. Then, using Ward's dendrogram, we identified similarities in the floristic composition. Also, we determined which species in the maple forests are protected by Species Protection Acts. Our results indicated that forests in tropical America containing sugar maple are species rich, have large numbers of both endemic and relict species. In addition, one maple forest from western Mexico, locally named Ojo de Agua del Cuervo, is unique in that it contains larger numbers of species, endemic and endangered plants than similar Asian forests containing ancient species. This maple forest is floristically related at the generic level to forests in Asia, as well as those in Mexico containing Tertiary relict tree species. We propose a 56395 ha biosphere reserve that includes Ojo de Agua del Cuervo and its surroundings.

367940 ENDANGERED MAGNOLIA IN MEXICO, CENTRAL AMERICA AND THE CARIBBEAN

Jose Antonio Vazquez-Garcia

Magnolia is an ancient Asiatic-American disjunct genus displaying a remarkable pattern of allopatric speciation in two of the three sections found in the studied area. Most of the species in these groups are narrow endemics and are seriously threatened, largely by forest logging. Many of species occurring in the area are already endangered, some of them even before they are described. This study mostly deals with sect. *Theorhodon* Spach (basically Mexico and Central America), the largest section in the western hemisphere, with 12 species; sect. *Splendentes* Dandy ex Vázquez, with ca. eight species; and sect. *Rhytidospermum*, with one species only. *Magnolia sensu stricto* in Mexico, Central America and the Caribbean consists of 16 published species, a half of those were recently published within the last 15 years. Botanical explorations in the Mexican states of Durango, Tamaulipas, Hidalgo, Queretaro, Oaxaca and Chiapas show that at least another five additional taxa, already under some anthropogenic threat, are yet to be described. This study illustrates that neotropical continental magnolias are quite diverse, perhaps as a result of a secondary radiation, confirming the notion that accelerated rates morphological evolution may have occurred in close relatives living in subtropical and tropical areas. These magnolias, even though are extremely isolated in remote mountains, they are not only still poorly understood but seriously threatened by human disturbance.

Speed

Speed Session Population Dynamics and Conservation Genetics

365457 WATERBIRD SURVEY OF THE MIDDLE REACHES OF YELLOW RIVER IN JANUARY 2009

Meng Yang

Although the middle and lower reaches of Yellow River are known to be of great importance for waterbirds, no comprehensive and simultaneous count has been carried out over a short time period. A survey of counting the number of winter waterbirds in the middle reaches of Yellow River was conducted during January 27th - 31st, 2009 to obtain accurate information on the abundance and distribution of waterbirds throughout the region. Most of the important wetlands between Xianyang and Zhengzhou were visited, and a total of 12362 waterbirds of 49 species (6 orders 12 families) was counted. Five threatened species were recorded, including one endangered species (*Aythya baeri*), two vulnerable species (*Anas formosa*, *Otis tarda*), and two near threatened species (*Anas falcata*, *Aythya nyroca*). This survey is a start for collecting the comprehensive and latest data on waterbird abundance and distribution. It shows the necessity to develop an effective monitoring programme and, also, to define an appropriate protected area system.

315630 MONITORING GOLDEN EAGLES WITHIN THE PROPOSED WIND ENERGY FACILITY IN NORTHERN BAJA CALIFORNIA, MEXICO

Lisa Nordstrom

As concerns over global warming rise, interest in renewable energy have increased dramatically. As a result, the development of wind energy facilities has expanded around the world. While wind energy is perhaps one of the most promising in terms of its ecological footprint, it is not without a cost, potentially posing great risk to birds and bats. One species of particular concern for the proposed Sempra Generation's Energia Sierra Juarez Wind Project in northern Baja California, Mexico is the golden eagle (*Aquila chrysaetos*), the national bird of Mexico and US protected species under the Eagle Protection Act. The main objectives of this research are to investigate the spatial and behavioral ecology of this species and identify ways to reduce or avoid potential impacts. We initially performed aerial nest searches to determine the number and location of active breeding pairs, as well as past breeding sites. In addition, we captured, marked, and attached GPS PTT backpacks on resident golden eagles within the proposed wind project site. By monitoring the movement patterns of golden eagles and identifying the conditions associated with high use, we are able to delineate areas of increased risk of mortality posed by wind turbines and provide a more accurate risk assessment prior to construction. Monitoring efforts, such as this, will greatly assist in the evaluation of the impacts of wind energy facilities and enhance the protection of species.

364878 ADAMAWA TURTLE DOVE (*STREPTOPELIA HYPOPYRRHA*) HABITAT UTILISATION IN SUB-SAHARAN AFRICA

Ademola Abiola Ajagbe

The Adamawa Turtle Dove (*Streptopelia hypopyrrha*) is endemic to Northern part of Nigeria and Cameroon, where it is found in wooded ravines and cultivated areas. The activities of Adamawa Turtle Dove in the Amurum Forest Reserve, Jos, North Central Nigeria, and surrounding farmlands were studied between February and April 2004. A total number of 413 birds were recorded in the two study sites using line transects, 185 individuals were recorded in Amurum and 228 in the surrounding farmlands. In the Amurum Forest, the peak of bird observation was before 0700 hours, particularly in transects around the gallery forests. Birds perched and flying were higher in the Amurum Forest Reserve before 0720 hours but no birds were seen foraging in the forest at that time. This suggests that these birds utilize farmlands during the day for foraging while they roost in the Amurum Forest Reserve. In the farmlands, birds foraging, flying, perched and hopping were higher after 0720 hours. Most birds foraging were observed in the farmlands. Furthermore, there were unique assemblages of foraging Adamawa Turtle Doves in freshly burnt farmlands which implies the benefit of communal roosting in protected habitat. The Amurum Forest also seems to be the nesting site of the Adamawa Turtle Dove.

315698 CORRELATES OF EXTINCTION RISK IN BIRDS

Tien Ming Lee

Understanding species extinction risk is vital for biodiversity conservation. Recent works highlight the importance of intrinsic traits (e.g., body size) or extrinsic factors (e.g., human density) or both, as well as geographic range size, in predicting IUCN Red List threat status for some vertebrate groups. Here, by using structural equation modeling, we examine a suite of relevant correlates of extinction risk for at least 7000 (the largest dataset to date) extant terrestrial bird species. We show that species with high past range loss (defined as the proportion of current range size transformed by past human encroachment) are more likely to be listed as threatened than those with low range loss. By itself, geographic range size decreases with increasing threat status, emerging as one of the strongest predictors. In essence, life-history, ecological niche and environmental niche factors appear to be significant in explaining the bird extinction risk data. Shared ancestry has some effect on the results. Overall, our findings advance the field of predictive conservation science under a more conceptual framework.

315224 A STUDY ON VASCULAR PLANTS IN BAXIANSHAN NATURE RESERVE IN TIANJIN

Li Yong

According to investigation in Baxianshan Natural Reserve in Tianjin from 2004 to 2007 and the collected specimen of Tianjin Natural History Museum, 524 species (including 20 varieties and forms) of vascular plants were recorded, which belonged to 310 genera, 96 families. The results showed that the flora of

Baxianshan Natural Reserve is important and particular in Tianjin region.

366579 HIGH GENETIC VARIATION AND PHYLOGEOGRAPHIC STRUCTURE OF *CARASSIUS AURATUS* COMPLEX (CYPRINIDAE) IN EURASIA

Yun Gao, Jing Luo, Shu yan Wang, Yan Li, Ya-Ping Zhang

The *Carassius auratus* is a widely distributed cyprinidae species over the Eurasia with sympatric coexisting diploid and triploid forms. It serves as a source of fish food for human consumption in China. However, the genetic diversity and relationship among the *C. auratus* complex and the origin of triploid form are under investigation.

Lineage divergence and genetic diversity in Chinese *C. auratus* complex were investigated and polyploidy events were mapped onto the phylogenetic tree together with downloaded European and Japanese subspecies based on ~424bp mtDNA D-loop sequences. A total of 66 haplotypes were identified among 631 Chinese individuals, which showed high genetic variations. Phylogenetic and network analyses inferred three divergent clades in Chinese and European *C. auratus* complex, which were distinguished differentiated from Japanese subspecies. Two major clades were distributed among the defined subspecies *C. a. gibelio* and *C. a. auratus*. Our results showed the island-isolation effect in *C. auratus* complex in Eurasia.

The triploid forms were found in divergent mitochondrial lineages and frequently shared the same haplotypes with diploid individuals. It indicated multiple origins of triploid from distinct matrilineal lineages and recurrent polyploidy events occurred independently in different subspecies and different geographic populations such as the subspecies *C. a. langsdorfi* in Japan, *C. a. gibelio* and *C. a. auratus* in China.

315379 ASSESSMENT OF INVOLVEMENT OF THE LOCAL POPULATION IN A PROCESS OF THE COMMUNITY BASED FORESTRY MANAGEMENT AND SHARING BENEFITS OF JOINT FOREST USE

Iliia Anatolievish Domashov

Development of the forestry sector of Kyrgyzstan directly depends on participation of the local population in that process in framework of the programme Community based Forestry Management (CBFM). This survey is aimed to determine a current state of the Community based Forestry Management, identify benefits and CBFM problems, and search of optimal steps on even distribution of the benefits within sustainable forest use and conservation of natural forest ecosystems.

Method of the semi-structural interview was used in the survey. Survey showed that during introduction of the CBFM practice in the Kyrgyz Republic, the local population considered the forest as available resource which is not valuable. In spite of that, the CBFM can ensure transition to improved attitude of the local people to the forest ecosystems.

In many cases, local population does not understand properly specificity of the CBFM practice and its role in the forest conservation in contrast to other types of forest use.

At present, a conflict exists in a sphere of CBFM between the forestry staff and local population. After research for local community and forest service was create list of recommendations.

315472 THE DISTRIBUTION OF EPIPHYTIC COMMUNITIES WITHIN THE CANOPY AND EMERGING FROM IT IN TSUGA HETEROPHYLLA TREES OF AN OLD-GROWTH FOREST, WASHINGTON STATE

Kelly Erika Gleason

This study investigated the influence of the sub-emergent within-canopy environment versus the emergent above-canopy environment on epiphyte diversity in dominant western hemlock trees. Five western hemlock trees, in a 950 year-old western hemlock/Douglas-fir forest in the Washington Cascade Range were examined. Using two sampling methods to capture inner and outer portions of the crown, we sampled frequency and abundance of epiphytes in the emergent and sub-emergent canopy zones. There was a significantly greater abundance and frequency of epiphyte species in the emergent zone plots than the sub-emergent zone plots. The mean percent coverage of epiphytes on emergent outer branchlets was over two times the coverage on sub-emergent outer branchlets. However, the mean percent coverage on the inner main branch axes was not significantly different between the two zones. The canopy environment had a greater influence on the distribution of functional group communities on the outer exposed branchlets than within the inner sheltered main axis region of the hemlock crowns. This suggests a variable heterogeneous environment around the outer exposed branchlets, and a more homogenous environment sheltered within the inner crown where diversity is less influenced by canopy coverage. The heterogeneous canopy environment that characterizes 'climax' old-growth forests may provide a higher diversity of epiphytes than younger lesser developed forest types.

365550 SUSTAINABILITY AND MANAGEMENT OF FRESHWATER LAKES BY COMMUNAL INSTITUTIONS IN THE LOWER FLOODPLAINS OF THE RIVER NIGER

EnoAbasi Deborah Anwana, Robert A Cheke, Adrienne M Martin

Freshwater lakes are ubiquitous throughout the Niger Delta, providing an estimated 80% of the total animal protein consumed by the people and primary employment to about 1.5 million people, including artisans and secondary employment associated with it. However, due to the combined force of reclamation, drainage and pollution the fisheries within these lakes face the grave danger of habitat loss. Drawing from findings of the multidisciplinary research conducted in nine communities within the Niger Delta floodplain, this paper examines the communal management of freshwater lakes as an alternative perspective to state-centered policies. Results show that the regulatory practices demonstrated in these communities preclude open access to natural systems, even in areas considered as belonging to all the members of the community and access to resources is determined by given institutions within the society. The legitimacy and acceptance of prescribed rules and social sanctions which clearly define access to resources within these communities help to reduce conflicts. These practices ultimately support the sustainable management of wetlands and do not allow the emergence of 'the tragedy of the commons' as posited by earlier theorist of common pool resources. From this standpoint, the paper argues for the active involvement and participation of these institutions in freshwater conservation planning and policy for a long term collective management of common pool

resources.

315366 EFFECTS OF INTERNATIONAL BORDER INFRASTRUCTURE ON LOCAL WILDLIFE POPULATIONS: THE CASE OF THE GRASSLANDS ALONG THE US – MEXICO BORDER WALL

Rurik List, Jesús Hermann Pacheco, Gerardo Ceballos González

The impact of climate change on the distribution of species and migration or movement patterns of species is of growing concern, particularly for the northern Chihuahuan Desert and the Sky Islands of the Southwestern United States and northwestern Mexico. It is here, where in an attempt to reduce security risks and illegal immigration, the US government waived the application of environmental laws to accelerate the process to build other infrastructure along the US - Mexico border line. We are assessing the effect of the border wall infrastructure on the bison and pronghorn populations of border region grasslands. Through aerial and ground surveys we identified wildlife crossings. Pronghorn cannot pass through the standard 5 to 7-wire border fence, but bison crosses it either by jumping over, or knocking it down, making openings which allow pronghorn to cross. Mule deer, bears and other large mammals also cross under or over the standard fence, but as the border infrastructure is completed, the risk that the trans-boundary movement of wildlife decreases or stops is high, particularly for bison and pronghorn. If the wall is left standing long enough, the viability of the populations of these and other species in the border region is compromised. Clearly, decisions affecting the biodiversity of two or more countries should not be taken unilaterally; now, a bi-national effort to mitigate the effects of the border wall on this biologically diverse area is urgently needed.

315754 ECOSYSTEM CONSEQUENCES OF DEPLETING OCEANIC APEX PREDATORS

Julia Kathleen Baum

The depletion of oceanic predators has elicited considerable concern, both about the conservation of these species and the broader ecosystem effects that might ensue from their removal. Yet studying the ecosystem effects of fishing large marine predators has proven challenging, since controlled manipulative experiments are largely infeasible in oceanic ecosystems and observational studies of single populations generally lack the statistical power to distinguish among competing hypotheses. Utilizing long-term time series, large-scale surveys, and appropriate statistical techniques, researchers have recently uncovered evidence of cascading effects of predator depletions in many geographic regions and almost all oceanic ecosystem types. These new studies indicate top-down control in the ocean is more common than previously thought and can have significant implications for fisheries and ecosystem function. Here, I present evidence for cascading effects of shark depletions from a case study on the U.S. east coast and overview other recent examples from the literature. I finish by outlining future research questions aimed at understanding if these predator depletions are also compromising ecosystem resilience, and what the costs to human societies might be if these species are lost.

365613 MOVEMENTS OF EASTERN PACIFIC GREEN TURTLES NESTING IN NORTHWESTERN COSTA RICA

Gabriela Silvina Blanco, Stephen Morreale, James Robert Spotila, Frank Vincent Paladino

The Pacific coast of Costa Rica is an important nesting site for the endangered eastern Pacific green turtle (*Chelonia mydas*). We analyzed the migration and internesting movements of eastern Pacific green turtles using satellite telemetry. We attached satellite transmitters to turtles after nesting on Nombre de Jesús and Zapotillal beaches, Northwest Costa Rica. Movements of turtles during the internesting period were variable. Some turtles traveled to the Gulf of Papagayo, 25 km north of the nesting site, while others stayed in the vicinity of the nesting beach. During migration, turtles followed different routes. Some turtles migrated north, crossing waters of Costa Rica, Nicaragua, El Salvador and Guatemala, while others migrated south to the Gulf of Panama. Additionally, we identified threats that require urgent attention such as poaching of eggs and artisanal fisheries which operate in the areas of the nesting beaches. Two thirds of transmitters were removed from turtles during the nesting season and we observed many turtles caught on longlines in the area. More research is needed to understand the migration of eastern Pacific green turtles. Our findings suggest that turtles are moving north and south to explore potential foraging areas. By determining "hot spots" for this species we can develop a conservation plan to protect their migration routes as well as their nesting and foraging areas.

307370 IS BYCATCH A BIG PROBLEM FOR SMALL FISH? ASSESSING AND ADDRESSING THE IMPACTS OF TROPICAL SHRIMP TRAWLING ON SMALL FISH SPECIES

Sarah Jane Foster, Amanda CJ Vincent

We here take a novel look at the effects of tropical shrimp trawling, by considering their effects on small fish species. Shrimp trawlers are numerous and wasteful, catching many million tonnes of non-target species (bycatch) each year. The majority of discards (often 90%) in tropical shrimp fisheries involve small fishes, species maturing at less than 20 cm. Despite this disproportionate impact, our analyses reveal that research to date has focused on (i) trawlers' impacts on megafauna (e.g. turtles, marine mammals), (ii) temperate systems and/or (iii) developed countries. Existing reports of numbers and weights do nothing to indicate impact on the thousands of small fishes obtained incidentally. Yet, such species are crucial for continued ecosystem function as well as human use. Commitments to ecosystem based management and food supply demand adjustment of small fish bycatch to sustainable levels. We suggest tractable approaches using easily extracted data to estimate how trawling affects small fish species. We also propose that the best way to reduce the impact of trawling on small species will be to reduce effort and close areas to trawling, at least at particular times. Technological solutions are unlikely to work for the smallest fish groups, given that they overlap in size with tropical shrimps. We further stress that current efforts to address waste by promoting new markets do not reduce impact, but do reduce incentives for conservation.

Speed Session Protected Area Planning and Design and Conservation Capacity Building

306706 BARRIERS FOR ACHIEVING SUSTAINABLE FINANCING IN PROTECTED AREAS: FROM THE CONVENTION ON BIOLOGICAL DIVERSITY TO SITE SITUATIONS

Maria Jose del Valle Pacha

Despite the rapid increase in numbers and area protected areas (PAs) worldwide, this has not been followed by an increase in funding for managing them effectively. Many developing countries with the highest level of biodiversity find it difficult to assign the necessary funding for PAs as they compete with social and economic needs. Achieving sustainable financing, that is the ability to have financial resources in the long term which are sufficient and stable to cover conservation costs, has proven difficult. Also at the international level governments have to answer to agreed commitments, such as the Programme of work on Protected Areas (PoWPA) of the Convention on Biological Diversity. In this presentation, the political, technical, institutional and technical barriers to achieve sustainable development in Latin America will be presented following regional workshops with PA managers. Results will be discussed in the context of the international agenda and possible solutions.

305165 CONSERVATION THROUGH RESERVE FOREST FORMATION AND PEOPLE'S PARTICIPATION IN RAJASTHAN, INDIA

Parul Gupta

Nature has always helped in flourishing the mankind. The present study will throw light on how effective have been the Protected Areas (PAs) as a means of conservation method in Rajasthan, India. But across India's PAs it was found that a major factor reducing the efficacy of this conservation method is 'LOCAL HOSTILITY'. Increasingly villagers just see PAs as harassment, their displacement and loss of livelihood & have turned to unsustainable livelihood alienated from their own surroundings. Should people around PAs be considered enemies of the wildlife to be harassed & displaced or protectors & given the right stakes & incentives? A few decades of treating them as a part of the problem has only created conflicts & ineffective conservation. So now a new paradigm in conservation is needed- the concept of 'Participatory Conservation'. People's participation & support is proving crucial for nature and wildlife conservation. Various projects are being implemented on experimental basis & success has been observed. The national policy on PAs should be adopted to recognize that PAs are habitats of flora and fauna which are all vital ingredients to the people's existence & important component of country's ecological balance & only with active participation of people at planning, execution & management level can we start a faithful mission to ensure ecological preservation & conservation.

315539 DOES "CRITICAL TIGER HABITAT" REFER TO ITS IMPORTANCE OR ITS CURRENT STATE? REALITY BEYOND CLASSIFICATION

Alison Wadmore, E.J. Milner-Gulland, Bill Sheate

Wild tiger populations are declining worldwide due to habitat loss, prey depletion and poaching. A number of range states are now identifying Critical Tiger Habitat as a conservation tool in conjunction with Protected Area planning. In India, this classification envisages inviolate areas with minimal human disturbance, legally sheltered under the Wildlife Protection Act. However classification is only the beginning - successful implementation depends on the stakeholders in situ, and the path to providing real conservation benefit may not be clear.

We use a case study to examine the issues: in Kela Devi Wildlife Sanctuary, Rajasthan a large area has recently been reclassified as Critical Tiger Habitat elevating it to core instead of buffer zone, following a nationwide tiger census and habitat survey by the Wildlife Institute of India in 2005. What does this reclassification achieve? There are currently 42 villages inside the 660 km² Sanctuary, with a further 190 villages within 5km of the border. The primary stakeholders are therefore the Forest Department and the local people. We used focus groups, semi structured interviews and questionnaires to establish a socio-economic and attitudinal baseline. One aim of the survey was to draw conclusions and make recommendations to support the PA managers' delivery of CTH objectives. The results show a significant gap between the current and desired state, but indicate opportunities for progress as well as major challenges to overcome.

315699 MOTIVES FOR ACTORS IN WILDLIFE MEAT TRADE, CAMEROON, CENTRAL AFRICA

Shannon Randolph

This project attempts to better understand human dimensions of the highly politicized African wildlife trade. Given the lack of existing research on socio-cultural drivers of urban wildlife consumption and trading, ethnographic research is still needed to understand individual, kinship and social factors shaping these behaviors in urban African populations. Ego-centric social network analysis and ethnography reveal social and demographic traits of consumers and traders; social aspects of the production chain; as well as the cultural prestige benefits derived by individuals. Preliminary ethnographic research indicates that elite consumers may gain prestige and social alliance benefits as facilitators and consumers in the covert trade of increasingly rare forest animals in the Cameroonian capitol, Yaoundé. This would challenge the current notion that urban poor Africans are the primary consumers and traders of wildlife

Through collaborative efforts with the Johns Hopkins Cameroon Program and training of Cameroonian university students as research assistants, this research contributes to capacity building and shared knowledge with African partners. This study also sheds light on why people gain prestige and other benefits through urban wild game consumption and trading, fundamental information to reformulating socially appropriate policy, management and advertisement strategies for target wild game consumer populations.

368070 CREATION OF PROTECTED AREAS AS A MECHANISM FOR INFLUENCING LAND USE DYNAMICS IN THE BRAZILIAN CERRADO

Ricardo Machado, Mário Barroso Ramos Neto, Aline Tristão Bernardes, Felipe Mendonça, Cristiano Campos Nogueira, Rafael Luis Fonseca, Roberto Cavalcanti

In the Cerrado of Central Brazil, legislation requires properties to keep at least 20% of their area in natural habitat, and to preserve native vegetation along rivers and streams and on the slopes and tops of hills and escarpments - in practice adding up to 25-30% of a landscape. Landowners have little incentive to coordinate among themselves in selection of set-asides, and poor enforcement increases risk that conversion exceeds legal limits. We projected effects of the creation of a 30,000 hectare protected area in the municipality of Paracatu, Minas Gerais. The region is a priority for conservation due to the presence of species such as the Critically Endangered Minas Gerais Tyrannulet (*Phylloscartes roquettei*). Land use is mainly for soybean, sugarcane and corn. We used Landsat images from 1986 and 2001, and a neural network routine with the software Idrisi Andes version to model regional land use from 1986 to 2016. In the absence of a protected area, the extent of cerrado natural woodland savannas and grasslands declined from 63% in 1986, through 37% in 2001 to 23% in 2016. The creation of the protected area would maintain 30% cover in 2016, or 57,506 hectares including the area itself, buffer zone, and others. Since federal and state governments provide tax incentives and revenue to private and public protected areas, we believe that this approach is a useful framework for local stakeholders to facilitate compliance to land use legislation.

315516 DEFINING A "FOREST": THE POLICY IMPLICATIONS

Kent H. Redford, Francis Putz

While research continues on the causes, consequences, and rates of deforestation and forest degradation in the tropics, there is little agreement about what exactly is being lost and what should be restored. Particularly unsettling is that many analyses and well-intended actions are implemented in the fog of ambiguity surrounding definitions of the term "forest"—a problem that is fundamental, not simply semantic. For example, according to the implementation guidelines of the Kyoto Protocol, an intact closed canopy forest of extraordinary diversity could be cleared and replaced with a monoclonal plantation of a genetically engineered exotic tree species and no deforestation would have occurred. Following these same guidelines, carbon credits for afforestation are available for planting trees in species-rich savannas, grasslands, and other non-forested ecosystems. Avoidance of such obvious conflicts between biodiversity conservation and carbon sequestration would be facilitated if "forest" were clearly defined and if the existence and values of other ecosystems were more explicitly recognized. We present a simple ecosystem classification system that reflects the importance of land-cover characteristics that can be assessed from space but also acknowledges the importance of species composition and recognizes that many sorts of forest degradation that do not reduce carbon stocks (e.g., defaunation) or canopy cover (e.g., over-harvesting of understory non-timber forest products).

315462 HOW TO MEET THE CHALLENGE OF CONSERVATION AND WOOD PRODUCTION? QUANTIFYING IMPACTS OF DIFFERENT FORESTRY PRACTICES ON BIRDS, BATS AND BUSH-CRICKETS

Yves Bas, Christian Kerbiriou, Jean-François Julien, Jiguet Frédéric

Most temperate forests are already heavily exploited for timber and fuel wood and current energy crisis is putting more pressure on these ecosystems. We present here an analysis based on multi-species samplings of birds, bats and bush-crickets in 117 forest sites in western France. Sampling intensity allowed us to get sufficient abundance data for almost all the present species and sampling design warranted weak correlations between four major parameters linking species biology and forest exploitation : stand age, age heterogeneity, proportion of introduced conifers and canopy openness. The results highlight good complementarity of birds and bats as taxonomic indicators. Specialist species of both groups show strong sensitivities to different types of disturbance : age homogenization for birds and introduction of conifers for bats. As opposed to that, bush-crickets don't show any indicative ability by the lack of specialist species. Finally, we used the modelling framework introduced by Rhys Green for farmlands to predict the efficiencies of different conservation strategies. The mostly concave nature of specialist species response to forestry parameters highlight that a global compromise ("wildlife-friendly forestry") should better promote species conservation than land sparing.

304431 THE CIRCUMPOLAR ARCTIC AS ONE PROTECTED PARK: AN UPDATE OF A CRISIS SITUATION

Falk Huettmann

The Arctic represents a precious region of the globe affected by climate change, human disturbance and natural variation. It is considered one of the last remaining wilderness areas, but major development plans are currently being proposed and underway. A public discussion on the protection and management of this unique zone has not happened, and would be difficult to implement globally. Here I present on a MARXAN optimization modeling analysis taking into account 50 unique circumpolar GIS layers and model predictions for marine and terrestrial ecosystems. This methods represents Strategic Conservation Planning, and is widely applied for Marine Protected Areas (MPAs) elsewhere. Using basic main scenarios, these models help to find the best available distribution of protected zones for the Arctic. However, such tools are only a first step and require to be further fine-tuned and approved by various governments, stakeholders and legislation. Due to a wider lack of Arctic data, the pre-cautionary principles outlined by IUCN and others apply, indicating that developing the Arctic involves loss of species, habitats, and sustainability detrimental to existing legislation. It gets proposed that the real Legacy of the International Polar Year (IPY) is indeed a large protected circumpolar park.

315233 IMPORTANCE OF NETWORKING IN KNOWLEDGE SHARING AND ENVIRONMENTAL EDUCATION FOR ENHANCING CONSERVATION ACTORS COMMITMENT

Solofoniaina Nandrianina Ralaimihoatra

The mission of the Network of Conservation Educators and Practitioners (NCEP) project in Madagascar (or REPC-MD in French) is to develop a connection between conservation practitioners and universities. The objective is to share knowledge and information on Biodiversity Conservation sciences and techniques. Membership evolution and expansion of network from 2004 to 2008 showed 12 academic institutions and 16 non-governmental organizations (NGO)/government institutions during this time and in total more than 350 teachers from 91 departments at 28 institutions of higher education in Madagascar, and more than 520 conservation professionals from 92 institutions. Since then, the network could publish more than 20 complete training modules for universities and professionals. Also, 24 trainings were carried out to reinforce capacities. Five university institutions are now using the modules as a basis of their curricula as official partners of the project. The two most important organisms in Resource Management are also involved as direct beneficiaries in capacity building. New partners permanently request for trainings from the network. Those tools and activities then serve as a basis for members to promote conservation goals and invigorate public awareness in the challenges we face in saving planet's living resources and to ensure harmony with society and nature.

315438 CONSERVATION VOLUNTEERS: CAN ANYONE MAKE A DIFFERENCE?

Diogo Gaspar Verissimo, Rebeca Chaverri, David Jones

The use of volunteers in scientific study is becoming increasingly common, particularly in developing countries where the economic burden is often greatest. However, it has been argued that volunteer use implies great logistic needs for recruitment, training and management, which exponentially increase costs. Most importantly, detractors argue that data collected by volunteers is not reliable for use in a conservation or management context.

In this study, we use data on marine turtle nest fate collected on Playa Norte, Costa Rica as a case study to refute these assumptions. The programme relies on paying volunteers to conduct the majority of the work and their fees in turn cover all running costs such as equipment, field staff, food and lodging. The volunteers are not subject to a selection process but instead are trained and tested upon arrival. Trained volunteers led by field staff then conduct the surveys.

We analysed the poaching rates on Playa Norte from 2006 to 2008 and compared them to the rates found to the immediate north and on the neighbouring Playa Tortuguero, south of the study area, to establish the programme's impact. Poaching rates are shown to be 17% lower than the unpatrolled northern sector and vary in opposition to Playa Tortuguero, with a year-on-year decrease of poaching on Playa Norte, resulting in a 35% decline over the three years.

The programme success demonstrates the contribution a non-specialist volunteer workforce can make in conservation.

364984 MAKING GOOD COMPROMISES IN IMPLEMENTING WILDLIFE CORRIDOR DESIGNS**Paul Beier, Jeffrey Jenness**

We have designed wildlife linkages to connect wildland areas in human-dominated landscapes. Each linkage design is > 1 km wide, nonlinear, and multi-stranded to meet the movement needs of 6-12 focal species. However, each design is based solely on species' needs, ignoring the political and financial constraints that confront planners, regulators, and conservation investors. For instance, the biological optimum design may include land planned for urban development. There may be an opportunity to conserve an alternative swath of land that does not have these problems. Compared to the optimal linkage design, is the alternative almost as good, half as good, or markedly inferior? Our Corridor Evaluation Tools allow planners to create an alternative corridor by drawing it on the screen or selecting parcels of interest. They can then compare several alternative corridor designs in terms of several GIS outputs: (1) frequency distributions of habitat quality for each focal species (2) narrowness and length of constrictions in each design (3) the longest distances between steppingstones of breeding habitat for each species, (4) circuit theory resistance, (5) maximum distances between riparian areas, and (6) development potential. We illustrate the Corridor Evaluation Tools by evaluating alternative linkage designs to connect two parks near Tucson, Arizona USA. We identified a practical compromise nearly as good as the original linkage design (www.corridordesign.org).

304727 ENVIRONMENTAL EDUCATION AND ENDANGERED SPECIES IN CHINA**Jerry A. McBeath, Jenifer Huang McBeath**

Education about endangered species in China is relatively recent. This presentation will focus on three avenues in which education for the general public has proceeded: 1) NGOs, both domestic and foreign, and including government-organized NGOs; 2) the media, including both print and electronic, and 3) schools, from elementary and secondary courses in "nature" to specialized university programs in environmental sciences and studies.

315689 ROLES OF COMMUNITY PARTICIPATION IN THE BIOLOGICAL CORRIDOR DESIGNING AND CONSTRUCTING FOR ASIAN ELEPHANT CONSERVATION**Zhao-lu Wu, Zheng-ling LI**

The biological conservation corridor has been considered as a key tool to link the fragmented habitats or protected areas for wildlife conservation. 2 projects have been implemented ambitiously with a high expectation to build 3 corridors for wild Asian Elephant and Guar conservation in Xishuangbanna, Southwestern China. In fact, it was found that the tenurial rights and economic and ecological threaten to community are the big roadblocks lying on the planned corridors. Unfortunately, such important fact was ignored. This paper presents the findings of the detail study in 5 villages located in the 2 planned corridors. Of the 196 households participated in the survey and handed in the valid questionnaire, 158 households (or 80.6%) supported the corridor construct with restrictions, some (34.7%) considered the corridors construct

may benefit both state and themselves and some (43.4%) believed they may get enough compensation. 38 households (or 19.4%) did not support the corridor construct, 15 households unknow what the corridor was, 21 households explained that corridor construct may limit their basic farming and lead more serious elephant trouble. The findings implied that, in order to build effective biological corridors for wildlife conservation, it is necessary to find effective answers by talking equally with local people and that more project cost should be used to improve community economic and ecological situation.

315263 SHOULD CHINA PLACE A HIGHER VALUE ON NATURALNESS?

John Fellowes

China's policies will have a vast influence, directly and indirectly, on what befalls biodiversity during the 21st Century. Policies reflect values, and conservationists have sometimes called for the value of naturalness - a problematic but definable trait - to be represented alongside social values. An influential example in America is Aldo Leopold's Land Ethic, equating naturalness with biotic integrity. Many "biodiversity" goals, including those under the Convention on Biological Diversity's 2010 Target, can lead to divergent outcomes according to the value placed on biotic integrity. Conservation policy in China is generally aimed at rational resource use - this includes the preservation of voucher species and ecosystems, but does not always mean managing for biotic integrity. Meanwhile biodiversity science often quantifies diversity but fails to guide ecosystem management. What would it mean, for policy and for science, if integrity were more expressly valued?

Speed Session Mammal Conservation and Conservation Modeling

319868 PRESENCE OF A SECOND INVASIVE MONGOOSE IN THE FIJI ISLANDS

Craig Gordon Morley, Marie-Lilith PATOU, Patricia McLENACHAN, Daniel Simberloff, Géraldine VERON

When trapping small Indian mongoose as part of an investigation into the spread of leptospirosis around Suva, Viti Levu, Fiji, six large red-coloured mongoose were also captured. The body measurements (weight, length and hind-foot size) of these red-coloured mongoose were significantly larger than a random sample of the grey-coloured mongoose *Herpestes auro punctatus* normally seen. Phylogenetic analyses using cytb sequences showed that the red-coloured mongoose belonged to an Asian clade, and it was not *H. auro punctatus* or *H. edwardsi* (as previously suspected). Recent phylogenetic studies of Asiatic mongoose clearly identified the second species as the Indian Brown Mongoose (*H. fuscus*). Unfortunately, this means that Fiji has the dubious honour of being the first island nation with two introduced mongoose present. This presents a major conservation problem as this species is threatened in its natural home range but is a potential pest in Fiji.

366849 THE BLACK-FOOTED FERRET, ONCE THOUGHT EXTINCT, RETURNS TO THE WILD**Pete Gober, Sarah M. Bexell**

One of the most endangered mammals, the black-footed ferret, once ranged widely wherever prairie dogs existed in mid North America from Canada to Mexico. Ferrets depend on prairie dogs for food and for shelter in their burrows. Prairie dogs, and ferrets by extension, were decimated by the conversion of prairie to cropland, by poisoning prairie dogs, and sylvatic plague. In 1979, ferrets were presumed extinct. Fortunately, a wild population was discovered in 1981. They succumbed to disease, but not before providing animals to begin captive breeding that has produced over 6,500 young. Six facilities manage captive populations totaling approximately 280 which ensure the species' survival and provide animals for reintroduction. For over 25 years, diverse partners have contributed. Some of the biggest challenges limiting recovery have achieved success, including captive breeding and reintroduction techniques. Since 1991, over 2,300 ferrets have been reintroduced at 18 sites. Today, wild numbers total over 1,000 individuals each fall, with perhaps half surviving to breed each spring. The species will not be recovered until more exist in the wild and reintroduction efforts are no longer necessary. Recovery is within reach. However, as with many species, habitat conservation constraints remain the fundamental obstacle to recovery.

302662 BUMBLEBEE VULNERABILITY: COMMON CORRELATES OF WINNERS AND LOSERS ACROSS THREE CONTINENTS**Sheila R Colla**

It is widely agreed that in many parts of the world some bumblebee species have declined and that this has most often been driven by land-use changes that cause reductions in the abundance of food plants. There is much less agreement about how changes in food plants affect some species more than others. We aim to identify which species' characteristics are associated with the relative winners and losers by comparing the three independent faunas from parts of Britain, Canada, and China. For this study of available survey data, we assess species' characteristics including: competition with congeners; size of climatic range; proximity to climatic range edge; food specialization; timing of colony initiation; body size; and size of geographic range. A meta-analysis of correlations showed support for the hypotheses that decline susceptibility is generally greater for species: (1) that have narrow climatic ranges; (2) in areas where they occur closest to the edges of those climatic ranges; and (3) with queens that initiate colonies later in the year. The latter might be at a particular disadvantage when they have long colony cycles if there were losses of food plants in late summer. We make recommendations for conservation action plans and further studies

315502 FIRE INFLUENCES HABITAT PREFERENCE OF THE 'VULNERABLE' FOUR-HORNED ANTELOPE (TETRACERUS QUADRICORNIS)**Suresh Jones**

The Four-horned Antelope is endemic to the Indian Sub-continent and its primary distribution within India is

restricted to the dry-deciduous forests of the Peninsula. Very little is known about its feeding/ breeding ecology and the conservation efforts for this unique antelope are hampered by this dearth of information. During the current survey to assess its ecological status and habitat use in the dry-deciduous forests of the Eastern Ghats in India, it has been found that they appear to have a preference for fire-affected Tree-Savannah deciduous habitat sub-type, characterized by a combination of low tree density and tall grass with a good degree of openness. The frequency and timing of fire coupled with precipitation is an important determinant of the vegetation and the movement of the Four-horned Antelope which otherwise leads a mostly sedentary and solitary life except during the reproductive period, in these forests. Prescribed fire could be one of the important habitat management practices for the long-term conservation of this species.

315362 RHINOLOPHOID BATS OF VIETNAM: TAXONOMY, ECHOLOCATION, AND CONSERVATION (MEGADERMATIDAE, RHINOLOPHIDAE, AND HIPPOSIDERIDAE)

Vu Dinh Thong, Christian Dietz, Annette Denzinger, Paul J. J. Bates, Hans-Ulrich Schnitzler

Although there have been comparatively few studies in the past, Vietnam is known to have a diverse fauna of bats. Recent studies have added many new country records and newly described taxa such that Vietnam is now recognized as a key country in Asia for both taxonomic research and bat conservation. To date, thirty-four species belonging to the Superfamily Rhinolophoidea are known from Vietnam. Since 2006, we have conducted a range of field surveys throughout the country with special attention to these taxa. With the initial support of echolocation data, a species new to the bat fauna of Vietnam (*H. khaokhouayensis*) was recently recorded, and the status of four taxonomically complex species (*H. grandis*, *R. steno*, *R. microglobosus*, and *R. borneensis*) have been clearly defined. A combination of molecular, morphological, and echolocation studies have contributed to the recognition of the specific status of *H. alongensis* as a distinct endemic species comprising two separated subspecies. Results from our acoustic studies also offer an invaluable tool for on-going monitoring, ecological studies and conservation assessments of the rhinolophid and hipposiderid bats of Vietnam. A brief history of bat echolocation studies in Vietnam is also included together with information on the taxonomic status of each rhinolophoid bat species together with its distribution and threats to its status. Recommendations for further monitoring and research and conservation priorities are provided.

366832 MANAGING FOREST STAND STRUCTURES TO ENHANCE CONSERVATION OF THE AMUR TIGER IN NORTHEAST CHINA

Xuemei Han, Chadwick Dearing Oliver

Amur tiger (*Panthera tigris altaica*) experienced a serious shrinking of its range and a significant population decline during the past century in Northeastern China and Russian Far East. Habitat loss and fragmentation caused by forest exploitation have been considered as the primary threat to tigers' survival, while there is a lack of study on the effects of forest characteristics associated with forest dynamic to tiger's habitat quality. In this study, we evaluated the forest in northeastern China with a dynamic perspective, and examined Amur tiger's habitat within it. Specifically, first we evaluated the forest development by systematically examining

the historical logging and management operations, natural and anthropogenic disturbances in this region, applied multiple metrological sivilculture methods to evaluate the current forest crowding and stand structures, and simulated the forest growth on a landscape scale with computer model Landscape Management System (LMS). Second we modeled and estimated the Amur tiger prey carrying capacity and consequent needed tiger home range under different stand structures with forest development. Finally we conclude that forest stand structure is one of the major limiting factor for tiger's population, thus managing forest to keep a diversified stand structures is critical to conserve Amur tiger in Northeast China.

315351 THE JAVAN RHINO IN VIETNAM (RHINOCEROS SONDAICUS ANNAMITICUS):LAST CHANCE OR TOO LATE?

Sarah Maria Brook, Hien Tran Minh

The Javan rhino is one of the rarest mammals in the world. Less than 10 of the subspecies annamiticus remain in 5000ha of poor quality habitat in Cat Tien NP, Vietnam.

This tiny population is under pressure from surrounding human settlements and no recent evidence of breeding has been found. The government remains unwilling to take action to secure a future for the rhino, due to the uncertain population size and structure and the conflicting needs of the rhino and indigenous minority groups.

Current development plans for the national park will benefit indigenous communities but intensify disturbance to the rhino and permanently prevent it using adjacent forest areas.

Following upcoming field surveys and DNA analysis of dung samples, an accurate population estimate should be obtained. WWF will then face a number of very difficult decisions:

At what point is it too late to save a subspecies of large mammal? If it is not too late, can the needs of local people and a critically endangered large mammal be reconciled? If not, translocation of the rhinos to safer more suitable habitat may be the only option, but at huge financial cost and great risk to the few survivors of a subspecies.

315251 THE DIET OF GIBBONS: HOW LIANAS INFLUENCE THEIR MENU DURING FOOD SCARCITY

Chanpen Wongsriphuek, WARREN YALDING BROCKELMAN

White-handed gibbons (*Hylobates lar*) have been studied on the 30-hectare Mo Singto Plot in Khao Yai National Park, Thailand since 1980. The details of their foraging behavior have been studied since 2003. Over 100 plant species are known to be eaten by gibbons, including varieties of lianas, which are a group of fruiting vine species. Lianas are an important life form in the forest, but their role in the lives of forest animals has never been studied. Based on over one year of observation, the frequency of gibbon feeding visits to lianas and trees varied from month to month. Gibbons fed on liana fruit much less than tree fruit in the rainy season, but exploited liana fruit more than that of trees in the cool-dry season. The fact that trees provided a larger source of food for gibbons overall than lianas is due to the relative abundance and diversity of trees in the forest. However, when most trees failed to fruit during the cool-dry season, lianas were a

significant food source for gibbons. This study is the first to highlight the potential importance of lianas during periods of food scarcity.

368309 BAT COMPONENTS IN THE DIET OF WINTERING LONG-EARED OWLS IN BEIJING CITY

Bao weidong, Yuan li

To study the impact of predation by wintering long-eared owls (*Asio otus*) on hibernation bats, bat species in owl food pellets were analyzed at two places of Inner city and Out city in Beijing from 2003 to 2006. The food pellets were collected monthly each winter and the bat numbers in pellets were identified. The results showed that only *Eptesicus serotinus*, *Nyctalus noctula*, *Pipistrellus abramus* and *Vespertilio superans* were found as bat prey. In each year and three wintering periods, the predation rate on *Pipistrellus abramus* was the highest while that of on *Eptesicus serotinus* and *Nyctalus noctula* were much lower, and *Vespertilio superans* occurred accidentally both at Inner city and Out city. The preyed bat numbers were different between Inner city and Out city populations. The annual bat compositions at two places and in three wintering periods at Out city were different while there was no difference at Inner city. Furthermore, the predation rates on *Pipistrellus abramus* in 2005/06 at both Inner city and Out city decreased obviously. The results revealed that bats availability at Inner city was less stable than that of at Out city. The heavy predation by the wintering long-eared owls would negatively affect the bat population in Beijing, and protection measures on bats should be taken to lessen the owl predation.

329223 GENETIC DIVERSITY OF FARM AND WILD MASKED PALM CIVET (PAGUMA LARVATA) POPULATIONS IN CHINA

Jinping Chen

The masked palm civet (*Paguma larvata*) is a threatened carnivore (Mammalia) that ranges throughout the forests of South-east Asia and has been suspected to be the host of SARS virus. To assess the genetic diversity and population structure of the palm civet populations in China, we reported the isolation and characterization of 6 loci, and further analyzed genetic diversity of 2 wild population and 4 farm populations in China. The mean expected heterozygosity within populations ranged from 0.468 to 0.649. Across all loci, significant deviation from Hardy-Weinberg equilibrium was observed in all civet populations. The deviation was in the direction of heterozygote deficit. The mean F_{ST} of all loci indicated that 3.5% of total variation could be attributed to the population difference. The results showed a reduced variability in Chinese civets and showed that farmed populations did not exhibit a lower genetic diversity than wild populations, suggesting frequent introductions of wild individuals into farms.

315126 FIRST THINGS FIRST: PRIORITIZING MANAGEMENT OF AN AQUATIC INVASIVE PLANT SPECIES IN TROPICAL AUSTRALIA

Stephanie Renee Januchowski, Piero Visconti ,Bob Pressey

The Wet Tropics bioregion is nationally significant Aquatic invasive plants (AIP) are considered a leading cause of species endangerment and extinction in freshwater ecosystems worldwide. This is particularly true in ecosystems where plant dormancy and seasonal dieback are limited. In tropical northern Australia over fifty percent of the weeds of national concern impact aquatic ecosystems and supported biodiversity. While numerous resources exist to identify wetland values and threats, there remains an identified need for regional prioritization to deliver effective and sustained management of AIPs. In an effort to address these limitations, we present a decision framework aimed at maximizing benefit while considering funding constraints, probability of project success, and likelihood of invasion and re-invasion. Fundamental to the method are explicit management objectives and working definitions of benefits, threats, costs, values and consideration of data limitations and uncertainties associated with estimating model parameters. Results will not only indicate priorities for resource allocation, but inform managers of gaps in data that could lead to more informed decision making in the future. This work complements a larger cross-regional strategy aimed at reducing and maintaining densities of AIP across northern Australia. In addition, the method can be easily updated as management priorities change and adapted to include multiple aquatic invasive plant management priorities.

Symposium

Symposium: Applying the IUCN Best Practice Guidelines for Gap Analysis into Private and Public Sector Engagement: Tools, Opportunities and Experiences, 68447

Organised by: Conrad E Savy, Conservation International; Jeffrey A. McNeely, IUCN

IUCN's Best Practice Protected Areas guidelines for gap analysis, based on over 20 years of testing and application in over 170 countries and territories, outline a practical approach to identifying and mapping globally important sites for biodiversity. These sites, known as key biodiversity areas, build upon the work of a number of existing partnership-supported initiatives - such as BirdLife International's Important Bird Areas, PlantLife International's Important Plant Areas, IUCN's Important Sites for Freshwater Biodiversity and sites identified by the Alliance for Zero Extinction - to map important sites for a wide range of critical biodiversity in marine, freshwater and terrestrial biomes. These sites represent priorities for protection at local, national and international levels and are likely to possess significant social, economic or cultural value to local communities. These factors contribute to a strong foundation and potential for ensuring sustainable management of natural resources through practices that integrate conservation needs and development priorities. The practical value of the IUCN best practice guidelines is already reinforced by numerous laws, policies and environmental safeguards around the criteria for defining critical habitats and important sites for biodiversity conservation. This symposium will showcase existing experiences, highlight opportunities and present new tools which support practical decision-making in the public and private sector.

THE VALUE OF THE IUCN RED LIST IN CONSERVATION PLANNING AND DECISION MAKING

Michael Hoffmann, IUCN

Systematic conservation planning aims to identify comprehensive protected area networks that together will minimize biodiversity loss. Importantly, conservation planners seek to determine where to allocate limited resources first, particularly given the uneven spread of, and threats to, biodiversity. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species incorporates data not only on threats to species, but also on their distributions and ecological requirements. These temporal and spatial attributes, when combined with other datasets, have proven useful for determining the most urgent priority areas for conserving biodiversity, from the global level down to the scale of individual sites. Here, we briefly review the development of the IUCN Red List and its function in conservation planning, specifically, in identifying priority areas for biodiversity conservation. We then consider some of the ways in which these resulting data can help inform decision-making for the benefit of conservation investments, safeguards, and management options. Although many challenges remain to be addressed, the increasing reliability and comprehensiveness of the IUCN Red List suggests that its role as a source of biodiversity data to underpin robust conservation planning exercises and to inform broader decision-making in multiple sectors is certain to expand dramatically.

ENHANCING KEY BIODIVERSITY AREA MANAGEMENT THROUGH ENGAGING LOCAL COMMUNITIES: THE SITE SUPPORT GROUP APPROACH IN AFRICA

Julius Arinaitwe, BirdLife International; Jane Gaithuma, BirdLife International; Kiragu Mwangi, BirdLife International

Important Bird Areas (IBAs) form the set of Key Biodiversity Areas identified for birds. The IBA programme aims to safeguard these sites, their biodiversity and the vital ecosystem services they provide. Some 43% of Africa's 1,257 IBAs have no formal legal protection, while some 'protected' sites remain severely threatened. The BirdLife Partnership's Site Support Group (SSG) approach engages local communities in sustainable biodiversity conservation at threatened sites. This approach can address conservation challenges at both legally protected and unprotected IBAs. Through SSGs, communities are empowered to manage biodiversity resources in a way that addresses threats but also provides for livelihood needs. In Burkina Faso, the Park National Kabore Tambi SSGs are tackling poaching and wild fires, while developing the processing of shea butter seeds and African locust seeds. In Ethiopia, local communities around the unprotected Berga Wetlands are guarding against human disturbance, grazing and harvesting of sedges in the breeding areas of threatened species, and simultaneously improving their food security, access to primary education and agricultural practices. In Kenya, the Kereita Forest SSG is rehabilitating degraded forest while developing resource centres for information dissemination, developing nature-based industries and engaging youth in biodiversity appreciation. Awareness of unique biodiversity around them and its multiple values is a key factor in SSG success.

PROTECTING THE ALLIANCE FOR ZERO EXTINCTION GLOBAL CONSERVATION PRIORITY SITES WILL ALSO PROVIDE VALUABLE HUMAN WELL BEING BENEFITS

Frank Wugt Larsen, Conservation International; Will Turner, Conservation International; Thomas Matthew Brooks, Conservation International

Efforts to conserve biodiversity can also ensure provision of valuable ecosystem services important for human well being, and thereby provide further conservation incentives and funding for conservation. However, the human well being benefits of protecting priority areas for biodiversity conservation remain poorly understood. In this study, we use the Alliance for Zero Extinction (AZE) sites to explore some human well being benefits of biodiversity conservation at the site scale. The AZE sites exist because they hold one or more species in imminent danger of disappearing; we here demonstrate that they may also harbor disproportionate shares of biodiversity more generally (between 57% and 69% of terrestrial vertebrates depending on taxon). We further find that there are considerable human well being benefits associated with conserving the AZE sites in terms of carbon emissions avoided (based on a global map of C stores and deforestation and plausible Reduced Emissions from Deforestation and Degradation mechanisms) and hydrological services (based on global modeling of flows, runoff, and demand for clean and abundant water). For example, mean carbon storage in the AZE sites (83.7 t C/ha) is much higher than that found outside of AZE sites within natural habitat of the AZE countries (37.4 t C/ha). Although results vary by service and region, conserving sites of global biodiversity importance will also provide considerable additional human well being benefits.

IS THERE A ROLE FOR BIODIVERSITY IN REDD? EXPLORING THE RELATIONSHIP BETWEEN AVOIDED CARBON EMISSIONS POTENTIAL AND BIODIVERSITY VALUE.

Matthew N Foster, Conservation International; Thomas Matthew Brooks, Conservation International; Ode Marie Louise Kouamé, Conservation International - Ghana; Oliver Coroza, Conservation International - Philippines; Ruth Jimenez, Conservation International - Mexico & Central America; Jonah Morris Busch, Conservation International; Marc Steininger, Conservation International

Over 20 percent of global carbon emissions result from tropical deforestation, yet this key driver was omitted from the negotiation of the Kyoto Protocol in the development of regulatory carbon markets. However, the 13th Conference of the Parties of the United Nations Framework Convention on Climate Change in Bali, December 2007, opened the possibility of rectifying this oversight through developing an incentive mechanism for Reducing Emissions from Deforestation and Forest Degradation (REDD). This is an obvious win-win for both climate change mitigation and biodiversity conservation, but a key challenge for biodiversity conservation scientists and policymakers will be to ensure that REDD funding is focused on areas of high biodiversity conservation priority, everything else being equal. In a series of four country case studies, we explore the relationship between avoided carbon emission value with biodiversity conservation value in order to, 1) identify areas that have the potential to yield multiple benefit carbon (carbon value plus biodiversity value) and 2) compare the potential REDD revenue at these biodiversity premium carbon sites with modeled opportunity cost. Our results show that REDD projects in areas of high biodiversity conservation priority can be competitive relative to alternative land uses, when their potential avoided carbon emissions revenue is compared against the modeled net opportunity cost.

MAINSTREAMING BIODIVERSITY INTO ASIAN DEVELOPMENT: BIRDLIFE'S WORK WITH THE HYDROPOWER, MINING AND TOURISM SECTORS IN ASIA

Jack Tordoff, BirdLife International

IUCN's best practice protected areas guidelines for gap analysis outline a practical approach to identifying and mapping networks of sites critical for the conservation of global biodiversity through the application of standard criteria. These sites, known as key biodiversity areas (or KBAs), represent practical tools for mainstreaming biodiversity into development plans and policies at local, national and international levels. BirdLife International is working closely with governments and major financial institutions to ensure that economic development is balanced with environmental sustainability and social equity. To this end, BirdLife has used KBAs as a tool for identifying biodiversity risks and opportunities associated with sectoral development plans in several Asian countries. Examples include: a strategic assessment of the impacts of mining, infrastructure and tourism on natural habitats in Mongolia (commissioned by the World Bank); a strategic assessment of the impacts of Vietnam's national hydropower development plan on biodiversity (also

commissioned by the World Bank); and monitoring of the biodiversity implications of trans-national development corridors in the Greater Mekong Sub-region (commissioned by the Asian Development Bank). This presentations reviews the challenges encountered and assesses the utility of KBAs as a tool for environmental mainstreaming.

MAPPING HIGH CONSERVATION VALUE: THE POTENTIAL FOR EXISTING DATA AND TOOLS TO FILL URGENT INFORMATION GAPS

Conrad E Savy, Conservation International; Leon Benun, BirdLife International; Christine Dragisic, Conservation International; Jorn P W Scharlemann, UNEP World Conservation Monitoring Centre; Charles Besancon, UNEP World Conservation Monitoring Centre; Bambi Semroc, Conservation International; John Buchanan, Conservation International; Brian Gurr, Conservation International; David H Knox, Conservation International

High Conservation Value (HCV) areas are natural habitats with conservation values (including biodiversity, ecosystem services and/or social and cultural values) that are considered critically important. Originally developed for use in forest management certification, the HCV concept is being incorporated into emerging private sector safeguards for biodiversity, such as roundtables on sustainable soy, palm oil and biofuels as well as corporate sustainability guidelines. However, HCV areas have yet to be comprehensively mapped for many countries, and damaging development impacts continue in the gap between good policy and good information. Two existing global databases of standardized site-scale conservation priorities, drawn directly from global networks of national sources, could help fill this information gap for HCVs that are defined for their significant concentrations of biodiversity values: i) The World Database of Protected Areas (WDPA) compiled by UNEP-WCMC and the IUCN World Commission on Protected Areas (IUCN-WCPA) and ii) The World Biodiversity Database (WBDB), which maps key biodiversity areas - important sites identified against standard criteria for a wide range of critical biodiversity in marine, freshwater and terrestrial biomes. Case studies are used to demonstrate the potential for immediate desk-top assessment that lay a solid foundation for further HCV assessment and decision-making support to the private sector.

Symposium: Wildlife Diseases and Biodiversity,72279

Organised by: Hongxuan He, Key Lab of Animal Ecology and Conservation Biology, Institute of Zoology, Chinese Academy of Sciences; Yung-fu Chang, Department of Population Medicine & Diagnostic Sciences, College of Veterinary Medicine, Cornell University

Climate warming can affect biodiversity and increase pathogen development and survival rates, disease transmission, and host susceptibility. Infectious diseases, especially wildlife borne EIDs, can cause rapid population declines or species extinctions. Avian influenza is a typical example about EIDs and biodiversity. HPAI H5N1 viruses can infect over 80 % of known bird species, including migratory and non migratory ones which would be at risk with members of the crow family and vultures of particular concern. Meanwhile, H5N1 viruses can infect wildlife animals include rabbits, primates, viverrids, mustelids, polecats, stoats, weasels and

wolverines. Infection and spread of avian influenza could break the balance of nature, so as to biological diversity. The loss of predators from some habitats, victims of the infection, could trigger an explosion of pests like mice and rats. This may trigger a rise in other human and animal infections as well as damage the prospects for other wildlife. A healthy environment can act as a buffer against old and the emergence of new diseases whereas a degraded one favors the spread of infections. In order to cope with outbreak of EIDs especially wildlife born diseases (Avian Influenza) and protect biodiversity under the global climate changes, we should cooperate for multilateral concern issue so as to establish early warning system and effective control about wildlife EID. In this symposium, we will synthesize existing knowledge of threat with wildlife EIDs and conservation for biological diversity.

The leptospiral Immunoglobulin-like protein repeated domains of Lig proteins promote adhesion of *Leptospira* spp. to elastin and tropoelastin

Yung-Fu Chang

Leptospira spp., the causative agents of leptospirosis, adhere to components of the extracellular matrix, a pivotal step in colonization of host tissues during infection. Previously, we and others have shown that *Leptospira* Immunoglobulin-like proteins (Lig) of *Leptospira* spp. bind to Fn, laminin, collagen and fibrinogen. In this study, we report that *Leptospira* can be immobilized by human tropoelastin (HTE) or elastin from different tissues including lung, skin, and blood vessels, and that Lig proteins can bind to HTE or elastin. Moreover, both elastin and HTE bind to the same LigB immunoglobulin-like domains including LigBCon4, LigBCen7'-8, LigBCen9, and LigBCen12 as demonstrated by ELISA and competition ELISA assays. The LigB immunoglobulin-like domain binds to the 17th to 27th exons of HTE (17-27HTE) as determined by ELISA (LigCon4, $KD = 0.50\mu M$, LigBCen7'-8, $KD = 0.82\mu M$; LigBCen9, $KD = 1.54\mu M$; LigBCen12, $KD = 0.73\mu M$). The interaction of LigCon4 and 17-27HTE was further confirmed by steady state fluorescence spectroscopy ($KD = 0.49\mu M$) and ITC ($KD = 0.54\mu M$). Furthermore, the binding was enthalpy-driven and affected by environmental pH, indicating it is a charge-charge interaction. The binding affinity of LigCon4D341N to 17-27HTE was 4.6-fold less than that of wild type LigCon4. In summary, we show that Lig proteins of *Leptospira* spp. interact with elastin and HTE and conclude this interaction may contribute to *Leptospira* adhesion to host tissues during infection.

Division for Wildlife-derived Infectious Disease Prevention and Control, Establishment of Monitoring Network for Wildlife-borne Infectious Diseases and Its Application in China

Xiangdong Ruan

This paper systematically introduced the background and progress of the wildlife-borne diseases monitoring network, and especially the key role on monitoring and controlling highly pathogenic avian influenza in migratory birds and other wildlife-borne diseases. In the practice of the recent four years since 2005, it is demonstrated that establishing wildlife-borne diseases monitoring network and strengthening the monitoring are important means to control and prevent the spread of wildlife-borne diseases, especially zoonoses, at source, and act as forefront of checkpoints and barriers in protecting public health security and promoting

economic and social development.

Development of a rapid neutralizing antibody test for rabies in dogs and cats

Gang Li

Rabies is a zoonotic disease. Rabid dogs and cats are dangerous to people. Immunization with vaccines is a practical approach to eradicate rabies in dogs and cats. In order to determine the level of immunization neutralizing antibody in vaccinees, an easy and reliable method is needed. The envelope glycoprotein G of rabies virus in vaccines induces the production of neutralizing antibodies important in the protection against the disease. The measurement of anti-envelope glycoprotein antibodies is a good predictor of the degree of humoral immunity in dogs and cats after vaccination. Based on the principle of immunochromatography, we developed a RNAT (Rapid Neutralizing Antibody Test) strip to determine the presence of neutralizing antibody in serum. A total of 67 dog sera and 2 cat sera samples were tested. The sensitivity, specificity and accuracy of the RNAT strip compared with ELISA test, were 85, 90 and 90%, respectively. The RNAT is a simple, safe and rapid method, which might be useful for screening a large number of dog or cat sera.

Major diseases in wildlife of concern in China

Hongxuan He

Wildlife plays a major role in disease transmission and is important when addressing certain diseases in domestic animals or humans. China is rich in wildlife animals. The pathogens carried by wild animals are extremely complex. Many animal and human diseases come from wild animals, or the main host and the media is wildlife animals, especially diseases transmission between domestic animals and wildlife animals.

In China, the major wildlife diseases mean which are broadly spread, highly dangerous to health and biodiversity, which include Avian influenza H5N1 virus, SARS (Severe Acute Respiratory Syndrome), ND (Newcastle Disease), Brucellosis, Yersinia pestis, Dengue, hemorrhagic fever, Foot and mouth disease, Rabies, and Chlamydomphila psittaci.

SARS in 2003 was one of the most serious public health crises in China, which had infected thousands human in China and killed hundreds of them. Through civet cat or bat as natural hosts, SARS transmitted from wildlife animals to human. The effective drugs were not found in time because of unexpected transmission and outbreak.

Highly pathogenic avian influenza has become the chief threat recently, not only because it has killed millions of poultry and wild birds, but also because it has infected and killed human beings. The wide spread among many species and highly mutant possibility of virus genome makes it difficult in preventing with vaccines and therapy with drugs.

About other wildlife disease, Newcastle Disease has many outbreaks in history of China, leading to millions of chickens and ducks killed. The case of rabies in China has become the world's second largest quantity, and rabies is one of most fatal disease of the first sort of infectious diseases. From 2005, Foot-and-mouth disease has several outbreaks in several provinces of China, as a highly contagious and sometimes fatal viral disease of cloven-hoofed animals. Brucellosis, Yersinia pestis, Dengue, hemorrhagic fever and Chlamydomphila psittaci are also concerned for their threats.

Prevalence and Molecular Characterization of *Cryptosporidium* spp. in Wild, Laboratory, and Pet Rodents in China

Chinaongxian Zhang

To understand the prevalence of *Cryptosporidium* infections in rodents in China and to assess the potential role of rodents as a source for human cryptosporidiosis, 723 specimens from 18 rodent species in China were examined between August 2007 and December 2008 by microscopy after Sheather's sugar flotation and modified acid-fast staining. *Cryptosporidium* oocysts were detected in 83 specimens, with an overall prevalence of 11.5%. *Phodopus sungorus*, *Phodopus campbelli*, and *Rattus tanezumi* were new reported hosts of *Cryptosporidium*. The genotypes and subtypes of *Cryptosporidium* microscopy-positive specimens were further identified by PCR and sequence analysis of the small subunit rRNA and the 60 kDa glycoprotein (gp60) genes. In addition to *C. parvum*, *C. muris*, *C. andersoni*, *C. wrairi*, ferret genotype and mouse genotype I, four new *Cryptosporidium* genotypes were identified, including the hamster genotype, chipmunk genotype III, and rat genotypes II and III. Mixed *Cryptosporidium* species/genotypes were found in 10.8% of *Cryptosporidium*-positive specimens. Sequence analysis of the 60 kDa glycoprotein gene showed that *C. parvum* in pet Siberian chipmunks and hamsters were all of the subtype IIdA15G1, which was found previously in a human case in Netherlands and lambs in Spain. The gp60 sequences of *C. wrairi* and the *Cryptosporidium* ferret genotype and mouse genotype were also obtained. These findings suggest that pet rodents may be potential reservoirs of zoonotic *Cryptosporidium* species and subtypes.

Symposium: Restoring Przewalski's Horses—Lessons Learned from In-situ and Ex-situ Conservation, 66567

Organised by: Peter Leimgruber, Hu Defu, Waltraut Zimmermann

Meeting room: 112

In the 1960s Przewalski's horses became extinct in the wild. The only surviving populations were found in western zoos. Through concerted breeding and reintroduction efforts the Przewalski's horse has now become a flagship species for the role of zoos in saving species from the brink of extinction. Zoo breeding efforts continue to ensure maximum genetic diversity in captive populations.

Since the 1990s, reintroduction projects have introduced Przewalski's horses to the wild and to semi-reserves in Hungary, China, and Mongolia. These restoration projects face the challenge of harmonizing conservation goals for nature with the needs of local communities and national societies. How can restoration projects counter the still-existing problems that originally caused the extinctions? How can this species successfully return to environments also used by local pastoral societies? Given China's active reintroduction program in Xinjiang, and with most other projects also found in the region, Beijing will be the perfect venue to convene many interested stakeholders.

The SCB 2009 Beijing meeting theme, "Harmony in Nature and Society", provides an excellent opportunity for reviewing progress towards restoring one of Asia's most prominent near-extinct species. Our symposium will synthesize this progress and the challenges faced in the restoration of Przewalski's horses from the

perspectives of different conservation disciplines, including captive management, wildlife biology, reserve management, history, and anthropology. By sharing lessons learned we will chart future directions for Przewalski's horse restoration.

THE MAKING OF THE PRZEWALSKI'S HORSE: AN ENVIRONMENTAL HISTORY OF ASIA'S MOST PROMINENT WILD EQUID

Catherine Ann Christen, Nigel Rothfels

To regard fully the Przewalski's horse of past and present, we must look beyond the animal itself to the history of human engagement with it. Part of that history, really an anthropological story about cultural identities, is local to Mongolia and China. Another portion is firmly anchored in the West, where the horse we see today was largely created out of a unique confluence of ideas about horses and primitivity. Perhaps more than any other reintroduced species, the 21st century *Equus przewalski* is a product of a kind of non-natural, indeed "cultural," selection. As zoologist Erna Mohr made clear in her book, *The Asiatic Wild Horse* (1971), the original stock of the horses which arrived in Europe in the late 19th and early 20th centuries exhibited much more phenotypic variability than the horses we see today. When those animals arrived in Europe, that variability was quickly explained by aficionados: they argued these were not all "pure" Przewalski, that many were clearly the progeny of cross-breedings between domestic Mongolian horses and wild Przewalskis. In an effort to limit the legacy of the domestic blood, the early collectors carefully bred these animals to conform to their imagined preconceptions about wild, primitive horses. Our paper examines this history and points to critical biological, ethical, and historical questions this century of careful breeding of "primitive horses" pose to today's reintroduction efforts.

CURRENT STATUS OF CAPTIVE PRZEWALSKI'S HORSE POPULATIONS WORLDWIDE AND CHALLENGES IN THE MANAGEMENT OF THESE POPULATIONS

David Powell, Waltraut Zimmermann, Wynne Collins, Budhan Pukazhenth, Steve Monfort

Captive breeding over the past 110 years has saved the Przewalski's horse (*Equus ferus przewalskii*), also known as the takh or je-ma, from extinction and made it possible to reintroduce this species to parts of its former range. The IUCN World Conservation Union recently down-graded this species from 'extinct in the wild' to 'critically endangered'. The long-term history of managing this species ex-situ illustrates many of the challenges of this approach to conservation, including a small founder population, inbreeding, an absence of records during the early years of captive management, genetic introgression of domestic genes, large fluctuations in population size and reproductive capacity due to population bottle necks, and varying levels of interest among zoos over time. In recent years, professional zoological associations in Europe (EAZA) and the United States (AZA) have worked to manage this species as a single global population with the goal of maintaining a genetically and demographically healthy insurance population that also provides animals for reintroduction. In this talk, we will discuss the history and lessons learned from more than a century of ex-situ management of the Przewalski's horse. We will also discuss current ex-situ research initiatives and partnerships aimed at improving our efficiency to achieve program goals for the long term. Finally, we will

discuss how zoos have contributed to the re-establishment of this species in the wild.

THE DEVELOPMENT COURSE AND FUTURE TASK OF XINJIANG PRZEWALSKI'S HORSE BREEDING AND RESEARCH CENTER

Jie Cao, Kai Li, Hu Defu, Zhengbiao Wang

Przewalski's Horse Breeding and Research Center of Xinjiang, China (88°45'E, 44°10'N) founded in 1986 has taken on preserving the existing genetic diversity of Przewalski's Horse, breeding the Przewalski's Horse population. The captive horse population from 18 imported horses increases to some 200 more. The average inbreeding coefficient has been kept below 0.2 and the survival rate is 85.61% on average, and average annual growth rate is 21.12%. Now the center keeps 142 horses (80 females and 62 males) in eight groups (one bachelor group and 7 harems). The Center has effectively controlled the diseases like horse botflies, horse roundworm, and there was no breakout of collective vital disease. After 20 years' efforts, the center has gone through the Soft Release Stage from Przewalski's Horse's adaptive feeding, captive population growth, to semi release and soft release, has accumulated lots of experiences in this species' reproduction and maintenance, achieved some preliminary results. Looking ahead, the center will focus on the following aspects of works: maintaining the basis of breeding populations and adjusting the population structures; importing the stallions to change the genetic structure of the existing population; strengthening the researches on the conservation of genetic diversity in captive populations.

DEVELOPMENT AND STABILITY OF HAREM GROUPS (EQUUS FERUS PRZEWALSKII) IN A SEMI-RESERVE IN HUNGARY

Waltraut Zimmermann, Kristin Brabender, Franziska Roth, Viola Kerekes

In cooperation with the Cologne Zoo, the Hortobágy National Park established a project with large herbivores in 1997. Przewalski's horses and Heck cattle (reconstructed aurochs) were released into a 2460-ha steppe area in the core zone of the park. The project's main goal is to use herbivore grazing as a landscape management tool in the maintenance of the highly sensitive fauna and flora of the salt steppe. The project design includes scientific monitoring, thus offering the unique chance to learn more about population dynamics and social organisation in Przewalski's horses under semi-wild conditions. At the project start, 22 (8,14) horses, originating from eleven zoological gardens in Europe, were released. By early 2009 the population had increased to 111 (55,56) horses. Each horse can be identified individually by its phenotype, and its genotype is known from DNA analyses. Based on observation data, we describe mechanisms of the formation of harem groups, their composition and stability. We contrast starting conditions in group composition and stability with today. For example, the initial sex-ratio was far from natural but has now adjusted to a more natural sex ratio of 50% stallion and 50% mares. Semi-reserves can play a fundamental role in the restoration of once extinct species, offering infrastructure and controlled conditions necessary for research in the species' biology and ecology.

THE ECOLOGY AND MANAGEMENT IN THE REINTRODUCTION OF PRZEWALSKI'S HORSE IN CHINA

Hu Defu, Qing Cao, Waltraut Zimmermann, Melissa Songer, Jie Cao, Feng Zhang, Jinliang Chen, Yuping Meng

Przewalski's Horse reintroduction was launched in Kalamaili Natural Reserve in northern Xinjiang in China in August, 2001. Since then we have conducted research and monitoring of the released population, and focus on eight points that are critical factors in the reintroduction of large and medium-sized wildlife. There are (1) natural forage, (2) natural water sources, (3) natural predator, (4) disease, (5) reproduction, (6) resource Competition, (7) nomadism, (8) extreme disasters. With the help of ground watching and satellite collar tracking, we initially evaluate the impact of each factor on the reintroduction of Przewalski's Horse. All of these works serve the re-wilding, survival and genetic diversity conservation of the released population. With the progress of Przewalski's Horse's reintroduction, some constrain factors such as disease risks and resource competitions may become gradually weakened, but some other factors may become more serious limiting factors, for example, the water sources and the genetic drift. At present, the works above are still ongoing. Our researches and monitoring works would guarantee the fast acclimation of the released Przewalski's Horses from soft releases to free ranging in the natural environments.

HABITAT SELECTION IN PRZEWALSKI'S HORSE IN THE KALAMEILI NATURE RESERVE, XINJIANG, CHINA

Cao Qing, Hu Defu, Melissa Songer, Peter Leimgruber

We work with the Wild Horse Breeding Centre to study habitat selection in Przewalski's horses in Kalameili Nature Reserve, China. We used GPS collars to track movements of seven horses between 2006 and 2008. By combining horse location data with satellite estimates of biomass, we developed logistic regression models for predicting habitat selection. We used Normalized Difference in Vegetation Index (NDVI) data acquired by the MODIS sensor to approximate biomass. Variation in NDVI was the most important factor for predicting Przewalski's horse presence and models were most significant for the spring. However, integrated NDVI (sum of all NDVI values throughout the year) was negatively correlated with horse presence, indicating that higher biomass areas may not always represent best habitat. As areas green up in the spring, grass shoots are high in nutrients. As biomass increases, nutrient content as well as digestibility for plants declines. Przewalski's horses prefer stipa meadows with a distinct seasonality in plant productivity and high productivity in early spring. However, these meadows may be lower in overall biomass than other vegetation communities. We are currently experimenting with spatial models that will allow us to map habitat suitability for Przewalski's horses using primary productivity patterns.

THE REINTRODUCTION OF THE PRZEWALSKI'S HORSE AND CONSERVATION OF WILDLIFE

Bandi Namkhai

The Przewalski Horse (takhi) went extinct by the late 1960s. Prior to the extinction, 53 takhi foals had been captured and transported to European zoos. These became the founders of a global captive takhi population of 1700 by 1990 animals. However, inbreeding was high in captivity, threatening even the captive population with extinction. Reintroduction and restoration of takhi to native habitats had become a major priority. Takhi reintroduction to Mongolia started in 1992 and the first 15 animals were brought to Khustain Nuruu, 100 km from Ulaanbaatar. Between 1992-2000, five animal transfers from western zoos provided a total of 84 individuals for reintroduction. Khustain Nuruu was declared a special national protected area by the Mongolian government in 1993, initiating systematic protection and conservation of the park's ecosystem and wildlife. This step successfully integrated reintroduction efforts with nationwide ecosystem and wildlife conservation. Today, Khustain Nuruu National Park is home to 450 vascular plants, 46 mammals, 385 insects and 217 birds. Protection efforts allowed for the recovery of substantial wildlife populations of marmots red deer, roe deer, Mongolian gazelles, yellow fox and wild sheep. Przewalski's horse have been the umbrella species to advance restoration, management and conservation of wildlife and biodiversity.

A DECADE OF BEHAVIORAL RESEARCH ON TAKHI AT HUSTAI NATIONAL PARK, MONGOLIA

Lee Boyd

Little behavioral information had been gathered about takhi (*Equus ferus przewalskii*) prior to their extinction in the wild. Their reintroduction to Hustai National Park has provided a wealth of opportunity to collect data on this endangered species. My research began in 1994 with a comparison of behavior before and after release. The released takhi spent more time moving from place to place and less time standing resting. Subsequent research has focused upon (1) grooming behavior, including a symbiosis that has arisen between takhi and magpies acting as tick birds, (2) use of rock formations by the takhi for thermoregulation in summer, (3) the age and fate of dispersing juveniles, as this is something we had no opportunity to study in captive populations.

LIVING ON THE EDGE - PRZEWALSKI'S HORSE RE-INTRODUCTION INTO THE MONGOLIAN GOBI

Chris Walzer, Oyunsaikhan Ganbataar, Petra Kaczensky

The last recorded sightings of Przewalski's horses occurred in the Dzungarian Gobi in SW Mongolia. In 1992 a re-introduction program was initiated. Early scientific input concentrated on determining causes of death and low reproductive rates. The elucidation of the effects of endemic piroplasmiasis on the population and subsequent management changes lead to remediation this deadly problem. As of December 2008, 135 Przewalski's horses roam in the protected area.

Przewalski's horses have been fitted with satellite collars in order to determine home range size and habitat

preferences. Research has also focused on the role, needs and possible impacts of local semi-nomadic herders that use the protected area. In 2007 a trans-boundary project was initiated. This project aims to promote nature conservation by supporting rural communities of nomadic pastoralists living in the trans-boundary area of the Dzungarian Gobi, in China and Mongolia.

There is no consensus on when a reintroduction program is deemed successful. Reaching a self-sustainable population is a crucial short to mid term goal. However, long term success, especially for a species living on the edge of its former distribution range, will require a long term commitment into monitoring and research. Thus, a self-sustaining financial base in conjunction with dedicated training and empowerment of local scientists and residents constitute essential prerequisites for the project's future.

MONITORING RE-INTRODUCED PRZEWALSKI'S HORSE IN THE MONGOLIAN GOBI

Oyunsaikhan Ganbataar, Petra Kaczensky, Chris Walzer,

Beginning in 1992, 91 Przewalski's horses (*Equus ferus przewalskii*) have been re-introduced to the Great Gobi B Strictly Protected Area in SW Mongolia. Since then 212 foals were born, whereas 169 animals died or disappeared. As of December 2008, 136 Przewalski's horses roam freely in that area. In order to document births, mortalities, group dynamics and range shifts, all harems are checked on a weekly basis by park rangers. In protected areas of Mongolia overgrazing, competition with wild ungulates and poaching are important management concerns. Between May 2003 and July 2008 we conducted 61 surveys each covering 350 or 850 km, mapping and counting all wild and domestic ungulates. Although the data does not allow for a quantitative assessment of wild ungulate population size or trend it allows a qualitative assessment of range use by different species and provides an overview about human activities.

So far direct conflicts between Przewalski's horses and local people have been minimal. In some rare cases Przewalski's horses have been accused by local people to compete with their livestock for pastures, or have been documented to raid vegetable plots, fight with or steal of domestic horses. Local people have been documented to sometimes scare or chase away Przewalski's horses and one stallion was poached. With the Przewalski's horse population growing, conflicts with local people can be expected to increase making a good monitoring and close cooperation most crucial.

SOCIAL DIFFERENCES IN MONITORING AND MANAGEMENT AT KALAMAILI AND HUSTAI NRUU

Michael Zukosky

The different social contexts in which scientists and technicians think about Przewalski horse reintroduction affects the monitoring and management of the species. These monitoring and management systems in China and Mongolia have their own distinctive histories and institutions that relate to local-level social events and experiences. For example, the reintroduction in Kalamaili does not utilize a participatory approach, developed an informal and tacit system of monitoring and management, and has only partially utilized foreign non-governmental organizations in project implementation. In contrast, the project in Hustai Nuruu has utilized foreign governmental and non-governmental organizations in implementation, developed a formal system of monitoring and management, and included a portion of the local population as rangers who are

involved in both monitoring and management. As international groups have encouraged the standardization of monitoring and management systems across different social contexts, this paper explores the potential for standardization and the value of diversity in these systems.

STATUS AND CHALLENGES FOR THE RESTORATION OF PRZEWALSKI'S HORSE TO THE WILD

Patricia Moehlman

The Przewalski's horse was categorized as Extinct in the Wild from the late 1960's. However, successful reintroductions that began in Mongolia in 1992 have qualified this species for reassessment. Once a reintroduced species has a 'mature' individual in the wild, then it is listed as Critically Endangered. A Critically Endangered species must have more than '50' mature individuals free-living in the wild for five years to qualify for down-listing. As of 2006 there were 55 mature individuals in the wild at Hustai National Park and Gobi B. In 2007 there were 79 mature individuals in the wild in Mongolia. If these reintroduced populations continue to have more than 50 mature individuals, then the Przewalski's horse will qualify for down-listing to Endangered in 2010.

The major threats to the Przewalski's horse in the wild are hybridization with domestic horses, disease and loss of genetic diversity. Competition for resources with domestic horses and other livestock also poses a threat. Predation on foals by wolves may account for a significant number of mortalities and is a threat to the population growth.

REINTRODUCTION OF PRZEWALSKI'S HORSE TO SERIIN NURUU AS PART OF AN INTEGRATED CONSERVATION PROGRAMME FOR KHOMIIN TAL, MONGOLIA

Byamba Munkhtuya, Dejid Nandintsetseg

Przewalski's Horse reintroduction was launched in Kalamaili Natural Reserve in northern Xinjiang in China in August, 2001. Since then we have conducted research and monitoring of the released population, and focus on eight points that are critical factors in the reintroduction of large and medium-sized wildlife. There are (1) natural forage, (2) natural water sources, (3) natural predator, (4) disease, (5) reproduction, (6) resource Competition, (7) nomadism, (8) extreme disasters. With the help of ground watching and satellite collar tracking, we initially evaluate the impact of each factor on the reintroduction of Przewalski's Horse. All of these works serve the re-wilding, survival and genetic diversity conservation of the released population. With the progress of Przewalski's Horse's reintroduction, some constrain factors such as disease risks and resource competitions may become gradually weakened, but some other factors may become more serious limiting factors, for example, the water sources and the genetic drift. At present, the works above are still ongoing. Our researches and monitoring works would guarantee the fast acclimation of the released Przewalski's Horses from soft releases to free ranging in the natural environments.

Symposium: Galliformes- Barometers of the State of Applied Ecology and Wildlife Conservation in Asia, 68378

Organised by: Philip McGowan, Guangmei Zheng

Meeting room: 113

The avian Order Galliformes (pheasants, partridges, grouse and relatives) enjoy a high profile in Asian research, conservation and culture. In China, for example, nearly a quarter of all publications on birds deal with these species and so they can be seen as embodying the status of the country's research, nowhere more so than in conservation science and its application to management.

There are two particular reasons why this topic is appropriate for this meeting. First, there is a long relationship between Galliformes researchers in China and their international counterparts and this is an ideal opportunity to present some of this work. Second, Galliformes have a very special role in China as they are important culturally, economically and in ecological research (including as a centre of domestication of the red junglefowl). The country is central to global efforts to conserve this group (more than 60 species have been recorded including many endemics) and so it is critical to ensure that the long tradition of research within the country benefits from, and contributes to, efforts to reduce the overall extinction risk facing this group (25% of the 290 species are on the IUCN Red List). The symposium will review efforts to conserve this group, with a special focus on China, by examining key issues and presenting case studies. This meeting is an exceptional opportunity to share lessons, take stock and re-assess priorities.

DOMESTICATION OF THE CHICKEN

Han Jianlin

STATUS OF RESEARCH ON GALLIFORMES IN CHINA: A CASE OF STUDIES ON ELLIOT'S PHEASANT

Ding Ping

China is a country with rich species of Galliformes. As a bird endemic to south of Yangzi River in China, the vulnerable Elliot's pheasant *Syrnaticus ellioti* is one of the Galliformes species which has been studied intensively and extensively on the ecology and conservation biology since early 1980's. The purpose of this paper is to get an overview about the scientific questions cared by Chinese researchers, the history, advance and status of research on Galliformes in China through a review of studies on Elliot's pheasant in past and current. To date, more than 30 research papers related to this pheasant have been published. In terms of those publications, we could know that few papers were published and most of the studies on Elliot's pheasant were about its distribution, habitat types, breeding, and some other life history traits in the field before 1990's. After that, the more intensive studies had been done on the habitat characteristics, the habitat selection and use, and the home range and its seasonal patterns based on radio tracking technique. Since 1999, the studies on Elliot's pheasant have been focused on the more topics, such as habitat fragmentation, effects of fragmentation, habitat patch occupancy patterns, metapopulation dynamics and models, dispersal

patterns, gene diversity and genetic structure of population, and conservation strategies, using more methods such as radio tracking, GIS, GPS and RS, and molecular techniques, and so on.

CHINA'S NATIONAL PHEASANT ACTION PLAN--TARGETS, PROJECTS AND PROGRESS

Zhang Zhengwag

Pheasants is one group of birds in Galliformes which has close relationship with human beings. As one of the countries in the world that rich in pheasants, 55 species of Phasianidae have been recorded in China, include 18 endemic species and 15 global threatened species. Since 2000, Chinese Government has paid more attentions on protecting the wild populations of pheasants. In the National Wildlife Protection and Nature Reserve Construction Project which carried out by the State Administration of Forestry of China, pheasants are among the 15 groups of animals and plants had high priority for conservation. The National Pheasant Action Plan compiled and released in 2001 has become the guiding principals for conservation of China's galliformes . In this paper, I will introduce the National Pheasant Action Plan of China, including the status and threats of this group of birds, targets and projects related to pheasant conservation, the progress has been made from the fields of on-site protection, off-site conservation and scientific research in recent years. The main problems existed in pheasant conservation and management in China are discussed. Further cooperations on conservation of global threatened species between China and international organizations such as World Pheasant Association are suggested.

OVERVIEW OF GALLIFORMES CONSERVATION SCIENCE IN ASIA

Peter Garson

Three decades ago our knowledge of Asian Galliformes species distributions was poor and detailed ecological studies were in their infancy. An international effort since then, fronted by the World Pheasant Association (WPA), has seen a quantum leap in the amount and quality of species information available, and the growth of substantial specialist expertise in many Asian countries. By the early 1990's, five IUCN/SSC/WPA Specialist Groups had been formed for Galliformes, resulting in improved Red List assessments and the publication Status and Conservation Action Plans containing prioritised projects. More recently still it has been possible in some cases to progress from investigations of status, ecology (State) and threats (Pressure) to conservation action based on science (Response). But have we yet reached the point of monitoring the effectiveness of the actions taken, or demonstrating improved species status even at a local level? This paper will review case studies from across Asia in order to assess our progress overall in conserving this spectacular and important group of birds.

HOME RANGE AND HABITAT USE OF REEVES'S PHEASANT IN THE PROTECTED AREAS CREATED FROM FOREST FARMS, CENTRAL CHINA

Xu Jiliang

Reeves's Pheasant *Syrnaticus reevesii*, the globally threatened that is endemic to China. From April 2000 to August 2003, the habitat use of 14 male Reeves's Pheasants was studied by radio-tracking at Dongzhai National Nature Reserve, central China. Conifer-broadleaf mixed forest was used preferentially in all seasons at the scale of the study area, as were mature fir plantation and shrubby vegetation. Moreover, young fir plantation was used preferentially during the breeding season at the scale of the home range. Surveys recorded the pheasant in 13 other protected areas in the Dabie Mountains, and indicated that broadly similar habitat types were available in all of them. Furthermore, the Reeves's Pheasant were found in habitats similar to those used preferentially at Dongzhai National Nature Reserve. It seems likely that a mosaic of habitats is crucial to meet the various requirements of male Reeves's Pheasants throughout the year and management should therefore concentrate on maintaining this patchwork of habitats. It is now urgent to know which habitats produce the most young pheasants and so nesting and brood-rearing habitats should be identified clearly. Further studies on the habitat mosaic would be useful, both at a local scale and also at a larger, landscape scale.

RESEARCH TO UNDERPIN PROTECTED AREA MANAGEMENT IN THE PHILIPPINES

Neil Aldrin Mallari

Puerto Princesa Subterranean River National Park (PPSRNP) in Palawan is a key site for the Palawan Peacock-pheasant *Polyplectron emphanum* and a suite of globally threatened endemic birds. It is one of the few protected areas in the Philippines that is supported by a very strong legal framework and operating under the auspices of collaborative institutional arrangements, and a multi-sector and participatory approach in protected area planning and management. However, due to the limitations in technical capacity of the PPSRNP, there is a clear gap between the management infrastructures and conservation planning which undermines the efficacy of PPSRNP in delivering its conservation objectives. To fill this gap, a suite of ecological and socio-economic analytical tools was employed to provide training to park staff and scientific inputs to guide this planning process. Results of the study showed gross mismatch of management regime and the conservation requirements of threatened species. This paper proposes to mitigate this mismatch by providing decision-making tools to guide site profiling, zoning, monitoring and evaluation as well as setting practical and measurable biodiversity conservation targets and work programme. It also provides a baseline for monitoring impacts of the management interventions that will be adopted by the park.

LONG-TERM RESEARCH AND MONITORING OF CABOT'S TRAGOPAN

Zheng Guangmei, Zhang Yanyun

In Madagascar as across the globe, new temperature and precipitation patterns are expected to alter species'

suitable climatic range. In this paper, we calculate least-cost strategies for ensuring minimum acceptable levels of habitat area in stable forest cover for 72 endemic plant species at successively greater levels of climate change. We have identified four categories of species, requiring four successively more costly levels of management action to maintain minimum habitat areas. Exacerbated climate change forces conservationists to confront a choice between spending more to protect the same number of species, or protecting fewer species at the same cost. Stabilizing existing natural forest from deforestation is cheaper than restoring natural forest once it has been cleared. Natural forest restoration will be necessary for some species, but should be highly targeted and will likely require new sources of financing.

PERCEPTIONS OF CONSERVATION BY CHILDREN AND WOMEN IN THE PALAS VALLEY, PAKISTAN

Emily Woodhouse

The success of community-based conservation projects depends on attitudes held by the local community, which influences levels of participation and behaviour. The research aimed to understand perceptions of under-represented groups for a conservation and development project in the Northern regions of Pakistan, to inform planned environmental education initiatives. Using semi-structured interviews with local children, women and key informants, qualitative and quantitative data was gained on resource use, knowledge, and attitudes towards wildlife and conservation.

Children and women were found to play central roles in the collection of non-timber forest products and displayed high levels of indigenous knowledge on local species. Collection may have a detrimental effect on biodiversity, including the vulnerable Western Tragopan (*Tragopan melanocephalus*). Both direct experience and formal education were found to play a role in knowledge of wildlife and conservation, and different kinds of valuation were placed on the natural world, informing attitudes. Children were more likely to focus upon non-use, especially aesthetic value. Attitudes toward conservation were generally positive, but influenced by education, age, gender and knowledge. The research highlights how consulting marginal groups may be important in gaining different perspectives and knowledge, in order to support inclusive community participation in conservation.

VALUES THAT INFLUENCE CONSERVATION BEHAVIOUR –SOCIAL SCIENCE CONCEPTS RELEVANT TO UNDERSTANDING CONSERVATION SUPPORT IN NEPAL

Kerry Waylen, Anke Fischer, Philip McGowan, E.J. Milner-Gulland

This talk shows the relevance of some concepts from social science (particularly economics and social psychology) for understanding local perceptions and conservation support in a developing country.

A mixture of qualitative and quantitative techniques were used to probe determinants of conservation support in villages of the Seti Khola valley, Nepal, the site of a long-term pheasant conservation project. Techniques derived from participatory rural appraisal revealed that local people have a variety of values for nature, from practical uses, to 'value as part of nature'. This informed a structured questionnaire survey of 661 households.

The questionnaire compared willingness to give time to support conservation of two familiar species, one indispensable, the other beautiful but useless. People gave time for both, not just the useful species. Many were motivated by social reasons, such as a desire for village welfare, or an obligation to help others. Other questions covered perceptions of nature (e.g. a feeling of connectivity), and general life priorities. Structural equation modelling showed links with conservation support.

Emphasising feelings of connection to nature, and the importance of helping others, may be a valuable strategy for encouraging support. To improve conservation success, research and management should take into account all values for nature, not just practical benefits.

PHEASANTS, FORESTS AND SCHOOLS IN PIPAR, NEPAL

Philip McGowan, Natalie Clark

The conservation value of Pipar was identified in 1977 when five of Nepal's six Himalayan pheasant species were found in close proximity. The forests seemed largely untouched and the traditional way of life of the villagers of the Seti Khola had relatively little impact on these resources. After conducting a baseline study of pheasants and their habitat use, a management plan was produced in 1983. However, it was soon felt that meaningful long-term aid required support from the villagers and so an agreement was quickly reached. In return for support for schools along the valley bottom, the forests would not be commercially exploited and there would be little or no significant harvesting of forest produce during the breeding season. This informal agreement has lasted 25 years and support is now given to nine schools, providing teachers' salaries, helping with repairs and new building projects and buying educational materials.

Regular surveys have monitored the health of Pipar's forest and its Galliformes since 1979. Recent results indicate that the forest remains largely unspoilt and pheasant numbers are stable. However, there are fears that this will begin to change as the forest is being increasingly used as a source of produce for both personal and commercial use. The end of the Maoist insurgency and the potential impact of collecting the 'caterpillar fungus' *Cordyceps* suggest that both tourism and unregulated harvesting could have a significant impact on the landscape.

RESPONDING TO COMMUNITIES LIVING AROUND PROTECTED AREAS IN SOUTHERN SICHUAN

Simon Dowell, Bo Dai

CONSERVATION ON BIRDS BY SACRED FOREST IN DAOCHENG COUNTY, SICHUAN PROVINCE, CHINA

Nan Wang

In Tibetan area, Sacred forest is located near villages and monasteries, special conserved by local culture for a long history, and it provide many habitats for birds. The conservation is not so strict outside the sacred forest, and local people utilized the habitat for the daily life. In November 2006 - July 2007, 6 sacred forests and their control sites were survived in winter and breeding season respectively in Daocheng County, Sichuan Province, China. The area of the sacred forest is 0.23 km²-1.80 km². Their habitats are significantly different from non conserved area (Mann-Whitney U-test $p < 0.05$). Point counted method was used in bird survey. In winter, 32 species were recorded in 6 sacred forestry and 33 in control sites. In breeding season, 56 species were in

sacred forestry and 50 in control sites. The species number (Winter: sacred forest 1.48 ± 0.11 , $n=161$; control site 0.63 ± 0.076 , $n=158$. Breeding season: sacred forest 2.69 ± 0.13 , $n=159$; control site 1.41 ± 0.12 , $n=163$) and the number of bird individual (Winter: sacred forest 4.46 ± 0.51 , $n=161$; control site 2.41 ± 0.54 , $n=158$. Breeding season: sacred forest 5.15 ± 0.347 , $n=159$; control site 2.45 ± 0.27 , $n=163$) recorded in the points were significantly higher in sacred forest both in winter and in breeding season (Mann-Whitney U-test $p < 0.05$). Habitat provided by the sacred forest conserved the birds with higher bird diversity.

HOW CAN RESEARCHERS CONTRIBUTE TO CONSERVING KEY SPECIES AND THEIR HABITATS? A RESERVE MANAGEMENT PERSPECTIVE FROM HAINAN, TROPICAL CHINA

Michael W.N. Lau, Bosco P.L. Chan, John Fellowes

Hainan's Yinggeling Nature Reserve contains the largest remaining forest-habitat block for several island-endemic Galliformes. Like other habitat reserves, it faces many challenges and has great limitations on its financial and human resources. How can young researchers contribute to conservation work in such Protected Areas (PAs)? We make some suggestions. (1) Think from a PA manager's perspective. What benefits will your project bring to the PA (e.g. funding and training), and what logistic help will you need? (2) Invite reserve staff involvement in the planning and reporting of research as well as the fieldwork itself. This may improve the applied focus of the study, and the conservation follow-up. (3) Learn from field staff and local people - they understand the local situation and some will know a lot about wildlife. (4) Ensure your science is sound - employ good sampling design and logical interpretation. (5) Keep recommendations simple, brief and practical, and look for synergy with those relevant to other species (e.g. hunting control). (6) Bring the species to life; help local people feel the value of conserving these animals and their habitats. (7) Keep in touch. You can be a continuing source of encouragement and information to people with difficult frontline conservation jobs.

Symposium: Conservation Practices in China, 72276

Organised by: Zhi Lu

To introduce Conservation Practices in China by 2 panels: 1) species and protected areas; 2) new conservation mechanisms and policies. To let conferees learn the conservation status, available cases and problems faced by China.

THE STATUS OF NATURE RESERVES MANAGED BY STATE FORESTRY ADMINISTRATION IN CHINA

Li Zhong

The nature reserve system was soon built up after the foundation of People's Republic of China. The first nature reserve, Dinghushan reserve was established in 1956 by the State Forestry Administration (SFA). Currently, there are 2531 nature reserves in China, covering an area of 152 million hectares, which accounts for 15.2% of china's total land area. Two thousands and six nature reserves are under the management of SFA,

covering an area of about 122 million hectares. Those nature reserves protect 90% of China's terrestrial ecosystem types, 47% of wetlands, 85% of wildlife populations, 65% of higher plant communities and 30% of the typical desert areas.

In the last few years, the major outcomes that have been achieved by SFA were as followings: 1) the spatial distribution of nature reserves improved; 2) several surveys conducted on the natural resources, i.e. plants, wild animals, wetlands and giant panda; 3) Development Planning for National Forestry Nature Reserves developed and implemented; 4) the legal system of nature reserves strengthened; 5) co-management of nature reserves with local communities enhanced; 6) training provided to improve the management capacity of nature reserves; and 7) exchange and cooperation between nature reserves reinforced.

ESTABLISHING A SYSTEMATIC AND MULTI-PURPOSE MANAGEMENT SYSTEM--A CASE OF WANGLANG RESERVE, CHINA

Chen Youping

Multiple approaches have been applied to the conservation management of Wanglang Nature Reserve since its establishment in 1963. A systematic monitoring and management system has been established and provided valuable information to the construction of laws and regulations, such as regulation of Payment for Ecosystem Services. Since 1997, we have conducted multiple projects of wildlife monitoring and patrolling, anti-poaching, community co-management, environmental education and eco-tourism, using integrated management approaches of science and social economics. The management approaches were proved to be successful. Up to now, Wanglang has provided training on the management of nature reserves to the staffs from numerous reserves in China and provided a demonstration for the nature reserve management throughout China.

PROBLEMS, PARCTICES AND PERSPECTIVE OF CETACEAN CONSERVATION IN THE YANGTZE

Wang Ding

There are two species of fresh water cetaceans surviving in the Yangtze River system in China, which are the baiji (*Lipotes vexillifer*) and the Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*). The threats faced by the cetaceans include over- and illegal fishing, vessel traffic, water project development, and water pollution. In order to prevent the extinction of baiji and a sharp decline in the abundance of the porpoise, in situ conservation and ex situ conservation strategies were proposed and have been implemented since the middle 1980s.

In the past 20 years, seven nature reserves and two semi-natural reserves have been set up along the river. But, the administrative measures taken in the natural reserves have not yet kept the populations of both species from sharply declining. On the other hand, under careful management, the porpoises in the semi-natural reserves have been reproducing naturally and successfully. Additionally, a small breeding group of porpoises is being established in captivity.

Even under the existing severely degraded conditions of the Yangtze system, the in situ conservation efforts in the natural reserves, and in the entire Yangtze River system, including the lakes, should not be ignored or abandoned at any time, the ex situ conservation should be emphasized, and the need to establish more new

semi-natural reserves should be placed on the agenda of local and central governments in the near future.

WHEN DO WE CLAIM SUCCESS IN PANDA CONSERVATION IN THE WILD?

Wang Hao

As a world known species, the conservation practice of Giant panda lead the trend of many other species. The most important task for conserving wild giant panda in next 20 years is to build corridors and connect isolated habitats. We developed a methodology and delineated the distributions for this species based on 2 national level panda surveys and several additional regional surveys. A total of 23 isolated panda population were recognized, and 21 corridors were defined to recover habitat integrity, among those corridors, 3 in Qinling mountains, 7 in Minshan Mountains, 5 in Qionglai mountains, 4 in Xiangling mountains, and 2 in Liangshan mountains. The recovery of Tudiling corridor and Nibashan corridor have recently been adapted in the post quake recovery plan.

CONSERVATION LED BY COMMUNITIES: CASE OF CONSERVATION INCENTIVE AGREEMENT IN CHINA

Li Shengzhi

Conservation Incentive Agreement (CIA) was introduced into China as a conservation approach in 2006 by CI and Shanshui Conservation Center (Shanshui), a Chinese conservation NGO.

A real partnership among governments, communities and private sectors in China would mobilize enormous additional resources and willingness of participation from each party who could complement each other, essential to long-term conservation outcomes and to effectiveness of current and future national conservation programs.

CIA makes government, community and private sectors sign a conservation contract. The parties of the contract contribute their advantages conservation strengths including labors, equipments, materials, awards, information & knowledge, planning, policy, tenure, conservation culture, etc. to achieve conservation objectives regulated by the same contract. The parties work together and benefit each other.

One key of CIA is trust and equality among parties. While in country like China with long tradition of top-down and centralization, how to make the communities work well with governments has a long way to go.

CIA pilot sites in China increased from 3 in 2006 to 17 in 2008. The paper Promoting Conservation Partnership: Conservation Incentive Agreement in China summarizes CIA experience and potential extension in China.

THE ROLE OF TIBETAN TRADITIONAL CULTURES IN CONSERVATION IN WESTERN CHINA

Shen Xiaoli

The importance of sacred sites in conservation is internationally recognized. We report the first systematic

study of the spatial distribution pattern, management system, and conservation effectiveness of Tibetan sacred mountains in Ganzi Prefecture, China. We visited 74 monasteries and recorded 213 sacred mountains, 150 of which were mapped with a total land area of 4189.9 km². The total land area of sacred mountains was estimated to be about one-third of the total land area of Ganzi. 73% monasteries assigned specific persons to manage their sacred mountains, and 64% monasteries conducted patrolling activities. Nature reserves had highly spatial overlap with sacred mountains, but few had collaboration with local communities in conservation. We found that sacred mountains were effective in conserving forest and bird diversity. In Danba County the deforestation rate from 1990 to 2000 on sacred mountains was lower than that from 1975 to 1990, due to the renaissance of sacred mountain worship and conservation in late 1980s. Forest coverage of sacred mountains was higher than that of non-sacred areas, and the disparity increased with the increasing resident density. We found that the villages with more traditional practices possessed higher bird diversity based on our investigation at nine Tibetan villages. We suggest that sacred mountains play an important role in conservation, and need to be considered in the regional conservation planning to promote conservation in western China.

LIFE AND DEATH OF TIBETAN BUNTINGS IN NYANBO YUZE, A SACRED LAND IN QINGHAI

Zhaxi Sange

In western China, the traditional cultures can be an important asset for conservation as they often have strong implication in respecting and protecting nature and life. Research done by Conservation International has indicated that in Ganzi Prefecture in Sichuan, about 1/3 of the land is acknowledged as "Sacred Land" with different degrees of protection by local Tibetan communities. Grassroots conservationists and community conserved area of various types could be a valuable complementary to nature reserves to promote conservation effectiveness, especially in western China, where financing them with adequate staffing and facilities of existing nature reserves recognized as a major challenge.

Ju Thashi Sanger, professor of Baiyu monastery in Guolo prefecture in Qinghai, started birding at the age of 13, and so far has more than 400 pieces of hand drawing works of local wild birds. Tibetan Bunting (*Emberiza koslowi*), IUCN red list NT, is an endangered species endemic to Bayan Har Mountain Range. Since 2005, Thashi started biological research to Tibetan Bunting with voluntary monks. Through well-designed community monitoring initiatives, Thashi has collected qualified information on habitat, breeding and migration etc. of Tibetan Bunting. A preservation plan for this species was developed corresponding to the analysis of the monitoring results, including designating a 300 ha community conserved area of Tibetan Bunting at Nyainbo Yuze Sacred Land.

MARKET-BASED APPROACH TO FRESHWATER CONSERVATION - PES AVAILABILITY AND PILOT PROJECTS IN CHINA

He Yi

Payments for Ecosystem Services (PES) schemes represent a major opportunity to produce large-scale conservation results whilst also providing enhanced human well-being. A variety of tools related to PES planning and decision-making and approaches are being tested to help develop means of paying for

conservation; including estimating markets for services, integrating ecological processes into payment mechanism design, and bundling services where markets already exist such as carbon markets. Successful approaches need to be replicated and scaled up, increasing revenue for both conservation and ensuring that resource protection is financially rewarded to those responsible for that protection.

Existing conservation incentive programs in China are already in place and are huge in scale; the planned investment for the Natural Forest Conservation Program and the Grain to Green Program is around \$100 billion. However, these schemes are based on top-down government decisions instead of explicit linking of service providers and service users via the market. There is potential to improve results through the use of market-based mechanisms, which would be the first project of its kind in China. Shan Shui has developed a pilot PES study in Lashi Lake Nature Reserve, Lijiang of Yunnan Province, where biodiversity and overland waterflows are protected by farmers, and visitors pay fees as part of a larger program to ensure that resource protection is financially viable.

Symposium: Integrated Protection and Restoration of Wetlands, Rivers and Subterranean Aquatic Ecosystems,66751

Organised by: Eren Turak, DECC, Australia; Jeanne Nel, CSIR, South Africa ;Jonathan Higgins,TNC; Changqing Yu, Tsinghua University

Water affects every activity and aspiration of human society and sustains all ecosystems. Its wise use is critical to the sustainable development of emerging economies and the well-being of the poorest sectors of our society, who depend on the health of natural resources for their livelihoods.

Conservation efforts for different types of freshwater ecosystems, i.e., wetlands, rivers and subterranean aquatic ecosystems, have generally been poorly coordinated. Mechanisms for determining the conservation values of different types of freshwater ecosystems, measuring their condition and protecting them have differed greatly. There has also been little effort to estimate overlap in biodiversity and ecological functions.

Given the high connectedness among different freshwater ecosystem types, the commonality of threats to their biodiversity and the important ecosystem services they provide, the current approach promotes inefficiencies in both protective and restorative actions. Without adequate quantitative tools that allow the benefits of alternative conservation actions to be measured, it is difficult to make best use of available resources in implementing management actions. This gap also hinders greater integration among freshwater terrestrial and marine conservation efforts.

Presentations will: demonstrate how different aquatic ecosystems have been incorporated into conservation plans and actions; explore the applicability of condition measures across ecosystem types; demonstrate how conservation planning algorithms can be used to integrate different ecosystem types into one conservation plan; and illustrate management actions directed at different types of aquatic ecosystems simultaneously.

EVALUATION OF BIODIVERSITY CONDITION AND INTER-RELATEDNESS OF SURROGATE CLASSES FOR INTEGRATED FRESHWATER CONSERVATION PLANNING

Eren Turak, Sarah Imgraben, Grant Hose

The use of systematic approaches in freshwater conservation planning is increasing but still largely confined to rivers. Where wetlands and aquifers are included, prioritisations for conservation are often separate.

Because of shared species and ecosystem processes, effective planning for biodiversity conservation requires accounting for links among these systems explicitly and quantitatively.

We developed a method for doing this and trialed it in the Hunter Region, Australia using best available spatial data and ecological knowledge for the region. We selected best classifications available and adapted these as necessary. For rivers we used an ecological typology based on data collected from reference sites. For wetlands we adapted a hierarchical classification based climate, hydrology and geographic region. Aquifers were classified by geology and ecological distances among them estimated using biological data for these and other aquifers in south eastern Australia.

Conservation planning units were defined based on the spatial configuration and functional relationships among classes and accumulation rules were created to account for 'downstream' impacts from disturbances. This allows biodiversity to be quantified for any planning unit and expressed as a function of human induced disturbance across spatial scales. The results of this are spatial data layers that allow integrated freshwater conservation planning and can be input into conservation planning software.

ADDING PIECES TO THE MARXAN PUZZLE: INTEGRATING RIVER, WETLAND AND GROUNDWA-TER CONSERVATION USING ASYMMETRIC CONNECTIVITY RULES

Simon Linke, Eren Turak and Hugh P. Possingham

Systematic conservation planning has become increasingly mainstream in the last decade. Large conservation plans have been designed in iconic areas such as the Cape Floristic Region (South Africa) and the Great Barrier Reef (Australia), integrating species level data with ecoregional attributes. Freshwater systems have been traditionally neglected in the field of systematic planning approaches, mainly because of perceived difficulties with spatial adequacy, i.e. the ability to maintain biodiversity targets.

MARXAN is a decision support tool for systematic conservation planning. Given a 'shopping list' of biodiversity attributes, MARXAN finds the cheapest and spatially most coherent solution using an optimisation algorithm (simulated annealing). Only in the last few years, connectivity rules for MARXAN were modified to accommodate for the unidirectional flow of freshwater systems. Using asymmetric connectivity rules (A requires B, but B does not require A to be protected), we present the first three-dimensional application, in which river, wetland and groundwater systems are used as representation targets. The new algorithm is demonstrated on data from the Hunter Region, Australia where we prioritise for a variety of conservation targets, ranging from taxonomic information to wetland and groundwater ecosystem classes.

RESTORATION AND CONSERVATION OF FLOODPLAIN LAKES IN THE CENTRAL AND LOWER YANGTZE

Chaode Ma

The Yangtze River Basin is the third longest river in th eworld, it produces 1/3 of grain, water resources of China, 40% of hydropower supply for China, the central and lower Yangtze is the main parts of the river. Working with partners including governmental agencies and local communities, WWF China has restored the Lakes including Honghu, Dongtinghu, and opened 17 sliuce gates accounted for 1900 sq km of water body.

These projects improved water quality and increased biodiversity as well, the national policies also support the actions in the future by using Intergrated River Basin Management concepts.

AMAZON CONSERVATION PRIORITY-SETTING WITH A FRESHWATER PERSPECTIVE

Juan Carlos Riveros Salcedo, Sidney T.Rodrigues, Cesar Suarez,Laura Secada

The Amazon biome covers 6.7 million km² and it holds ca. one half of the planet's remaining tropical rainforest. The Amazon River flows 6400 km from its source high in the Andes to the Atlantic Ocean, and the rivers and streams that feed it contain 20% of the Earth's free-flowing freshwater. Direct anthropogenic development pressures and global change drivers are bringing to an end the passive conservation that remoteness use to provides. In this context it is critical that actions be taken to design and implement conservation landscapes for the Amazon basin that take into account both present and future biodiversity patterns and process.

We developed a coarse level priority-setting analysis for the Amazon basin based on the principles of representation, irreplaceability, functionality, flexibility, vulnerability and connectivity. By combining a set of proxies for terrestrial and freshwater heterogeneity and freshwater ecological integrity we identify priority areas for biodiversity conservation.

In order to preserve hydrological connectivity we use small basins (200 sq km on average) as planning units aligned within a hierarchical connectivity system.The resulting Ecological Priority Areas are expected to guarantee the representativity of at least 30 percent of each conservation target (freshwater and terrestrial) and the spatial connectivity with a minimum cost of implementation and maintenance.

THE CLOSE RELATIONSHIP OF WETLAND QUALITY AND SPECIES VIABILITY: A CASE STUDY OF THE CRESTED IBIS

Xinhai Li

Wetland degradation is a major reason for the declination of many bird species. The crested ibis (*Nipponia nippon*) had declined severely from a common species in East Asia to only two pairs in central China in 1981. After extensive conservation effort on its habitat the crested ibis had dramatically recovered to more than one thousand individuals in 2008. The wetlands with small streams and rice paddies are the key forage sites. Human activities such as using fertilizer and pesticide, drying the over wintering rice paddies, and hunting were the major reasons for crested ibis' declination. We developed multivariate (i.e. wetland, human impact, elevation, and vegetation), multiscale (from one ha to 2.6×10^5 ha) models to quantify the species-habitat relationship in the course of declining and recovering of the bird, which indicated the human activities as key threat. We used the crested ibis as an indicator of the health of this wetland ecosystem, which includes a number of other species and local farmers.

SCALE-BASED FRESHWATER CONSERVATION PLANNING: TOWARDS PROTECTING FRESHWATER BIODIVERSITY IN KWAZULU-NATAL, SOUTH AFRICA

Nicholas Andrew Rivers-Moore, Peter Goodman, Jeanne Nel

We apply a two-step, hierarchical process to capture catchment- and local-scale dynamics to freshwater conservation planning using generic conservation planning software. Priority primary catchments were first identified, and then used at a second level for selecting priority sub-catchments, which served as planning units at a finer scale. Quantitative targets were set for defined freshwater biodiversity features. Selection of priority planning units at both catchment levels was manipulated using modified weighted cost discounts and penalties, which included the presence of priority estuaries and free-flowing rivers, planning units falling within priority primary catchments, planning units identified as important in an existing terrestrial conservation plan, and the degree of catchment degradation. Upstream-downstream connectivity was achieved by linking adjoining sub-catchments associated with main rivers and wetlands, and enhanced by setting high targets for sub-catchments through which eels must migrate. Ecological processes were incorporated by discounting planning units important for surface and groundwater yield. The hierarchical approach of selecting priority primary catchments and using these to affect sub-catchment costs, plus the use of high targets for migratory fish species, could be applied in any freshwater conservation plan to favour planning unit selection within selected basins, while facilitating connectivity in upstream-downstream sub-catchments.

DEVELOPING INTEGRATED CONSERVATION AREA NETWORKS FOR AQUATIC AND TERRESTRIAL ECOSYSTEMS: APPROACHES AND LESSONS FROM A CASE-STUDY IN SOUTH AFRICA

Jeanne Lindsay Nel, Nancy Job, Genevieve Pence, Kate Snaddon

Systematic conservation planning is an applied field of science that provides guidance on where to invest limited conservation resources to ensure the persistence of biodiversity. Although originally pioneered in the terrestrial realm, there has been considerable progress in its application to marine and freshwater settings. Conservation planning within these realms, however, have generally been undertaken separately despite widespread acknowledgement of the need to integrate planning efforts. Such integration explicitly recognizes the linkages between terrestrial and aquatic ecosystems, avoids duplication of conservation effort and facilitates cooperation amongst those tasked with managing land, sea and water resources. This paper presents a systematic approach to designing a space-efficient conservation area network for terrestrial, river and wetland biodiversity. Areas were selected using spatial data for: river, wetland and vegetation ecosystem types; species of special concern; existing protected areas; land cover; river ecological integrity; significant wetland clusters; and significant groundwater recharge areas. Spatial criteria such as size, connectivity and position in landscape were also considered. Guidelines were prepared to accompany this map, which can be used within the context of both protected area and land use planning. This lends itself to applicability in the freshwater realm, as it recognizes the need for human utilization of water resources.

PLANNING FROM THE LAND TO THE SEA: AN INTEGRATED OPERATIONAL FRAMEWORK

Jorge Gabriel Alvarez Romero, Robert L Pressey

Urbanization, logging, agriculture, industry and infrastructure are threatening freshwater and marine habitats through altered fluxes of sediments, nutrients, pollutants and freshwater. Modifications in one realm affects biodiversity in another and this leads to important changes in the way planners perceive threats patterns. When linkages between realms are considered, selection of conservation areas and assignment of priorities in all realms can change. Furthermore, effective implementation of conservation plans calls for integrated management and collective decision-making, involving stakeholders with diverse needs and interests. Planners almost always design independent reserve networks for different realms and the requirements for implementation are often neglected. Therefore, a conceptual and technical framework is needed to guide effective approaches to integrated land-sea planning. We reviewed case studies and the latest scientific literature on integrated coastal planning. Examples of these exercises are scarce in scientific literature. Methods to integrate different realms in conservation planning are just beginning to develop. Based on available studies, we propose an initial operational framework for integrated land-sea conservation planning. The framework will continue to evolve, but includes a first array of key elements, arranged in stages, to be considered by planners when integrating terrestrial, freshwater and marine conservation objectives.

THE CASE STUDY ON THE CONSERVATION AND SUSTAINABLE WATER RESOURCE MANAGEMENT OF WULUNGU RIVER

Changqing Yu

Wulungu River, the home of the endangered species of beavers (*Castor fiber birulai*), is one of the most important wetland and water resource for the biodiversity conservation and sustainable development in Juggar-Altay region. The unsustainable usage of the wetland resources such as the water & soil exploitation and over grazing threatens to the river system including the beaver which is listed as the first category of the national protection endangered species. The establishment of big dams in the upper reaches has not only fragmented the beaver population into several small sub-populations and blocked the migration of fishes, but also changed the flood rhythm and resulted in the seasonal drying up in the lower reaches, and then led to the habitat loss. More and more local nomadic people turned to settle down along the river bank whose livelihood would mainly rely on the wetland and water resource for cropping and grazing. Afforestation projects in desert resulted in the waste of water. The strategic conservation planning with ecosystem approach, the conservation of beavers as the flagship species, awareness raising and capacity building are the priority activities for the sustainable management of Wulungu River.

FIRST THINGS FIRST: PRIORITIZING MANAGEMENT OF FRESHWATER INVASIVES

Robert L. Pressey, Stephanie Renee Januchowski, Travis Sydes, Lynise Wearne, Damon Sydes

Aquatic invasive plants (AIPs) are considered a leading cause of species endangerment and extinction in freshwater ecosystems worldwide. This is particularly true in ecosystems where dormancy and seasonal dieback of invasives are limited. In tropical northern Australia over fifty percent of the weeds of national concern affect aquatic ecosystems and their associated biodiversity. While numerous resources exist to identify wetland values and threats, there remains an unfilled need for regional prioritization to deliver effective and sustained management of AIPs. To address this gap, we present a decision framework to maximize benefit to aquatic biodiversity while considering funding constraints, probability of project success, and likelihood of invasion and re-invasion. Fundamental to the method are explicit management objectives and working definitions of benefits, threats, costs, values and consideration of data limitations and uncertainties associated with estimating model parameters. Our results will indicate priorities for resource allocation and inform managers about gaps in data that could improve future decision making. Our work complements a larger cross-regional strategy to reduce or limit the densities of AIPs across northern Australia. Our approach is easily adapted to other management scenarios and can be easily updated as management priorities change and new data are collected.

INVASIVE SPECIES AND HABITAT DEGRADATION IN IBERIAN STREAMS: AN ANALYSIS OF THEIR ROLE AND INTERACTIVE EFFECTS ON FRESHWATER FISH BIODIVERSITY LOSS

Virgilio Hermoso Lopez, Miguel Clavero

The diversity crisis is specially pressing in freshwater ecosystems. Habitat loss and degradation and invasive species are commonly cited as the main causes. Distinguishing the role of each extinction driver and their potential interactions through a mechanistic understanding of impact is crucial for achieving conservation goals.

We analyze whether freshwater fish invasive species are mere passengers co-occurring in the biodiversity loss process driven by habitat degradation or as main drivers of the decline of native fish communities in an Iberian basin. We also tested whether native species simply responded to the abundance of invasive species or if habitat degradation modified the functional relationship between natives and invasive species.

Invasive species were leading the decline of native freshwater fish, while habitat degradation neither played an active role nor influenced invasive species per capita effect on natives. Lower reaches and areas close to reservoirs held the most seriously injured fish communities independently of their habitat degradation status. Mediterranean freshwater fish show some resilience to habitat perturbations while invasive species should be raised to the center of attention of conservation actions. The ecological role that hydrologically stable reaches play for native communities' persistence in highly fluctuating environments is endangered by the proliferation of invasive species.

Symposium: Beyond Ideas: Using the Valuation of Ecosystem Services to Advance Conservation on the Ground, 66781

Organised by: Heather Tallis

Meeting room: 73

Global assessments, books, and hundreds of journal articles have discussed how to quantify and value ecosystem services, and suggest that such valuation will advance conservation, possibly in lock step with development goals. Frameworks, conceptual models and guidelines have been developed to help identify tradeoffs and synergies between biodiversity, ecosystem services and commodity production or development. What happens in reality when these ideas are put into practice? This symposium highlights analyses and synthesis of outcomes from the use of ecosystem service valuation as a key conservation strategy. The focus is on conservation outcomes on the ground as opposed to methods or assessments. We demonstrate the use of ecosystem service valuation to create change in conservation planning, private land management, regulatory permitting, oil palm management and the design of water fund programs, among other applications. We also highlight how the strategy of ecosystem service valuation can best be delivered to the public and decision-makers so that land use and management decision are altered. This symposium directly addresses the conference theme, Harmony for Nature and Society, by providing some of the first examples of how we can actually achieve the alignment of these two systems that are often placed at odds under the current methods of decision making. We demonstrate a practical, transferable tool that can be used around the globe to take concrete steps towards a sustainable society.

MAPPING ECOSYSTEM SERVICES AND POVERTY IN THE AMAZON BASIN

Heather Tallis

Assessments of the state of ecosystems, the climate, or particular biomes have been playing increasingly important roles in policy design and decision making. Such approach was applied to the spatial assessment of the present state of ecosystem services in Mexico, a country that is well know for its wealth of natural and cultural capital. For that purpose we built an interdisciplinary team, compiled all the available information and used simple decision rules to map how ecosystem services were provided and benefited from in the country. We included in this assessment the following services: food (from agricultural and pastoral activities), woodfuel, water, carbon storage, pollination, regulation of floods, biodiversity regulation and susceptibility to invasive species; benefits were measured in terms of economic revenues, consumption rates, and number of benefited people. We then emphasized interconnections and trade-offs among services and among benefits by building two contrasting stories and providing management guidelines and main messages in a final document that was previously discussed with a heterogeneous sample of federal level decision makers. The impacts of this assessment on federal policy are still to be evaluated.

CONSERVATION AND DEVELOPMENT ARE COMPATIBLE GOALS: EVIDENCE FROM THE WORLD BANK, THE NATURE CONSERVANCY AND WORLD WILDLIFE FUND

Susan Ruffo

Rates of biodiversity loss are escalating as conservation efforts flag, worryingly undermined by a lack of harmonization in the policy arena and a dearth of agreed scientific findings. Despite unprecedented resources spent on convening meetings and commissioning consultations, assessments and studies, a concerning lack of crucial cross-sectoral action prevails. The failure among the Multilateral Environmental Agreements and between these conventions, the NGOs and other sectors to join forces is further weakened by the scientific community's seeming inability to provide timely, consensus-based findings required to deliver effective policies and actions. With conservation and development agendas delivering to different donors and aspirations, the prevailing silo-approach has resulted in severe competition for scarce resources and an inability to join forces to stem the growing degradation and ensure more profound and sustainable outcomes for the Planet. This is further exacerbated by a lack of consistent and coherent messages for the public; fueling a gap in understanding with regard to the relationship between functioning ecosystems, individual well being and solutions to the perils faced. There is an urgent need for the relevant communities of practice to "connect the dots" far more deliberately; actively reducing the benefits of territorial imperatives for institutions and individuals while providing incentives and tools to foster the sharing of ideas, data and skills.

REGIONAL CLIMATE CHANGE IMPACTS ON ECOSYSTEM SERVICE PROVISION

Peter Kareiva

ECOSYSTEM SERVICE AND BIODIVERSITY CONSEQUENCES OF FUTURE GLOBAL FOOD SECURITY

Erik Nelson

We construct two possible 2015 global land cover maps using published projections of urban and cropland expansion. Using these two scenarios of land cover in 2015, we estimate the change in the global production of several ecosystem services from 2000 to 2105, including crop production, timber production, and terrestrial carbon storage. We also estimate the change in biodiversity across the globe using species-area curves. Additionally, we project changes in irrigation water use and deforestation rates from 2000 to 2015. Finally, we estimate the Reduced Emissions from Deforestation and Degradation (REDD) payment levels that could prevent some or all of the projected deforestation. We assume REDD payments would have to be greater than the opportunity cost of retaining forests. All ecosystem service modeling is done using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) methodology introduced in Tallis et al. (2008) and Nelson et al. (2009).

MULTI-SCALE ECOSYSTEM SERVICE VALUATION IN INTEGRATED LARGE RIVER BASIN MANAGEMENT: DECISIONS IN THE UPPER YANGTZE BASIN

Wang Yukuan

As part of its efforts to reduce floods in the Yangtze River basin, the Government of China (GOC) is implementing a series of soil and vegetation conservation programs in the upper Yangtze watershed. To further increase the benefits of these measures, the GOC plans to establish an Ecosystem Function Conservation Areas (EFCAs) network of protected areas that aim to not only increase water retention capacity and reduce sediment loads, but also provide global benefits of biodiversity conservation and carbon sequestration. In order to feasibly plan the EFCA network and implement Integrated Ecosystem Management (IEM) in the upper Yangtze River basin, InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) models were applied at multiple scales to map and value the key ecosystem services of water yield, sediment retention, and carbon sequestration, and to map priority biodiversity protection areas. The regional scale of the entire upper Yangtze river basin (1,000,500 km²) and local scale of the Baoxing river basin (3,321 km²) provide information for EFCA planning, IEM, and Payments for Ecosystem Services (PES). In the Baoxing river basin, the ecosystem provides more than three times the value of Baoxing County's GDP to the local people, and at least that amount to downstream beneficiaries. To capture these values for promoting conservation, multi-scale results can be used to develop market-based regulation and PES as well as to design the critical EFCA network.

MAKING ECOSYSTEM SERVICES MAINSTREAM FOR PRIVATE LANDOWNERS: INSIGHTS FROM HAWAII

Gretchen Daily

Over the past decade, efforts to value and protect ecosystem services have been promoted by many as the last best hope for making conservation mainstream - attractive and commonplace worldwide. In theory, if institutions recognize the values of Nature, then we can greatly enhance investments in conservation and foster human well-being at the same time. In practice, we have not yet developed the scientific basis, and the policy and finance mechanisms, for integrating natural capital into resource and land use decisions on a large scale. We propose a conceptual framework and sketch a strategic plan to deliver on the promise of ecosystem services, drawing on emerging examples from Hawaii. We describe key frontiers for advancing the science and practice of accounting for natural capital in the decisions of individuals, communities, corporations, and governments.

IMPLEMENTING REGIONAL ECOSYSTEM BASED MANAGEMENT IN THE PUGET SOUND ECOSYSTEM

Juliann Aukema

Ecosystem services are becoming an increasingly important piece of conservation planning. For this reason we have been mapping, and in some cases, assessing the economic value of select services in the Puget Sound basin. Using the InVEST tool developed by the Natural Capital Project, we modeled several biophysical processes across the basin based on spatial data of land cover, topography, soil characteristics, etc. to assess the relative contribution of each part of a landscape to particular ecosystem services. In Puget Sound we modeled water yield, water retention, pollutants (PCBs, copper, PAHs, cadmium and PBDEs), and carbon storage. We discuss how this information is linked with marine work and how it can be used to guide basin-wide planning, restoration, and conservation actions in the Puget Sound.

INTELLIGENT DESIGN OF WATER FUND PROGRAMS: NEW SUCCESSES IN ECUADOR AND COLOMBIA

Alejandro Calvache

Deforestation, agricultural development and urbanization are heavily impacting biodiversity as well as water sources. To face this problem The Nature Conservancy has worked for over a decade establishing financial and institutional mechanisms that protect biodiversity, as well as conserve water sources for human consumption. Our working hypothesis is that better functioning ecosystems provide cleaner water and stabilize flow. The Nature Conservancy supported the creation of Quito Water Fund (FONAG) in Ecuador in 2,000. FONAG proved to be a successful tool for conservation, with a capital of 7 million dollars, is investing more than 1 million every year for watershed and biodiversity conservation activities. This model is being replicated across the region; with several examples as the city of Bogotá in Colombia and Cuenca in Ecuador, helping to protect more than 370.000 hectares of moist tropical forests and paramos (high-altitude grasslands). TNC strategy of creation of water funds is being designed and implemented using the best planning tools and science available and is bringing direct benefits to: biodiversity conservation, climate change mitigation, savings in treatment costs for water facilities due to avoided sedimentation, new environmental services payments creation, additional funds to protected areas and public private partnership for conservation investments.

Symposium:Asian Elephants in Fragmented Landscapes: Conflict or Conservation or Both? 66328

Organised by:Raman Sukumar, Aster Li Zhang, Prithiviraj Fernando

Meeting room:77

The Asian elephant (*Elephas maximus*) is often projected as a powerful flagship for the conservation of biodiversity in South and Southeast Asia. There are less than 50,000 Asian elephants left in the wild. On the basis of continued loss of habitat and regional reductions in population numbers, the Asian elephant is listed as Threatened in the IUCN Red List.

Most biologists and conservationists realize that the continued loss and fragmentation of habitat accompanied by increased elephant-human conflicts poses a significant threat to the survival of the elephant in Asia. Several studies of elephant-human conflict across the Asian range states are investigating the proximate environmental factors (e.g. landuse and vegetation patterns in the landscape) as well as ecological and behavioural factors (e.g. foraging strategies in relation to seasonal movement patterns) that correlate with elephant intrusions into crop fields and human settlements. Studies have also been evaluating the relative success of various methods (from noise making devices to electric fencing, chili-based deterrents and tracking "problem individuals") being used by governments and local communities to manage conflict. China has a small elephant population in conflict with human interests. A symposium that brings together studies from various parts of the elephant's range in Asia to share experiences and lessons in management of conflict would be very appropriate to the SCB's theme of "Conservation: Harmony for Nature and Society".

TOO MANY PEOPLE OR TOO MANY ELEPHANTS—HABITAT SELECTION AND HUMAN IMPACTS ON ASIAN ELEPHANT(ELEPHAS MAXIMUS) IN NANGUNHE NATIONAL NATURE RESERVE, YUNNAN OF CHINA

Li Zhang, Limin Feng, Zhisheng Wang, Liu Lin, Shaobing Yang, Bing Zhou, Chunhua Li, Youming Xiong

There are about 20 wild Asian elephants (*Elephas maximus*) living in the remained monsoon forest in Nangunhe National Nature Reserve in Yunnan province of China. Data on vegetation type and abundance, geography parameters (including aspect, slope, location and elevation etc), frequency of elephant sightings and other wildlife sightings records from the area were collected. Vanderploeg and Scavia's selectivity index were used to assess Asian elephant's preference to different habitat parameters. The results indicated that elephants preferred to select the habitat that the elevation is less than 1,000 meters, slope less than 10° and towards southeast and south. We also analyzed the change of forest pattern based on the satellite images of 1988, 2002 and 2007. The result was shown that 8% elephant preferred habitat was lost due to rural development in the Valley of Nangunhe River in the past 30 years. Meanwhile, eight elephants were killed for ivory poaching and human elephant conflicts. It's indicated that the loss of suitable habitat and increasing of human impacts were threatening the survival of Asian elephant population in Nangunhe region. How to balance the development of indigenous people's rural economy and preservation of elephant's nature habitat are the key tasks for the conservation of elephants in Nangunhe.

UNEASY NEIGHBOURS: PROMOTING HUMAN-ELEPHANT COEXISTENCE IN A FRAGMENTED ALTERED LANDSCAPE OF THE ANAMALAI HILLS, INDIA

Anand Kumar

Human-elephant conflict resolution has been critical for conservation of Asian elephants (*Elephas maximus*) in modern landscapes. The 220 km² Valparai plateau is an island of rainforest fragments, tea, coffee, and Eucalyptus plantations within the Anamalai-Parambikulam Elephant Reserve. I tracked elephant herds on foot and vehicle using GPS, and assessed property damage on field to study elephant use of habitats and their

conflicts with people for four years during 2002-07. Natural vegetation, despite its low availability, was crucial for elephants than monoculture plantations. Coffee and Eucalyptus were important refuges in areas devoid of natural vegetation, while tea was mainly used by elephants for movement at night. On average, 69% of conflicts and highest number of human and elephant deaths occurred between October and February. Landscape variables such as bamboo presence negatively and distance from park boundary positively related to human-elephant conflict incidents. Conflict incidents were significantly related positively to herd-days and negatively to rainfall in that month. Developing informant network system about elephants' presence, efforts by forest department and plantation community, and promotional campaigns by news media resulted in reduction of property damage and led to no human deaths. Establishing conflict response units and elephant communication system would promote human-elephant coexistence in such similarly fragmented landscapes.

ELEPHANT MANAGEMENT IN SRI LANKA: HIGH DENSITIES OF ELEPHANTS AMONG HIGH DENSITIES OF PEOPLE

Prithviraj Fernando, Sarath R. B. Dissanayake, Jennifer Pastorini

Elephant range in Sri Lanka is less than 2% of the global range but it supports over 10% of the global Asian elephant population. Seemingly a paradox when considering Sri Lanka's human density of over 300/km² and largely agriculture based economy. Research on elephant ecology showed that optimal habitat for elephants is created and maintained by anthropogenic disturbance of forests and creation of fresh water reservoirs, leading to high elephant densities. Habitat fragmentation through slash-and-burn agriculture benefits elephants, but habitat conversion to human settlements and permanent cultivation eliminates them. While substantial elephant mortality occurs through conflict with humans, the rarity of elephant poaching and high degree of tolerance displayed by Sri Lankans, related to their cultural and religious background, creates conditions amenable to human-elephant coexistence. Assessing impacts of management activities showed that management based on separating humans and elephants by limiting elephants to protected areas, a legacy of long held erroneous beliefs on elephant ecology and management practices dating back to the colonial era, failed in both mitigating the human-elephant conflict and conserving elephants. Therefore, a new strategy of managing elephants based on a landscape approach and research findings, making use of the beneficial effect of traditional agricultural practices, has been developed and is now being implemented in Sri Lanka.

REDUCING HUMAN-ELEPHANT CONFLICT: THE NEED FOR EVIDENCE-BASED APPROACHES

Simon Hedges, Donny Gunaryadi

Species conservation should be based on good science and reliable evidence: too often this is not the case. While there is a growing appreciation of the dangers of making interventions without evidence of their effectiveness, this appreciation is growing too slowly and is failing to have sufficient impact on conservation practice, even for high profile species such as elephants. Human-elephant conflict (HEC) is one of the most serious threats to elephants in Asia and Africa and can cause major economic losses for farmers. It is now widely accepted that effective and sustainable reduction of crop damage by elephants requires small-scale community-based methods for repelling elephants, but there are surprisingly few tests of such methods'

effectiveness. From Oct 2005 to May 2007, we tested a community-based crop guarding system using traditional tools at 3 HEC "hotspots" around Way Kambas National Park in Indonesia. In the 3 tests, elephant raids were repelled on 91% (52 out of 57), 88% (156 out of 178), and 80% (16 out of 20) of occasions. These results suggest that guarding using traditional tools can substantially reduce HEC. In attempting to compare our results to those from other projects in Indonesia and elsewhere, we were hindered by an apparent lack of evidence and we call for better reporting of what works, and what does not, so that best practice methods can be identified more readily and unsuccessful or unsustainable methods are not continually promoted.

HUMAN AND ELEPHANT CONFLICT - THE EFFECTS OF FOREST LOSS AND FOREST FRAGMENTATION IN SABAH(NORTH BORNEO)

Raymond Alfred

The biggest cause of human-elephant-conflict and ultimately decline in elephant populations in SE Asia has been due to the conversion and fragmentation of elephant habitat into plantations for oil palm and acacia. To study the impact of fragmentation on elephant ranging and habitat use, we tracked the movement and ranging of five elephant groups using Satellite based GPS collars. Elephant groups were collared both in fragmented habitats as well as in large contiguous habitats. In Sabah, Lower Kinabatangan Wildlife Sanctuary and Kalabakan Forest Reserve are extreme examples of the habitat conversion and forest fragmentation and we found very high rates of

conflict between humans and elephants in these two areas. This was a result of compression of elephant populations into smaller forest patches and cutting of critical corridors. The disturbance also resulted in elephants having to move frequently and thus resulting in high rates of daily movement probably leading to more conflict.

Although several mitigation measures are currently used in reducing the conflict, the future ideal options to manage the elephant and human conflict in Sabah are (i) restoring/securing the important ecological corridors and (ii) allowing the isolated elephant to be connected with bigger forest landscape.

THE ELEPHANT IN YOUR COFFEE CUP

Amirtharaj Christy Williams, Elisabet Purastuti, Nurchalis Faldhi

Many of us consider a cup of coffee as an essential ingredient of our daily life, but few would make a link between their cup of coffee and the disappearance of elephants in faraway Sumatra. We show here the impact of coffee consumption on the highly endangered Sumatran elephants in the Bukit Barisan Selatan NP (BBSNP), a world heritage site. We investigated the effect of this large scale habitat loss and fragmentation on the survival of Asian elephants in the Sekincau area of BBS NP using a combination of historical records of population numbers since 1993, satellite radio tracking and an analysis of the change in forest cover over the last 35 years. During this time, we found that forest cover within the range of elephants in the Sekincau area had declined by 85 %. The elephant numbers had declined by 88% in the last 15 years and the remaining 4 elephants had to be translocated to prevent them from being killed thus leading to the complete extinction of elephants in Sekincau area of BBS NP. We discuss these results in the context of increasing coffee prices over the last couple decades and show that illegal coffee grown within BBS NP went all over the world to be

consumed by people like us. In light of these findings, we discuss how that elephants might have a threshold of habitat loss and fragmentation beyond which their chances of surviving the immediate short term (<50-100 years) is slim.

TRACKING ELEPHANTS AND THEIR CONFLICTS WITH HUMANS IN THE FRAGMENTED LANDSCAPE OF NORTHERN WEST BENGAL, INDIA

Raman Sukumar, Mukti Roy, Sumanta Kundu, Anisha Thapa, Baskaran N

The habitat of a population of about 500 elephants along the Himalayan foothills in the Indian state of West Bengal is a fragmented mosaic of tropical moist forest, tea gardens and crop fields. This region has been one of the "hotspots" of elephant-human conflicts with an average of about 50 human deaths annually apart from extensive damage to cultivation. Using VHF- and GPS-based telemetry we tracked the movements of 14 elephants, including 7 bulls and 7 family groups, over periods from 3 to 54 months. Most of the elephants moved across forest patches through settlement and cultivation; home ranges of elephants tracked over dry and wet seasons varied from about 300 km² to over 1000 km² with the larger ranges covering more than one forest patch. All the collared elephants raided crops to varying extents. We illustrate this by describing in detail the movements of a family group whose annual movement pattern was tightly linked to a strategy of obligate crop raiding during the two seasons of cereal cultivation. The management of "viable" populations of elephants in highly fragmented landscapes requires active intervention to contain elephants in the short-term and consolidation of habitat in the long-term to reduce conflict.

ELEPHANTS FACILITATE PLANT INVASION DISPERSING MORE SEEDS, AND FARTHER AWAY, THAN SYMPATRIC MAMMALS IN SRI LANKA

Ahimsa Campos-Arceiz, Sampath K. K. Ekanayaka, Asier R. Larrinaga, Prithiviraj Fernando, Luis Santamaria

Plant invasions can be enhanced by biotic facilitation, such as seed dispersal mutualisms with local fauna. Different dispersal agents may have different effects on plant establishment and spread. We studied the seed dispersal of mesquite *Prosopis juliflora*, an invasive leguminous tree, by three functional groups of mammals (Asian elephants *Elephas maximus*, free-ranging domestic bovids *Bos taurus* and *Bubalus bubalis*, and monkeys *Semnopithecus entellus* and *Macaca sinica*) in southeastern Sri Lanka. Elephants dispersed more seeds (mean = 60.9 seeds/defecation), more frequently (seeds present in 47% of samples, N=180), and farther away (> 5 km) than bovids (mean = 14.9 seeds/defecation; 31% of samples, N=180; < 1 km) and monkeys (mean = 1.3 seeds/defecation; 17% of samples, N=179; dispersal only within invasion areas). Germination rate improved for seeds consumed by bovids (28.3% of seeds germinated, N=336), as compared to uningested controls (17.0%, N=289) and seeds consumed by elephants (9.2%, N=358) and monkeys (4.5%, N=178). Time to germination increased for seeds consumed by animals. Elephants and bovids are efficient and complementary seed dispersers for mesquite — elephants facilitate the colonization of new areas by long distance dispersal, while bovids facilitate the spread nearby current populations. The high efficiency of Endangered Asian elephants as dispersers of alien plants

results in a new form of conservation conflict.

Symposium: Cranes, Communities and Conservation: A Charismatic Bird Inspires Wetland Conservation Across Eastern Asia,68485

Organised by: James Harris, John Barzen, Fengshan Li, James Burnham

Meeting room:73

For 25 years the International Crane Foundation (ICF) has been active in East Asia identifying, studying and protecting the ecosystems that cranes and other water bird species utilize. Fundamental to ICF's mission of protecting the wetland and grassland systems that cranes need is the explicit acknowledgement that local human communities also depend on these ecosystems. By addressing the needs of human communities and applying sound scientific research, ICF contributes to conserving ecosystem function for a variety of users. While there is no magic formula that can be applied to the varying ecosystems or socio-political structures within East Asia, ICF has initiated and maintained projects tailored to conservation issues throughout the region. This symposium will illustrate the methods that ICF employs to address threats to wetland and grassland systems across eastern Asia. Eight speakers will use current ICF projects to illustrate these efforts; including micro-lending programs in southwestern China, community enterprise developments in Vietnam, educational efforts in China and Russia, understanding how waterbirds utilize landscapes in southeastern China, nature reserve management in eastern Russia and engaging policy makers in northeastern China to alter water-management practices. Although these projects all differ in the issues they address and in their objectives, they all seek similar outcomes: to find the common denominator between human and waterbird communities through the systems they share and ensure these ecosystems continue to function for a variety of users.

Community Trust Funds and Farmer Leadership in Integrating Community Development with Wetland Conservation at at China's Cao Hai National Nature Reserve

Fengshan Li, Liu Wen , Song Haokun

The community trust funds (CTFs) were initiated in 1995 at Cao Hai Nature Reserve of China, where local communities were poor economically and had had significant conflicts with the nature reserve over resource use. CTFs, with diverse operational mechanisms, were the first community micro-lending project and have been sustained the longest in China. Under supervision and assistance from the reserve, farmers themselves organize and operate the funds. While some groups failed in the early and middle years, 15 CTFs are now running, with 491 households participating and a total of 140,887 RMB of principle and interest. The establishment and operation of the CTFs has been a process of building farmer leadership, creating alternative livelihoods, and reducing pressure on Cao Hai's natural resources. In 2008, the Cao Hai Farmer Conservation and Development Association was established. The farmer association, operated on a project basis, receives projects through the reserve by taking conservation actions; the reserve gains supports from the farmers by facilitating development projects for the farmers. The transition from the CTFs to the farmer association has further involved the local community in the overall conservation effort, improved the relationship between the reserve and the community, and is achieving our long-term effort to integrate community development with nature conservation at Cao Hai.

Facilitating Community-based Enterprises and the Benefits for Conservation at Vietnam's Phu My Protected Area

Tran Triet ,Jeb Barzen

In many developing countries, there is a prevailing conflict between biodiversity conservation and the need for poverty alleviation. One possible solution for solving that conflict is to find ways that help poor people directly benefit from nature conservation activities. That approach has been tested in a wetland conservation project in Phu My village, Kien Luong District, Kien Giang Province. The 2,000-hectare seasonally inundated grassland, dominated by the sedge *Lepironia articulata* (Cyperaceae), in Phu My Village is the last of its kind remained in the Mekong Delta. In January 2004 a new model of protected area was established in Phu My Village. It is an "open" protected area where the local Khmer ethnic minority people are still allowed to harvest *Lepironia* as they have been doing for hundreds years. The project provides local people with skill training and production equipments so that they can make fine handicrafts from the *Lepironia* they harvest. The project also helps with marketing handicraft products to higher profitable export markets. After three years of operating, the daily income of people who participated in the project was on average twice as much as it was before the project. The unique remnant wetland is protected, which would otherwise have been turned into a rice cultivation area according to a previous land use planning of Kien Giang Province.

A Flyway Approach to Education Based on Local Perspectives on Resource Needs and Protection

Zhang Juan, Han Jing, Sara Moore , Joan Garland

Environmental education for local communities near nature reserve often fails because it does not address local concerns. This project explored methods for involving local communities in developing teaching materials and activities along the flyway of the endangered Siberian Crane. Our activities focused on the importance of wetlands, wildlife, and other natural resources from the perspective of local communities and aimed to enhance local leadership. School curricula, written in part by local teachers and specialists, provided classroom resources for villages near wetland reserves, while training built the capacity of teachers. Small grants encouraged teachers and students to take action for studying and conserving nature. A nature guidebook modeled approaches for teachers and reserve staff to introduce resource issues to nature reserve visitors. Our activities also linked communities in China, Russia and the United States through educator and student art exchanges, and through student camps, thus showing rural children the global significance of their activities. We exceeded our pre-set indicators for program evaluation, such as numbers of participants and types of participation. Achieving sustainable impacts depends upon on-going direct contact with project staff during the project development, recruitment of local "champions" for extending materials and activities, and recognition by nature reserve staff of the importance of local activism for conservation.

Incorporating Local Communities into Management of Muraviovka Park: a private approach to protected area strategies in Russia

SERGEI SMIRENSKI ,Marina Kolodina, James Harris

Muraviovka Park is the first non-governmental territory of sustainable land use in Russia. This paper reports on its efforts to protect threatened cranes, storks and wetlands, introduce environmentally friendly ways of land use, and improve education and living conditions of local people by involving them in Park activities. These approaches distinguish the Park's efforts from traditional governmental protected areas. The work began with nearby villages, bringing teachers and students to summer camps; some teachers worked as volunteers since 1994. The Park's most active supporters, however, come from elsewhere in Amur Region and abroad. A volunteer group Friends of Muraviovka Park (FOMP) was organized in 1998 in USA. In 2004, a similar group began in Amur Region, including people from surrounding villages, but most members live far from the Park. These regular visitors are highly diverse, but all enjoy new tasks and the human companionship of this international effort. In 2005, a South Korean FOMP began. Hundreds of people from around the world represent a global community of the Park, but too many from surrounding villages are still passive. We need to adjust our focus to expand local involvement and benefit from conservation and promote emerging feelings of ownership and pride.

Long-term environmental monitoring at Poyang Lake Nature Reserve and its role in regional decision making

JAMES BURNHAM, Jeb Barzen, Zeng Nan Jing , Wu Jian Dong

Worldwide, cranes inspire us through their depiction of fidelity, longevity and grace. As such, cranes represent a shared value through which divergent peoples can collaborate. Varied perspectives arise from disparate cultures like Russian and Vietnamese or through the varied life experiences of farmer and conservationist. Inspiration alone, however, is insufficient to derive effective solutions. It is through ecosystems, not cranes, that the resources capable of sustaining people and natural resources are found. An ecosystem approach, in turn, depends upon data. Data that elucidate the interaction among multiple services like biological diversity, carbon sequestration, water quality, and commodity production are critical to formulate conservation strategies that balance resource management in the context of ecosystem function as opposed to maximizing production of one resource or species alone. Success requires more time than funding cycles traditionally provide. Across the diverse cultures of eastern Asia, using cranes as a focal lens to view ecosystems has been productive but it requires a distribution of human resources that differs from current organizational arrays. Scaling up this approach from isolated sites to broader regions challenges traditional conservation strategies. Success with this human-based ecosystem approach requires diverse collaborations and open goals that can accommodate the adaptive responses inherent in any ecosystem analysis.

Twenty-five Years Experience with Cranes as a Flagship for Wetlands Conservation and Community Involvement in eastern Asia: Lessons, Limits, and Next Steps

Jeb Barzen , JAMES HARRIS

Worldwide, cranes inspire us through their depiction of fidelity, longevity and grace. As such, cranes represent a shared value through which divergent peoples can collaborate. Varied perspectives arise from disparate cultures like Russian and Vietnamese or through the varied life experiences of farmer and conservationist. Inspiration alone, however, is insufficient to derive effective solutions. It is through ecosystems, not cranes, that the resources capable of sustaining people and natural resources are found. An ecosystem approach, in turn, depends upon data. Data that elucidate the interaction among multiple services like biological diversity, carbon sequestration, water quality, and commodity production are critical to formulate conservation strategies that balance resource management in the context of ecosystem function as opposed to maximizing production of one resource or species alone. Success requires more time than funding cycles traditionally provide. Across the diverse cultures of eastern Asia, using cranes as a focal lens to view ecosystems has been productive but it requires a distribution of human resources that differs from current organizational arrays. Scaling up this approach from isolated sites to broader regions challenges traditional conservation strategies. Success with this human-based ecosystem approach requires diverse collaborations and open goals that can accommodate the adaptive responses inherent in any ecosystem analysis

Symposium: Drivers of the 21st Century Global Wildlife Trade: Key Challenges and Opportunities for Sustainability, 68382

Organised by: Julia Baum, Scripps Institution of Oceanography; Jedediah Brodie, University of Montana

Meeting room: 87

The global wildlife trade provides livelihoods for millions of people, and is an important source of food, medicine, and ornamentals in markets around the world. It is also one of the main drivers of biodiversity loss, endangering many wild populations and facilitating the introduction of diseases and invasive species into new regions. Trade is currently estimated at US\$5-20 billion, much of which is illegal, and it is rapidly growing. The goals of this symposium are to first synthesize current drivers of wildlife trade into a global framework, and second to develop strategies to mitigate the impacts on wild populations. Drawing on research across taxa and ecosystems, talks within the first session will assess the disparate global drivers of the trade, factors likely to affect trade in the coming decades, and compare subsistence versus luxury markets as well as local versus global markets. The second half of the symposium will focus on finding solutions to ensure that wildlife trade is sustainable, including global monitoring efforts, regulatory mechanisms, market-based solutions, and public-awareness campaigns. We will challenge speakers to be creative and to assess novel ideas for improving the wildlife trade. By understanding the global scope of the issue and commonalities across nations and continents, we will attempt to forge solutions that benefit both human livelihoods and wildlife populations. East Asia is a wildlife trade hotspot, making this symposium timely for this venue.

WILDLIFE TRADE: AN OVERVIEW OF CHALLENGES AND OPPORTUNITIES

Steven Broad

Human-wildlife conflict is one of the most significant problems for conservation in Indonesia today. Conflict in crop raids, wildlife trade, or habitat competition between human and wildlife are few examples the authority faces everyday. The Indonesian Government recognizes the significance of this problem and has developed policies in managing these conflicts. However, the problems remain to be too complex to be tackled by the Government alone. Improved policies and regulations, public awareness, and collaboration among all sectors should be adopted promptly to resolve human-wildlife conflict. Here, we present a case study on illegal beetle hunting and trading in the forest corridor of Halimun Salak National Park (HSNP). Beetle-human conflict arose due to the "invasion" of beetles to some human-restricted areas. HSNP are inhabited by 12 beetle species, of which one species is endemic to only Java. Their illegal hunting and trading poses a very serious threat not only to the biodiversity but also forest destruction. Collaboration of national park, NGO, university, business sector, local government and local communities from 6 sub-villages has played an active role in promoting the importance of the sustainability of HSNP. Through participatory biodiversity monitoring scheme, community empowerment and developing alternative livelihood, the model of community-based conservation in HSNP offers one alternative to answering the challenge on human-wildlife conflict in Indonesia.

USING INTERNATIONAL AND DOMESTIC LAW TO LIMIT WILDLIFE TRADE

John Fitzgerald

Fitzgerald will review the requirements of the Convention on International Trade in Endangered Species and other agreements. He will highlight parts of CITES and other agreements that could provide additional tools for ensuring that trade is limited to sustainable levels, including:

- *refining the Article IV requirement that species listed on Appendix II continue to fulfill their role in their ecosystems throughout their ranges and
- *that their harvesting be legal in other respects as well;
- *expanding use of Appendix III which allows countries to ask importing countries to help enforce their harvest limitations
- *empowering elements of other agreements such as the Conventions on Biological Diversity and Migratory Species
- *Implementing domestic laws of the US and others supporting sustainable limits, such as the 2008 US ban on the importation of illegally harvested wood
- *how we might integrate the forest and agriculture provisions of climate change agreements to help control excessive harvests of wildlife and plants and to help restore ecosystems
- *constructive and successful approaches that countries have taken in the World Trading Organization to new wildlife trade controls, and
- *options for funding control mechanisms.

SOLVING THE CRISIS: ELEMENTS OF SUCCESS IN MANAGING THE WILDLIFE TRADE

Elizabeth Bennett

Unsustainable wildlife trade is one of the most urgent threats facing many species today, whether for pets, food, medicines or other products. The threat is especially acute for tropical forest wildlife due to its low productivity. Solutions are often difficult due to real or perceived conflicts between livelihood and conservation goals, weak governance, low capacity and political support and, in some cases, the illegal nature of the trade and high prices for certain wildlife. Solutions are possible, however. Using case examples from Africa, Asia and Latin America, this paper shows that critical components of success include: long-term programs to build knowledge, relationships and trust; multiple partners bringing different skills and transparency; and sufficient capacity, resources and motivation at many levels.

WHY DEMAND REDUCTION CAMPAIGNS ARE ESSENTIAL TO MODERN DAY ENDANGERED SPECIES CONSERVATION AND HOW EFFECTIVE COMMUNICATIONS ARE CENTRAL

Steven Trent

Viewed globally, endangered species conservation is failing. Increasing numbers of species become vulnerable, threatened or endangered each year and this is occurring at such a startling rate that it is described as the 6th mass extinction of geological time - a direct result of human activity. The IUCN lists ~1 in 3 amphibians, 1 in 7 birds and 1 in 4 mammals as extinct or at risk of extinction. A new approach is necessary. A driving force behind the illegal trade in endangered species and the legal, but largely unsustainable trade in other wildlife is demand. The function of demand in endangered species trade is broadly analogous to its role in the illegal trade in narcotics, in that as long as demand exists the trade is likely to continue, irrespective of legal regulation and multi-lateral agreements, enforcement operations and increased expenditure. To address this, WildAid has pioneered an approach to demand reduction that uses communication tools and techniques from the commercial world, using the same methods companies employ to sell products as a means to persuade consumers not to buy endangered species. We call this "Conservation by Communication" and this presentation outlines how it works and what the results have been.

ALLIES AND APPROACHES FOR MOVING THE SEAHORSE TRADE TOWARDS SUSTAINABILITY

Sarah Foster

Innovation is required if the trade in seahorses (genus *Hippocampus*) is to proceed without damaging wild populations. These quirky fishes are overexploited all around the world for traditional medicine, aquarium display and curiosities. Because most are obtained by small-scale fishers or in trawls and other nonselective fishing gear, direct fisheries management is very difficult. We instead focused on influencing trade, from the primary buyer to end consumer. One key approach lay in convincing CITES Parties to regulate seahorse exports for sustainability, helping to provide (indirectly) a new instrument for regulating global fish trades. We were then able to generate support for a 10 cm minimum size limit for seahorses at export, and thus also

at capture. A key variable in conservation progress has been our strong engagement with the traditional Chinese medicine community, particularly in Hong Kong. We developed an advisory council of representatives from the traditional medicine industry, Chinese medicine training college, government, non-government conservation groups, academia, and public institutions. Along the way, we generated codes of conduct, research ventures, trade advisories, outreach programmes and a climate of trust that sustains new ventures. We are now creating a one stop web-based resource on seahorses, their trade and their management for national authorities charged with implementing CITES, as well as for traders, scientists and other interested groups.

SUSTAINABLE USE OF A VULNERABLE REEF FISH, THE HUMPHHEAD WRASSE: CITES, IUCN AND CONSUMER CAMPAIGNS

Yvonne Sadovy

The Napoleon fish (Humphead wrasse), *Cheilinus undulatus*, is one of the largest of all reef fishes and of considerable commercial value in Southeast Asia, particularly among Chinese communities, as part of the live reef food fish trade. The biology of this species makes it particularly vulnerable to overfishing and high demand in several countries pose a threat to the long-term sustainability of the species. To place international trade volumes of this species under sufficient control to ensure a sustainable fishery, the species was listed under the Convention on International Trade in Endangered Species of Flora and Fauna (CITES) on Appendix II in 2004. Major exporting countries, Malaysia and Indonesia have introduced export quotas based on a novel and interactive fisheries model for the species. Trade volumes through Hong Kong, the major entrepot for the species and which has taken serious steps to monitor and control the trade, appear to have declined and the considerable illegal trade from the Philippines into Malaysia is receiving increasing scrutiny and attention. A consumer campaign in Hong Kong is addressing the sustainable consumption of seafood in the live fish trade. As the time of writing this abstract, the major importing country, Mainland China, has yet to implement the Appendix II listing. Progress in the management of this species has been achieved as a result of the CITES listing, the first of its kind for a commercial reef food fish.

Symposium: Conservation Science for Giant Pandas and Their Habitat, 68030

Organised by: Ron Swaisgood, Fuwen Wei, Andy Kouba

The giant panda is considered a national treasure of China and an icon of conservation globally. If there is one species with which the Chinese are struggling to live in harmony, that species is the giant panda. The focus of the symposium is the identification of key ecological factors that influence giant panda populations and how human activities may impact these factors for good or for ill. Giant panda habitat is also among the most biodiverse in temperate ecosystems, making the more than 60 established panda reserves a case study of umbrella species protection for other fauna and flora. Most of these reserves have been established in the past decade and they are in need of conservation management strategies founded on sound science.

A significant expansion in fieldwork on giant pandas is underway and new information is emerging on critical limiting resources, landscape ecology, population ecology, movement patterns, nutritional ecology, and human-panda conflict over resources. For the foreseeable future panda conservation strategies will be implemented against a backdrop of changing scientific understanding of the species. If the Chinese people are

to live in harmony with pandas and their habitat, reserve managers and government agencies will need access to the most recent scientific information and rural communities will have to be engaged in the conservation process.

ARE BIRTH DENS A FACTOR LIMITING GIANT PANDA POPULATIONS IN RESERVES WITH A HISTORY OF LOGGING?

Ron Swaisgood, Zejun Zhang, Fuwen Wei,

The ecological carrying capacity is not known for any giant panda reserve. Bamboo resources are clearly a major determinant meriting investigation, but other resources may also be important. Here—using data collected at the Foping Nature Reserve, China—we propose that the availability of maternity den sites may be a significant resource limiting panda population size in many reserves. In most panda reserves in China, including Foping Nature Reserve, logging long ago eliminated most of the old-growth forests that contain trees of sufficient age and girth to contain a cavity suitable for a panda den. In such reserves pandas use rock caves, whereas in reserves with old-growth forests, pandas readily use tree cavities. These observations suggest that both the number and quality of available dens in most panda habitat today may be significantly less than before deforestation. Our behavioral observations of wild pandas provide evidence that den quality and quantity may compromise survival of cubs. We also found evidence that pandas may successfully rear twins when den conditions are optimal, a result in conflict with the almost universally held belief that pandas have obligate litter reduction. If our inferences are correct, we cannot rely on natural processes of forest recovery for a quick solution, as it will take centuries for the restoration of old-growth forests. In the short term, provision of artificial dens, where needed, could speed population growth and recovery.

ASSESSING THE IMPACT OF CLIMATE CHANGE ON GIANT PANDA HABITAT

Melanie Delion, Melissa Songer, Peter Leimgruber

Giant pandas (*Ailuropoda melanoleuca*) are probably one of the best known endangered species globally. Habitat loss is the main cause for the species' decline during the last 30 years. In addition to the direct impacts of human activities, the indirect impacts resulting from climate warming is another threat that could impact the giant panda's chance for survival in the long-term. We used published data in a Geographic Information System to expand habitat suitability models across the entire panda landscape to obtain a current estimate of potential habitat. We then used 2 widely-recognized global climate models to predict how climate change will impact giant panda habitat by the year 2080. Our current model showed that approximately 28,000 km² potential suitable habitat remains, with only 33 patches greater than 200 km². Climate change models estimated a reduction in habitat by 35-40% by 2080, depending on the model. The average elevation of the suitable habitat remaining shifts from 2,300 in the current model, to greater than 3,000m. Strategies for increasing protected area in the giant panda range should take the potential effects of climate change into consideration.

FORAGING STRATEGY AND SPATIAL ECOLOGY OF WILD GIANT PANDAS IN FOPING NATURE RESERVE, CHINA

Zejun Zhang, Yonggang Nie, James Sheppard, Ron Swaisgood, Fuwen Wei

Giant pandas depend on bamboo as their primary food source. The temporal and spatial distribution of bamboo of varying nutritional quality should therefore be a determining factor governing pandas' use of space. An understanding of these aspects of the animal-environment interaction is essential for the development of effective conservation management plans. To address these questions we studied the foraging ecology of wild giant pandas from 2007-2008 in Foping Nature Reserve, China. We found that the diet of pandas was composed primarily of new shoots of *Bashania fargesii* in Spring, leaves and new shoots of *Fargesia qinlingensis* in Winter-autumn, and leaves of *B. fargesii* in Winter. Our data from GPS-collared pandas revealed strong seasonal patterns of space use, with pandas dividing their time between high-elevation forests where *Bashania fargesii* is dominant and lower-elevation forests where *F. qinlingensis* is dominant. Analysis of nutrients in bamboo samples indicated that new shoots are more nutritious and digestible than other parts of the bamboo (branches and stems) and that pandas' seasonal space-use patterns bring them to bamboo stands of higher nutritional value at that time of year. These results underscore the need for conservation plans to afford protection for a variety of types of bamboo forests at different elevational ranges to accommodate for pandas' nutritional needs across time and space.

THE SPATIAL PATTERNS AND DYNAMICS OF GIANT PANDA'S HABITAT AND ITS IMPLEMENTATION IN CONSERVATION

Zhiyun Ouyang, Weihua Xu

Habitat loss and fragmentation are the main threats for giant pandas conservation. Combined with RS data since 1974 and field survey in all 23 panda distribution counties, the panda habitat patterns and their dynamics were accessed. Results showed that (1) Currently panda habitat was distributed in 24 isolated habitat units in six mountain ranges in southern-western China with the total area of 3.14 Million ha. (2) Spatial patterns of the panda habitat did not change much since 1974, but area of habitat decreased by 0.20 million ha since then. (3) 62 nature reserves were established in giant panda distribution region, protecting about 47% of the panda habitat. But most reserves were isolated with each other. 15 key areas and 18 linking areas were identified as critical areas for panda conservation. (4) The panda habitat is facing more and more threats from rapid tourism development, hydropower and mineral resource exploitation, and rural transportation development. The panda conservation is still facing challenges from habitat loss and fragmentation. Making every effort to link the isolated nature reserves and to build up nature reserve groups based on six mountain ranges should be the key strategy for the future panda habitat protection.

THE UTILITY OF CAMERA-TRAPPING AND SIGN TRANSECTS FOR WILDLIFE MONITORING IN NATURE RESERVES – A CASE STUDY OF WANGLANG NATURE RESERVE, CHINA

Sheng Li, William McShea, Dajun Wang, Junzhong Huang, Liangkun Shao,

Wildlife monitoring plays an important role in the management and conservation of biodiversity. Indirect sign surveys along pre-fixed transects are the standard methodology to monitor giant panda population during current monitoring activities in nature reserves within giant panda range, though it faces numerous uncertainties and problems. The utility of camera-trapping has been well developed for wildlife research in recent decades and successfully applied to the study and conservation of multiple species. We present a case study of expanding current giant panda monitoring by integrating camera-trapping into the monitoring system in Wanglang Nature Reserve, China, and assess the effectiveness of camera-monitoring compared to traditional sign transects. We found that Carnivora, Artiodactyla and Galliformes are appropriate taxa for monitoring with camera-trapping. Camera-trapping and sign transects differed little on detecting large mammal species richness, whereas camera-trapping was more effective on detecting pheasant species richness. We propose an improved biodiversity monitoring system that integrates camera-trapping with sign transects. Within the proposed system, camera-trapping will be used to monitor the diversity of large mammals and pheasants, while sign transects will focus on monitoring the population trends of certain large mammals such as giant panda, and serve as an additional tool to generate species list.

POPULATION SUBDIVISION AND SPATIAL DYNAMICS IN GIANT PANDA BASED ON LANDSCAPE AND POPULATION GENETICS ANALYSIS

Lifeng Zhu, Xiangjiang Zhan, Hua Wu, Tao Meng, Michael Willams Bruford, Fuwen Wei

dispersal is an integrative topic of paramount importance in evolutionary and behavioral ecology in animals. Ongoing habitat loss can alter individual behavior and local population dynamics. However, the correlative data on giant panda (*Ailuropoda melanoleuca*) is rare and controversial. Here we investigated population dynamics in its most isolated realm, the Xiaoxiangling and Daxiangling Mountains, and found the natural barrier, the Dadu river, and more recent physical barrier, 108 National Road, leading to habitat loss and fragment combing the human activity, had decreased gene flow between patches. But some potential migration individuals were identified between patches, which may reflect the evolutionary adaptation and counteraction on habitat fragmented of giant panda. Further, according to population and landscape genetics analysis, we strikingly found dispersal heterogeneity, different spatial genetic distribution, male-biased dispersal (FST, mAlc, vAlc and IBD test), especially in XXL regions, which may be contributed to different habitat quality, landscape features, inbreeding avoiding and intraspecific competition which each different patch under long-term human pressure. In conclusion, we provided a new insight on evolutionary adaptation of small isolated population of giant panda under different habitat quality, landscape features, and other environmental pressure. Finally, we put forward the efficient conservation strategies in these regions.

TOURISM DEVELOPMENT AND ITS IMPACT ON PANDA HABITAT IN WOLONG NATURE RESERVE, CHINA

Wei Liu, Guangming He, Christine Vogt, Jianguo Liu, Gary Roloff, Jian Yang,

Worldwide ecotourism has been widely promoted and implemented as a new conservation tool in protected areas, including the Wolong Nature Reserve for Giant Pandas in China. We conducted an interdisciplinary study on the ecological and socioeconomic impacts of tourism development in the reserve. We found a spatial disparity of tourism's economic benefit distribution toward households close to roads, which limited its potential on supporting forest conservation in remote areas. The numbers of hikers to core panda habitats have been increasing significantly, but vegetation survey showed that trail-use had not altered vegetation structure significantly. Our finding that pandas tended to avoid areas with high level of human use suggests its potential effects on functional habitat fragmentation. Across the reserve increasing use of the main road and recent tourism development in a major panda corridor area negatively affected panda population's long-term viability. While ecotourism has again been identified as the major conservation and development tool in the reserve's post-earthquake restoration and reconstruction, this study, which showed its mixed positive and negative impacts on panda habitat, appears to be timely and important. We suggest that future tourism planning and development in Wolong should follow a precautionary rule and adaptive management principle.

SPATIAL GENETIC STRUCTURE OF THE GIANT PANDA POPULATION IN LIANGSHAN MOUNTAINS

Yibo Hu, Xiangjiang Zhan, Dunwu Qi, Michael Willams Bruford, Fuwen WEI,

Spatial genetic structure, i.e. nonrandom spatial distribution of genotypes and alleles, influences and is influenced by many ecological and evolutionary processes. In this study, we examined the spatial genetic structure of the giant panda population in Liangshan Mountains, Sichuan Province, using noninvasive genetic sampling, 12 microsatellite loci and least-cost path model. Nonrandom spatial genetic structure was revealed and may be explained by restricted gene flow and family group structure. Spatial autocorrelation analysis demonstrated significant positive autocorrelation over close distances. Further spatial autocorrelation analysis and relatedness analysis revealed female-biased dispersal pattern of giant pandas at a large mountain-wide scale. The spatial scale of genetic structure occurred within distance of 12500 m derived from a least-cost path model. The characterization of spatial genetic structure of giant panda can therefore provide potentially valuable guidelines for habitat restoration and corridor construction.

GIANT PANDA HABITAT DYNAMICS IN A RECOVERING NATURE RESERVE

Xuehua Liu, Xiaoming SHAO, Xiangbo He, Ruixuan Tian, Yun Zhu, Gaodi Dang

Better conservation on giant pandas and their habitat has increased obviously the population density of giant pandas in Foping Nature Reserve (NR) with 91 individuals. Foping NR currently has the highest population density of giant pandas in the Qinling Mountains. The resource competition could make giant pandas to

migrate or disperse to the neighbor NRs which has similar or improved habitats. Therefore, the protection and recovering researches of these neighboring reserves are becoming important. Guanyinshan NR as a neighbor NR was selected in 2004 for implementing our recovering research. It has long been as a forest production bureau. Local forest resources have been restored after the Natural Forest Protection Program began, especially after its conversion to NR in 2000, which makes it possible to become the potential habitat for giant pandas to migrate or disperse from Foping NR. We aimed at (1) detecting the spatial-temporal changing of habitat pattern; (2) analyzing the plant community change; and (3) bamboo growth. The 10 permanent plots were set up in the research area for long-term habitat monitoring. The plant community survey was carried out every three years. The remote sensing was used to make analysis of the spatial-temporal habitat change.

ECOLOGICAL MONITORING IN GIANT PANDA RESERVES TO ENHANCE MANAGEMENT BASED ON SCIENTIFIC INFORMATION

Dajun Wang, Sheng Li, Hao Wang, Xiaodong Gu, Cheng Li, Yuanbin Zhang, Shaoying Liu, Wei Yang, Youping Chen

By the end of 2008, at least 63 nature reserves had been established focusing on protecting giant pandas (*Ailuropoda melanoleuca*) in China, relatively immense fund and effort had been invested into these reserves trying to increase the wild population, enlarge nature habitat, and conserve the biodiversity. To assess the effectivity of these nature reserves, a demonstration ecological monitoring project was developed and conducted in several giant panda reserves in Sichuan and Shaanxi province, including Wanglang Nature Reserve, Wolong Nature Reserve and Changqing Nature Reserve, aiming on several ecological indicators and different wildlife taxonomic groups using different methodologies. Within the proposed monitoring system, large- and medium-size mammals were monitored by camera-trapping, small mammals were monitored using mark-recapture, amphibians were monitored using breeding site survey, and insects were monitored using multi-methods. Also we monitored water, soil erosion and vegetation indicators. All monitoring data were collected and analyzed to evaluate the efficiency of conservation management, guiding the reserve managers to adjust their management activities to meet their conservation objectives.

LANDSCAPE CHARACTERISTICS OF GIANT PANDA HABITAT IN THE QINLING MOUNTAIN REGION OF CHINA

Tiantian Feng, Frank T. Van Manen, Naxun Zhao, Ming Li, Fuwen Wei

Because habitat loss and fragmentation threaten giant pandas, habitat protection and restoration are important conservation measures for this endangered species. However, distribution and value of potential habitat to giant pandas on a regional scale are not fully known. Therefore, we identified and ranked giant panda habitat in Foping Nature Reserve, Guanyinshan Nature Reserve, and adjacent areas in the Qinling Mountains of China. We used Mahalanobis distance and 11 digital habitat layers to develop a multivariate habitat signature associated with 247 surveyed giant panda locations, which we then applied to the study region. We identified approximately 128 km² of giant panda habitat in Foping Nature Reserve and 49 km² in

Guanyinshan Nature Reserve. We defined core habitat areas by incorporating a minimum patch size criterion based on home range size. Percentage of core habitat area was higher in Foping Nature Reserve than Guanyinshan Nature Reserve. Within the larger analysis region, Foping Nature Reserve contained 32.7% of all core habitat areas we identified, indicating regional importance of the reserve. We observed a negative relationship between distribution of core areas and presence of roads and small villages. Protection of giant panda habitat at lower elevations and improvement of habitat linkages among core habitat areas are important in a regional approach to giant panda conservation.

A WEBGIS-BASED DECISION SUPPORT SYSTEM FOR BALANCING HUMAN ENERGY NEEDS AND PANDA HABITAT CONSERVATION

Guangming He, Xiaodong Chen, Wei Liu, Shiqiang Zhou, Hemin Zhang, Zhiyun Ouyang, Shuxin Li, Jianguo Liu,

A daunting challenge for conservation scientists is to assist geographically dispersed stakeholders in understanding the dynamics of complex human-natural systems and balancing human needs and biological conservation. Using Wolong Nature Reserve for giant pandas (*Ailuropoda melanoleuca*) in China as an example, we have developed a web-based decision support system named WOW (Wolong Online WebGIS) that is integrated with geographic information systems, systems modeling and simulation, and decision analysis for panda conservation. With WOW, users can construct policy scenarios to simulate the dynamics of human population and energy needs (fuelwood), assess the social, economic and ecological impacts of fuelwood collection on human community and panda habitat under different scenarios, and make collective choices assisted by a multicriteria decision-making method. To demonstrate the functionalities and capabilities of WOW, stakeholders worldwide were invited to evaluate four pre-designed scenarios. The evaluation results showed that the scenario of thinning plantation forests to meet energy needs of rural households in the reserve was preferred by most stakeholders. WOW not only provides an open platform for stakeholders to participate in the decision making but also can be used as an educational tool for the general public to understand complex human-natural systems. The methodology presented here can be used for similar issues in such systems in many other parts of the world.

GLOBAL WARMING THREATENS SURVIVAL OF THE GIANT PANDA

James Robert Spotila, Hou Rong, Zhang Zhihe, John Spotila

The giant panda is a symbol of conservation in China and in the world. Historically the giant panda occupied a range that encompassed a large area of China. Today it is restricted to a few reserves in mountainous areas of Sichuan, Gansu and Shaanxi Provinces. There are about 1000 pandas in the wild and it is not known how many survived the Sichuan earthquake of May 2008. We have undertaken a study to determine the potential effects of global warming on the survival of giant pandas in this century. Preliminary data indicate that pandas move up and down mountains in response to seasonal changes in temperature. Biophysical studies of insulation and absorptive properties of panda fur provide insight into their thermoregulatory capabilities and provide a preliminary "climate space" for the giant panda. Climate projections suggest that global warming

will cause life zones to shift up the mountains, further reducing viable habitat for giant pandas. The Chengdu Research Base of Giant Panda Breeding provides an excellent location to study the physiological and biophysical ecology of the giant panda in order to better predict the habitat requirements for this species and foster the reintroduction of giant pandas into the wild.

Symposium: The Asian Primate Crisis: Priorities and Actions, 68294

Organised by: Yongcheng Long

Meeting room:113

Primates represent the third most diverse order of living mammals after Rodentia and Chiroptera, with 634 recognized taxa. They are also one of the most threatened, with 48% of taxa threatened globally. Asian primate species constitute 1/5th of the total primate species of the world and according to the latest red list assessment, with 71% of them are considered threatened.

Presentations in the symposium "The Asian Primate Crisis: Priorities and Actions" address these issues of profile, policy and practice as well as the technical underpinning of conservation biology which allows an understanding of the dimensions of the crisis. With presentations addressing issues such as human-primate conflict, communities and conservation, and the issues involved with legislating and enforcing relationships between primates and humans, this symposia highlights the need for primates and humans to live in harmony. We have not yet lost a primate species in the 20th or 21st centuries. Only with a holistic approach and deep understanding of the relationships between human actions and their impacts on primates can we ensure that this does not occur in the future.

THE ASIAN PRIMATE CRISIS IN THE GLOBAL CONTEXT—CHALLENGES, OPPORTUNITIES, AND POTENTIAL SOLUTIONS

Russel Mittermeier

CURRENT STATUS AND CONSERVATION NEEDS FOR CHINESE GIBBONS

Xuelong Jiang, Peng-Fei Fan, Yingxiang Wang

As typical tropical forest dwellers in Southeast Asia, gibbon extended its distribution range in history to Yangtze River, and in Guangdong and Guangxi, southwest and south China, and become unique components of Chinese fauna, including Hoolock leuconedys, Hylobates lar, Nomascus concolor, N. hainanus, N. leucogenys, and N. nasutus. Nomascus hainanus is endemic to Hainan Island with a tiny population of 17-20 individuals in Bawangling National Nature Reserve. N. nasutus, a recently rediscovered gibbon with 18 individuals, inhabits Bangliang limestone forest in Jingxi, Guangxi along the border of Vietnam. H. lar in western Yunnan, a distinct subspecies (H. l. yunnansis) along the border of Myanmar, might be extinct. Similarly, N. leucogenys would suffer great conservation problems since no reports about its population and

distribution for many years. *H. leuconedys* though can be heard or found in some sites, no status review has been done in past fifteen years. The largest population is *N. concolor*, a gibbon mainly found in Yunnan with a population of over 1,000 individuals. Lacking data on population, distribution and habitat is a common issue for all gibbons and much other wildlife in China. Major threats to Chinese gibbons are habitat loss, degradation and fragmentation, and hunting. Habitat loss and hunting are principal reasons for gibbon extinction in history, while habitat and population fragmentation are potential threats for their survival in near future.

EFFORTS TO SAVE CRITICAL ENDANGERED PRIMATES IN INDONESIA

Jatna Supriatna, Achmad Yanuar

Over 70% of Asian primates are threatened with extinction, and at least two dozen taxa are Critically Endangered (CR) and 5 of them are in Indonesia namely Sumatran orangutan (*Pongo abelli*), Western and Central Javan Gibbon (*Hylobates moloch moloch* and *Hylobates moloch pangolsoni*), Siberut macaque (*Macaca pagensis siberu*), and Pagai macaque (*Macaca pagensis pagensis*). Rampant of deforestation activities either caused by agriculture expansion included palm oil plantation, recurrent Forest fires, pulp industries, mining at the protected forest, hunting or human resettlement threaten the primate habitat. Frequent surveys were carried for those CR but not for Pagai macaques. Compilation of all survey data produced a comprehensive picture of orang-utan distribution in Sumatra, approximately is still . 6,500. Recent survey in 2008 has the same results of 2004 surveys that Javan gibbon population at the range of 4500 both in west and central Java. Based on 2008 surveys Pagai and Siberut macaques, however, has decreased significantly not only because their habitat is plumented due to logging but also traditional hunting for food. Conservation efforts to establish new protected areas, making corridor among protected areas and others have been carried out in those critical endangered primates except the Pagai macaque.

THE ENIGMATIC HAINAN GIBBON *NOMASCUS HAINANUS*: WHAT DO WE ALREADY KNOW AND WHAT ELSE DO WE NEED TO KNOW?

Bosco P. L. Chan, John Fellowes

In 2005, we summarised what was known about the Hainan gibbon, and recommended actions to improve its chances of survival into the next century. Being the world's most threatened ape, there has been a recent surge of study and conservation work on the Hainan gibbon. However, probably due to a lack of communication, there remains a lot of untested information regarding the population size, social structure, ecological requirements, and the most urgent actions required to revive the depleted population. We have been working on-site with the provincial conservation authority and nature reserve since 2003, and gained a fairly comprehensive understanding of the situation. We have also been funding habitat restoration, gibbon monitoring, and postgraduate studies regarding the species and its habitat. Here we summarise existing information on the species' biological / ecological requirements, and report what, to our knowledge, has been done on the ground to conserve the species and its habitat. The most urgent actions appear to be the continued restoration of lowland forest habitat, the study of solitary individuals and barriers to new group formation, and better enforcement against poaching and forest clearance. The latter would be achieved most

effectively in parallel with community conservation work.

PRIMATE ECOTOURISM: PROSPECT AND CRISIS ON ITS CONSERVATION IN CHINA

Jinhua Li

Primate tourism is a recent and growing trend in primate habitat countries. Primate tourism may also have a serious downside, and some conservationists argue that researchers have not done enough to evaluate its impact on primate groups (Butynski 2001). Clearly such information would be useful in designing tourism operations that minimize detrimental effects on primates. As a primate-rich country, China has developed many primate tourism projects in the last 20 years. Most Chinese including governmental officials believe that primate ecotourism would be effective to resolve economic and conservation conflicts. Therefore, primate ecotourism as popular tourist attractions has been rapidly expanded in China. We focused on three populations of Tibetan monkey (*Macaca thibetana*) in three different provinces (Mt. Huangshan (Anhui), Mt. Emei (Sichun) and Mt. Tangjiahe (Gansu)), and analyzed the relations between tourist contact and population growth. We particularly followed Tibetan monkeys in the Mt. Huangshan population and assessed tourist impact on their social behaviors. According to our results, we put forward some suggestions to decrease or avoid negative effects on primate populations from primate ecotourism. The present study would be a general instruction to Asian primate conservation due to similar tradition, history, economy and culture in the area.

WILD TO WILD RAPID TRANSLOCATION: A POTENTIAL CONSERVATION AND RESCUE TOOL FOR HOOLOCK GIBBONS IN NORTHEASTERN INDIA

Sally R. Walker, Sanjay Molur

The Hoolock Gibbon has been assessed as Endangered in 2009 IUCN Red List of Threatened Species, but its status does not reflect its perilous position. Facing a predicted decline of 75% in the next two decades, the main problems for the 120 hoolock populations throughout 5 states of Northeastern India are habitat loss and hunting. This includes 52 isolated populations (43%) of 1-10 individuals. Twelve healthy populations (10%) consisting of 51-160 individuals are distributed in two states while 56 populations (47%) vary widely from 11-50 individuals in 4 states. Given the difficulty of curtailing habitat destruction and hunting, and of effective protection, the implementation of immediate, radical conservation methods may save existing healthy populations from further decline and extinction. Wild-to-wild rapid translocations utilizing the small populations to strengthen the larger ones will thereby salvage many of those populations as well. Targeting localities nearby the larger and better protected Hoolock habitats as recipient sites would satisfy behavioural, genetic and demographic issues. A programme including rapid translocation, restoration, economic and social features strengthened by education and awareness, following IUCN Reintroduction Guidelines may save Hoolocks from extinction in India.

SURVIVING STATUS AND SUFFERING THREATS OF FRANÇOIS' LANGUR WITHIN ITS BROAD REGION AND CORRESPONDING SUGGESTIONS FOR CONSERVATION

Gang Hu

Trachypithecus francoisi is noticeably widespread geographically, ranging from northern Vietnam to southwest China, about 21°30' to 29°08'N. It was historically recorded in 3 provinces (Guangxi, Guizhou, and Chongqing) in China and 6 provinces in North Vietnam.

Latest surveys showed that François' langur has been extirpated from some of its original distribution and become restricted to isolated fragments. By 2003, only 300 individuals were found in 14 isolated sites scattering in 10 counties in Guangxi. Similarly, less than 300 individuals, survived in 10 isolated sites in 2 provinces in North Vietnam and hunting was considered to be the main threat.

Contrarily, population size remained relative stably in Guizhou where hunting pressure was much slight, but food resource was general scarce and fluctuating due to geographic influence and human disturbance. Langur overcame these hurdles and kept thriving via dietary broadening and switching, crop-raiding, and other behavioral flexibility. These adaptive strategies, however, exacerbated existing human-langur conflict via raiding crops and competition with grazing goats, and may lead to potential inbreeding.

Thus, except hunting forbidden, setting up of migrating corridor between isolated sites should be given priority in Guangxi and North Vietnam, while limitation of goat rearing, agricultural encroachment and firewood collection should be taken into account in Guizhou.

FFI'S EXPERIENCE INVOLVING LOCAL COMMUNITIES IN SITE-BASED CONSERVATION OF CRITICALLY ENDANGERED PRIMATES IN NORTHERN VIETNAM AND SOUTHERN CHINA

Lu Yan, Paul Insua-Cao

Northern Vietnam and southern China have several species of Endangered and Critically Endangered crested gibbons (*Nomascus*), langurs (*Trachypithecus*) and snub-nosed monkeys (*Rhinopithecus*). Conservation issues affecting these species share similarities. They are often only known from few locations, being isolated forests in remote mountainous regions and local communities are usually poor, marginalised ethnic minorities with a mostly subsistence lifestyle dependent upon local forests. For several years, FFI has been implementing field-based conservation projects targeting four Critically Endangered primates at different sites in the region. FFI's approach in these locations has been to work closely with local communities, particularly in planning, awareness raising and forest patrols. The degrees of success are variable, with two of the species showing good signs of recovery. We need to examine closely external factors affecting successful conservation outcomes, prior to making a long-term commitment at new locations. With limited resources, it is necessary to strategically select locations where investment is most likely to yield the highest returns for conservation. The type and level of impact from local communities is an obvious starting point. In addition, it is important to consider the commitment and support from local government partners for direct field conservation activities and provincial government for political and regulatory support.

SETTING UP A GEODATABASE FOR PRIMATES IN CHINA

Yongcheng Long

China is the continental country in north hemisphere with most primates species. The country has more primate species than any Asian countries except Indonesia with 24 species or 45 taxa, belonging to 8 genera in 3 families. It is estimated that about half of the country's territory might have served as the habitat for the primate taxa. To date, all the data about their taxonomy, distribution and conservation status have been documented as the word description and scattered in a large array of files with more than 200 papers in a time span almost one century. Hence, the flaws on the data are very hard to be identified not to mention the revision or correction. The purpose of this initiative is to get all sorts of data related to the primates in China to be well integrated in a geodatabase so as to provide a baseline data set that is easy for general review by all the stakeholders in this field. Thus, its ultimate goal is to ensure all the data in the set be verifiable, revisable, fine-tunable, manageable and accessible. In this way, a good platform will be set up for guiding the efforts of conservation, management and all sorts of basic study on the primate species in China so as to attract more investment and attention from international communities.

THE IMPACT OF HUMAN-PRIMATE CONFLICT ON PRIMATE CONSERVATION IN INDIA

Sanjay Molur, Sally R. Walker

Shrinking habitats, adept learning behaviour in primates and increasing intolerance in humans have seen an increase in human-primate conflicts in India in recent times. An overwhelming welfare approach in carrying out mitigation of such conflicts has led to several instances of compromise in in situ primate conservation status. Documented problem primate releases show an increasing trend in such exercises (88% increase since 2001 as compared to the previous decade) conducted by organizations in India; 72% by government agencies and the remaining by non-government agencies. There is not an instance of such releases or translocation measures carried out till date that reflect a sound scientific rationale as per the suggestions of the IUCN reintroduction guidelines. No effort to monitor such released populations has been conducted and in some instances primates have occupied vacant niches where the species never occurred before. This amounts to introduction of aliens as well as creating human-primate conflict in additional localities. Human-primate conflicts and such mitigation attempts create additional conservation problems increasing the ongoing Asian Primate Crisis. Steps to mitigate these threats through scientific conservation measures and limit the dangers posed by poorly planned releases will benefit both animal and man.

CURRENT STATUS AND CONSERVATION OF THE GRAY SNUB-NOSED MONKEY IN GUIZHOU, CHINA (ORAL PRESENTATION)

Zuo-Fu Xiang, Ming Li

Gray snub-nosed monkeys *Rhinopithecus brelichi* (Colobinae), categorized as Endangered on the IUCN Red List, are endemic to Guizhou, China. To evaluate the species' current status we surveyed five sites in the Mt

Fanjing area between August 2007 and June 2008. These sites were identified from previous surveys and interviews with local officials and villagers. Four sub-populations, with a total of ca. 750 individuals, were located in mixed deciduous and evergreen broad leaf forest at 800 - 2,200 m asl. Identified threats to the species include (1) accidentally injured or killed by poaching, (2) loss or alteration of habitat through wood extraction, and (3) loss or alteration of habitat through economic activities, such as building projects and illegal mining. We recommend that several actions be taken to alleviate the anthropogenic pressure on the ecosystem including: (1) designating specific forest reserve for sustainable wood extraction, (2) utilizing biogas to reduce firewood demands, (3) introducing local people to bamboo utilization for generate greater cash income, (4) educating for young people and encouraging them to work in developed areas, and (5) encouraging the villagers to move out the mountain.

A MOUNTAIN TO CLIMB: WILDLIFE PROTECTION - A SLIPPERY SLOPE OF REGULATIONS AND ENFORCEMENT IN INDOCHINA

Tilo Nadler

Natural environments in the Indochinese region suffer from immense wildlife extraction. There is increasing consumer demand for wildlife products, with a majority of illegal exports flowing to local markets in China. All Indochinese countries have passed regulations which generally provide protection for rare and threatened animal species, including penalties for violation. These laws are widely viewed as mere suggestions and are not strictly enforced. Some regulations provide support for the illegal wildlife trade. Failed enforcement of a strict law in Vietnam, passed in 1992, resulted in amendments which allow auctioning of confiscated wildlife, and the return of such wildlife to the trade as "legal". Other regulations support the farming of wildlife, including rare and threatened species, with purported intention to compensate consumer demand and protect wild populations. However, regulations do not consider the source of these animals. Without proper laws and enforcement, wild caught animals remain cheaper to produce than farm animals.

Conservation activities of foreign organizations / governments have rarely focused on support for regulation drafting and operational plans to implement law enforcement. These governance actions are generally respected as national autonomy. Without consulting governance legislation, all other activities to protect and conserve wildlife populations will remain insufficient.

LANDSCAPE GENETICS ANALYSIS OF YUNNAN SNUB-NOSED MONKEY (RHINOPITHECUS BIETI), IMPLYING ANTHROPOGENIC GENETIC DISCONTINITY

Zhijin Liu, Baoping Ren, Yongcheng Long, Fuwen WEI, Ming Li

Here we reported landscape genetic analysis of the Yunnan snub-nosed monkey (*Rhinopithecus bieti*), a Tibetan Plateau endemic primate. DNA was extracted from blood, tissue and fecal samples of 137 wild individuals from 11 out of 15 extant monkey groups. Ten microsatellite loci were used to characterize patterns of genetic diversity. The most striking feature of the population structure was the presence of five subpopulations with distinct genetic backgrounds and unique spatial regions, which were defined as five management units (MUs). Even *R. bieti* is the highest non-human primate inhabiting in relatively primitive

Tibetan Plateau, its population structure appeared to be shaped by anthropogenic landscape features and gene flow between subpopulations were strongly impeded by arable land, highway and human residential sites. These anthropogenic landscapes explained greater proportion of the genetic variation (59.29%) than the geographical distance alone (22.09%) among monkey groups. It suggests that the increasing human influence, especially anthropogenic habitat fragmentation, is becoming the third main factor shaping genetic structure and evolutionary potential of wildlife on the Tibetan Plateau, besides commonly considered historical plateau uplift and climate changes.

RAPID FIELD TECHNIQUES IN CONJUNCTION WITH PRIOR KNOWLEDGE ON LANGURS AND MACAQUES IN SOUTHERN INDIA

Mewa Singh

A variety of methods have been developed to determine occurrence, distribution patterns, relative abundance and densities of wild animals. However, if the purpose of census is to develop theoretical models regarding population dynamics, one needs most accurate figures. On the other hand, if the purpose is to develop conservation strategies that are urgently required for a species, even the less accurate methods such as Rapid Surveys provide enough information, especially for a species that is widespread. I here report the results of a Rapid Survey carried out in 1984 on lion-tailed macaques in the Western Ghats of India by Karanth. Recently, we undertook a long term study during which we actually sighted almost all groups of lion-tailed macaques in the state of Karnataka in south India. Surprisingly, our results matched most of the findings of Karanth. I further illustrate the distribution of Hanuman langurs in India which are now being classified into several species. These langurs are the most widespread primates in India and little field data are available on their status. It is possible that some species/subspecies are endangered. The census aimed at figures with high accuracy would require years. I advocate that Rapid Surveys may provide urgent data required for the identification of the status of these species so that proper management plans could be developed before these species/subspecies reach the status of becoming Critically Endangered.

THE DIET COMPOSITION OF HAINAN GIBBON

Jiang Zhou

The food composition of Hainan gibbon: Hainan gibbon was a frugivore. The total plants species are 122 species, 72 genus and 49 families which eaten by the Hainan gibbons, there were 83 species 53 genus and 36 families belong to the rain season foods of Hainan gibbons, the ratio of arbors is 83.1%, the vines are 15.7% and the herbs are 1.2%. The percentage of fruits is from 90.4% to 91.6%, and the young leaves are from 7.2% to 8.4%, the flowers are 1.2%. There are great differences of the food compositions among the Hainan gibbon and the other gibbon species, especially for the ficus fruit. The mainly plant families are Moraceae, Myrtaceae, Annonaceae, Lauraceae, Euphorblaceae, Elaeocarpaceae and so on, which eaten by Hainan gibbon. There were 64 species 31 families plants were recorded, which were eaten by Hainan black-crested gibbon (*N. hainanus*) in dry season. The life form of the food plants could be divided into arbor (79.7%), vine (15.6%) and herb (4.7%), the components of the dry season were fruits (77.9-82.8%), young leave (17.6-18.8%) and flowers (4.4-4.7%).

A PRIMATE IN CRISIS: A CASE STUDY OF THE WESTERN PURPLE-FACED LANGUR IN SRI LANKA, ONE OF THE 25 MOST THREATENED PRIMATES IN THE WORLD

Jinie D S Dela, Anura Sathurusinghe, U K G Kalinga Padmalal, Asantha Ratnayake, Sangeeth Silva

PRIMATES AT NANKANG, MT. GAOLIGONG, YUNNAN: SPECIES RICHNESS AND THREATS TO THE COMMUNITY

Wen Xiao, Sheng Huo, Peng-Fei Fan, Ru-Tao Lin, Huai-Sen Ai

Nankang (24°49'N, 98°47'E; 1700-2200 m asl.), locates between Gaoligongshan national reserve and Xiaoheshan provincial nature reserve, is managed as a habitat corridor for wildlife. It is separated by two highways from two nature reserve. Supported by RSG, a survey was done to evaluate species richness and threats to primate at Nankang between March 20 and April 5, 2008. About 40 km² forest was traversed several times follow a series of transects by 25 people which were divided into 4 groups. Rangers from nature reserve and locals from nearby village were interviewed at the end of survey. Five species, including Hoolock hoolock, *Trachypithecus phayrei*, *Macaca arctoides*, *Macaca leonine* and *Macaca assamensis*, was rescored; while another two, *Macaca mulatta* and *Nycticebus coucang*, was reported at Nankang region during this survey.

Nankang is the place of the most primate richness in China and a primate hotspot north to the tropic of Cancer since so many species occurs in such a small area. However, primate community at Nankang still facing threats including habitat degradation resulting from tea-ko plantation, population isolation by highway and poaching. In addition, abundance of Hoolock hoolock is low in this region. Thus, conservation actions should be reinforced at Nankang, although both nature reserves have strengthened their management in recent years.

Symposium: Forest Management and Wildlife Conservation from China and International Perspectives - Seeking Harmony of Wildlife Biodiversity and Human Demands for Forest Resources, 68456

Organised by: Yong Wang

Meeting room: 77

Forest managements affect habitat suitability of wildlife species. There exists heightened concern for wildlife biodiversity conservation by resource managers and conservationists worldwide, and it is a foundation principle of ecologically sustainable forestry. Meeting both human and wildlife goals is a challenge for forest management because forests support approximately 65% of the world's terrestrial taxa. Forests are the most species-rich environments on the planet for many wildlife groups. China faces similar and unique challenges in forest resources management and wildlife biodiversity conservation. Suitable forest habitats for wildlife are declining. Wildlife species are probably more severely affected by human-induced environmental and habitat changes in China because of large population and rapid economic development. While forests cover 30 million ha (17% land area, ranked 122), China has had one of the highest rates of forest depletion over the past 50 years. China is among the countries with the greatest number of threatened birds and mammals. Forest exploitation and monoculture have led to adverse consequences including loss of wildlife biodiversity.

The objectives of this symposium are to provide an opportunity for forest and wildlife researchers from China and international to examine issues related to forest management practices, discuss the impact and importance of these practices to wildlife biodiversity, and share collaboration ideas for sustainable forest resource management for wildlife conservation.

MANAGING FORESTS FOR WILDLIFE AND PEOPLE: AN HISTORICAL PERSPECTIVE

Malcolm L. Hunter

The earliest forms of forest management were based on the instrumental value of wild species as resources for people: chiefly trees for fuel and construction material, and various animals and plants for food and medicines. First “custodial forestry” focused on simply protecting these resources from overexploitation and fires. This was followed by “sustained-yield forestry” that carefully regulated harvests, especially of timber, to assure a continuous supply of commodities. Later this evolved into “production silviculture” that emulated agriculture in its attempts to channel a site’s resources into high levels of timber production. A strong focus on timber production was balanced to some degree, especially on public lands, by “multiple-use forestry” that recognized the importance of other assets such as water, recreational opportunities, and wildlife. All of these approaches to forestry still exist to some degree but beginning in the 1980s, two significant paradigm shifts started to shape new approaches to management. First, the whole set of values of all species (various instrumental values, potential value, and intrinsic value) have been increasingly recognized, as marked by the ascendancy of the term “biodiversity.” Second, “ecological forestry” has come into the spotlight, bringing with it an emphasis on natural patterns and processes, both working with them as a model for management and striving to maintain their integrity.

SUSTAINABLE FOREST MANAGEMENT PRACTICES AND CONSERVATION OF WILDLIFE BIODIVERSITY IN USA: PAST, PRESENT AND FUTURE.

Callie Schweitzer

The discussion of sustainable forest management has focused primarily on what not to do, not on what needs to be done. Although we have progressed to more comprehensive metrics on which to base sustainable management (i.e. the Montreal Criteria and Indicators), we still lack knowledge of which values of these indicators are associated with sustainable or unsustainable forestry. Changes in forest area by forest type may be an indicator used to measure biological diversity; however, does this correctly reflect needed habitats, on different temporal and spatial scales, for a particular animal species, or group of species? We are still struggling to ascertain how forest management activities impact species such as reptiles and amphibians on a stand level. The mechanisms affecting wildlife population dynamics from forest management practices have often been treated as a black box. Statistically valid studies (in particular those that are replicated) involving large-scale stand manipulations and analysis of vegetation and animal response are few, and application of results among different physiographic regions must be done with care. However, it is data from exactly those types of studies that will allow us to adapt forest management practices to meet not only growing demands, but also a growing knowledge base of wildlife habitat management requirements.

THE EFFECT OF SELECTIVE LOGGING ON THE HABITAT USE AND SELECTION OF WAPITI (CERVUS ELAPHUS XANTHOPYGUS) IN THE WANDA MOUNTAINS, NORTHEAST CHINA

Minghai Zhang

In 2004 and 2005, we studied winter habitat use and selection of wapiti by the methods of “used habitat versus available habitat”, in the Wandashan Mountains, Heilongjiang Province, China. Using Geographic Information System (GIS) and Remote Sensing (RS), we measured habitat availability in terms of the area of each habitat category in the study area. The used habitat were measured by designing 35 transects, 498 plots (10m*10m). The results revealed that middle and high harvested habitat were heavily used by wapiti and were selected positively, while low harvested habitat was less used and negatively selected. There had been high food abundance and availability in deforested land during 7 years after timber harvest.

Wapiti bed-site habitat heavily used mixed coniferous and broadleaf stands, clear area, bare land, brush land, broad-leaved scattered woodland and positively selected the later four type stands. Wapiti forage habitat heavily used mixed coniferous and broadleaf stand, cleared area, broad-leaved scattered woodland brush land, and positively selected the later three type stands.

Wapiti bed-site and forage habitat were mainly distributed in the distance range from 600m to 1km to open road, and there was a buffer zone around resident area with radius 2.74 km where no Wapiti activity point was observed.

IMPACTS OF MANAGEMENT AND ENVIRONMENT FACTORS ON OF BIRD COMMUNITIES IN FOREST- GRASSLAND ECOTONE IN EAST ASIA

Kun Shi

The paper focused on bird communities in forest-grassland ecotone affected by management and environment factors in East Asia. In central Japan, bird species were divided into several groups depending on their occurrence in forest-grassland edges: grassland specialists including the skylark *Alauda arvensis* and the fan-tailed warbler *Cisticola juncidis*, semi-grassland species including the barn swallow *Hirundo rustica* and the cattle egret *Bubulcus ibis*, semi-forest species, such as the tree sparrow *Passer montanus*, the bush warbler *Cettia diphone*, and the brown-eared bulbul *Hypsipetes amaurotis*, forest specialists, such as the great tit *Parus major*, generalists, such as the oriental greenfinch *Carduelis sinica* and the black kite *Milvus migrans*, and miscellaneous other species. The bird communities were separated into different groups due to vegetation structure, geographic factors and management impact. In northern Inner Mongolian grassland, vegetation structure and biomass and other environmental factors affected species richness and abundance of birds inhabiting forest-grassland ecotone.

Symposium: Combining Local and Scientific Knowledge to Monitor Central Asia's Ungulates, 66461

Organised by: Navinder Jeet Singh, Imperial College London, Nature Conservation Foundation, India; E.J. Milner-Gulland, Imperial College London

Central Asia's rangelands and mountains are strongholds for several endemic ungulates. Little is known about the ecology of these species due to the region's remoteness and the isolation experienced by most of the countries during Soviet times. Hunting, habitat modification, increased livestock grazing and development are major current threats (Berger et al 2008; Bhatnagar et al. 2006; Robinson & Milner-Gulland 2003; Singh 2008). There is an urgent need for better monitoring to identify the size, distribution and dynamics of these populations if we are to deal effectively with these threats. The feasibility of standard scientific monitoring is greatly influenced by the remoteness of the region, low capacity and financial constraints. This is true both for species inhabiting inaccessible mountain terrain (e.g. argali) and those which are migratory over very large areas of rangeland (e.g. Mongolian gazelle, saiga).

Participatory monitoring involving local people is a practical approach to obtaining the necessary information that has been well tested elsewhere (Danielsen et al. 2005). Involving local people in monitoring and conservation of species also leads to a sense of ownership and engagement in resource management that has so far been lacking in these regions. However, further challenges in implementation include how best to structure incentives for involvement in monitoring when the animals are not continuously present in a monitor's local area, and when the monitors may well currently be illegal resource users.

MONITORING MOVEMENTS AND HABITAT OF MONGOLIAN GAZELLES USING SATELLITE TECH-NOLOGIES

Takehiko Y Ito, Atsushi Tsunekawa, Badamjav Lhagvasuren

Mongolian gazelles (*Procapra gutturosa*) inhabiting the Mongolian steppe migrates long distances, and conservation strategies for gazelles are required. To conserve long-distance migratory ungulates, understanding of animal movement patterns and monitoring habitat condition in vast range are necessary. Because interannual climate variation is great in arid lands such as Central Asia, it may affect plant productivity and habitat use of animals. Satellite technologies are powerful tools to research animal movements and evaluate their habitat condition in such environments. We are tracking Mongolian gazelles using Argos system in Mongolia, and evaluating their habitat using normalized difference vegetation index (NDVI) derived from satellite images as an indicator of plant availability. Continuous monitoring from 2002 has shown interannual differences of tracked gazelles' movements and spatial distribution pattern of NDVI values in their habitat, and suggests that interannual change of spatial distribution of plant availability affects habitat use of Mongolian gazelles. Drought in summer and snow cover in winter seems to be main factors of interannual differences of gazelles' habitat use. Therefore, conservation strategies considering interannual climate changes are necessary for long-distance migratory species.

THE HIDDEN COSTS OF CASHMERE: DO MONGOLIAN SAIGA HAVE A FUTURE?

Joel Berger, Bayabaatar Buuveibaatar, Charudutt Mishra

Numerous ungulates of Asia's arid steppes are in decline. Mongolian saiga (*Saiga tartarica mongolica*) are no exception. To conserve saiga, we are adopting multiple approaches, including examination of past data and current field work to identify factors associated with population change. Analyses of censuses spanning 3 decades showed no clear relationship to any single or suite of factors including livestock densities, winter severity, summer rainfall, and density dependence. However, livestock densities comprise more than 98% of the ungulate biomass in saiga range. While camels and horses have declined in abundance, goat numbers have more than doubled in ten years. Given that 1) China and Mongolia are the world's largest producers of cashmere, 2) cashmere is increasingly popular as an export, and 3) it is available at progressively lower prices in Italy, the United Kingdom, and the United States, a desire for fashion may inadvertently be lowering the probability of long term persistence for saiga and other Asian ungulates. That semi-nomadic pastoralists aspire to improve their lifestyles is obvious, making the issue itself simple -- finding ways to facilitate herders while not impeding saiga persistence. Solutions will be complex and require thinking from more than conservation biologists.

COMBINING LOCAL AND RANGER-BASED MONITORING OF SAIGA ANTELOPES AS A CONSERVATION TOOL IN KALMYKIA, RUSSIA

E.J. Milner-Gulland, Elisabeth Whitebread, Khongir Manzhiev, Diana Obgenova, Yuri Arylov, Ana-toly Khludnev, Navinder Jeet Singh, Anna Lushchekina

Due to the nomadic behaviour of the critically endangered saiga antelope in Kalmykia, southern Russia, there is a dearth of information on seasonal changes in saiga distributions and behaviour outside reserves. We developed a pilot participatory monitoring programme, building on several years of community engagement, aimed at involving local shepherds within the saiga range in collecting ecological information about the species. We carried out a concurrent assessment of potential biases in the 5-year ranger monitoring programme within the saiga reserves. Ranger sightings were concentrated in areas with tracks, meaning large areas of the reserves are under-monitored. Saiga group sizes were on average 20% overestimated. Rangers and shepherds had comparable accuracy in assessing saiga distance and group sizes. In the first few weeks shepherds had made 40 sightings, mostly near reserves, adding substantially to the saiga monitoring area, but seeing many fewer saigas than rangers patrolling in the same area. 96% of villagers were positive about the pilot scheme, boding well for efforts to build a sustainable monitoring network. A key requirement for monitoring in the future is to ensure that a measure of effort is included in any observation programme.

USING RESOURCE SELECTION FUNCTIONS TO SAMPLE RARE SPECIES IN HIGH-ALTITUDE ECO-SYSTEMS: A CASE STUDY WITH TIBETAN ARGALI

Navinder Jeet Singh, Nigel Gilles Yoccoz, Joseph Larkin Fox, Yash Veer Bhatnagar

a. Sampling and monitoring for conservation must be based on efficient sampling schemes. Simple random sampling approaches are not of sufficient sampling intensity to ensure enough observations. Stratified random sampling (SRS), with strata defined using resource selection functions (RSFs) is a promising approach for improving the models of distribution of rare species, increasing precision and correcting for bias. We used SRS to sample the Tibetan argali (*Ovis ammon hodgsoni*) in Indian Transhimalaya to estimate their distribution and test if it leads to a significant reduction in survey effort. We first used a priori selected vantage points and survey transects to sample argali in the study area and make initial spatial predictions. The spatial predictions based on estimated RSFs were then used to stratify the study area. The model-based SRS demonstrated that even though only 16.7% of the total time sampling was spent in the highest RSF stratum, it contained 50% of the observations. The lowest stratum received 63.5% of the total survey effort but contained only 12% of the observations. Furthermore the best models selected on the basis of the prospective sample differed from those using the first a priori sample, suggesting bias in the initial sampling effort. The method therefore has significant implications for decreasing sampling effort in terms of sampling time in the field, especially when dealing with rare species, and removing initial sampling bias.

Monitoring movement and Food niche of argali in Southwestern Altai, China

Chu Hongjun, Jiang Zhigang, Lan Wenxu, Qi Yingjie, Tao Yongshan, Jiang Feng

Argali sheep *Ovis ammon* is listed as the endangered species in China. However, ecology and conservation status of this species is barely unknown. From 2004, we started argali biological conservation program in Altay Prefecture, Xinjiang, China. We present the preliminary results on radio telemetry and diets of argali in paper. From October 2005 to November 2006, we captured and put radio-collars on a 4-year-old male argali and a 4-year-old female using improved steel traps in the eastern part of Mt. Kekesen. We traced the radio collared argali for continuously 13 months and successfully recorded 180 positions of the radio collared argali (89 data from the female argali, 91 from male). We calculated the home range with the 100% Minimum Convex Polygon (MCP) Method and Kernel Method. MCP home range of the male argali was 158.87 km² and 27.63 km² for the female, respectively. According to Kernel Method, areas of 95% occurrence was 101.66 km² for the male and 29.25 km² for the female. Home ranges of argali were relatively stable; no difference was discovered in moving distances of argali in all seasons. Home ranges of collared argali were all around water source. From November 2006 to December 2008, food niche of argali *Ovis ammon* and its overlaps with the niches of sympatric goitred gazelle *Gazella subgutturosa sairensis*, domestic sheep, horse and camel were studied with micro-histological analysis in Mt. Kalamaili and Mt. Kekesen in southern Altai. We found (1) Those herbivores mainly grazed on *Stipa* spp., *Ceratoides lateens*, *Artemisia* spp., *Haloxylon persicnm* and *Spiraea hypericifolia*; (2) Values of Pianka's niche overlap index, *C*, between pairs of herbivores were all over 0.8 in winter. The results illuminated there were food competition among argali, gazelles and pastoral livestock in forage shortage seasons. Increase in the numbers of domestic sheep and goats poses a risk for argali and goitred gazelle populations in the area. Thus, for protecting argali, wildlife management should

protect water source, reduce human activities around water source and restrict the grazing areas of livestock.

CONSERVATION AND MONITORING OF TIBETAN ANTELOPE, TIBETAN GAZELLE AND KIANG IN THE CHANG TANG NATURE RESERVE, CHINA

Joseph Larkin Fox

The still abundant high plains ungulates of the western Tibetan Plateau are ostensibly protected within large new nature reserves, but at the same time new rangeland management policies are being applied within those reserves that have the potential to significantly affect their populations. Both reliable assessment of what is there in terms of these wildlife populations and means to assess population changes present large challenges. Questions of population monitoring have been given little thought, just as effects on wildlife of the livestock development actions have received little consideration. I present new results for density estimates of antelope, gazelle and kiang in the western Chang Tang reserve (including previously unsurveyed areas), and consider the needs and challenges to effectively monitor the effects on their populations of the rapidly changing rangeland management and resource use patterns in this region. A combination of multi-level enhancement of conservation awareness, including community level participation and benefits, will be required to effectively address the reserve's stated conservation goals. The importance of such considerations focuses on the fact that although the populations of these species in the reserve still lie in the tens of thousands, and include ancient long-distance migratory patterns, ongoing development actions are likely to greatly threaten both.

Symposium: Common Property, Biodiversity Conservation, and Climate Change,69006

Organised by:David Barton Bray, Ashini Chhatre

Evidence accumulates that both strict protected areas and community tenure, i.e. multiple use commons with multi-scale governance, can be effective at reducing land cover change and biodiversity loss. Evidence that both can be effective in varying circumstances forces consideration of another socially desirable goal: poverty reduction. Meanwhile, climate change shuffles the habitat deck creating shifts in species distribution and abundance, with high extinction rates predicted with unchecked climate change. We examine interactions and comparisons between strict protected areas and multiple use commons institutions and poverty reduction and climate change mitigation and adaptation. We will analyze larger landscapes with varied tenure forms and their capacity to achieve biodiversity conservation and sustainable livelihoods in the context of global climate change. Despite mounting evidence of no panaceas on an increasingly flat, hot, and crowded planet, strict protected areas are still the main institutional mechanism for biodiversity conservation globally. But many protected areas have human habitation, and democratization and development do not favor continued expansion of exclusionary institutions. Papers will examine theory and evidence from global comparisons and many world regions on an institutional architecture that may integrate protected areas and multiple use commons at larger spatial and altitudinal scales for improved governance of biodiversity conservation and sustainable livelihoods. This symposium is organized by the International Association for the Study of the Commons (IASC) and the Social Science Working Group (SSWG) of the SCB.

COMMUNITY PROTECTED AREAS, BIODIVERSITY CONSERVATION, AND CLIMATE CHANGE MITIGATION IN MEXICO

David Barton Bray, Elvira Duran

Research on institutions suggests that external interventions “crowd out” desired behaviors if perceived to be controlling, but can “crowd in” desired behaviors if they are supportive. Public protected areas frequently crowds out conservation behaviors by local populations. Emerging community conservation areas (CCAs) offer the opportunity to crowd in intrinsically motivated conservation behavior in new institutional mosaics in landscapes protected by community collective action. Megadiverse Mexico is an example where current land tenure patterns make it difficult to decree more public protected areas (now 11.3% of territory), and where CCAs are becoming an important conservation strategy aided by new legislation. We review data from a national survey on CCAs and draw on interviews, field observations, and available literature to analyze the emergence of CCAs in the Sierra Norte of Oaxaca and impacts on biodiversity conservation and opportunities for climate change adaptation in an anthropogenic landscape with suites of productive land uses that include timber production, payment for environmental services, and ecotourism. We find that in this social-ecological system common property regimes impacted by unstable commodity prices and emigration have strategically adapted by creating new conservation-oriented multi-scale governance institutions in a region that includes unique vegetation associations and opportunities for conservation of jaguars (*Panthera onca*).

POTENTIALS AND CONSTRAINTS TO CARBON TRADING IN CHINESE COLLECTIVE FORESTS

Jianchu Xu, Andreas Wilkes, Timm Tennigkeit

Protected areas are central to biodiversity conservation, but do not often meet conservation objectives on their own, while imposing heavy social costs on local residents. Complex interactions among institutional characteristics within surrounding landscapes also shape conservation outcomes, particularly in human-dominated landscapes. A better understanding of this complexity factors prominently in academic and policy debates, which increasingly seek effective strategies to maintain forest cover and biodiversity while sustaining local livelihoods.

We investigated the role of forest management institutional diversity in mediating trade-offs between forest biodiversity and livelihoods in complex landscape mosaics. We employed theoretical insights from institutional economics, landscape ecology, and sustainability science, to explore the relationship between institutional mosaics regulating a landscape, and biodiversity and livelihoods outcomes. Drawing on spatial data for forest cover and institutional designations, plot-level vegetation data, and interview-based livelihoods information, we used quantitative measures of landscape structure to examine how institutional mosaics relate to tree diversity and forest-derived livelihoods across the landscape. Results focus on spatial patterns of outcomes in three landscapes – one each in Guatemala, Tanzania, and India – at the forefront of the challenge to reconcile biodiversity conservation and human well-being.

FOREST INSTITUTIONAL MOSAICS, BIODIVERSITY CONSERVATION, AND SUSTAINABLE LIVELIHOODS IN HUMAN-DOMINATED TROPICAL LANDSCAPES

Lauren Persha, Ashwini Chhatre, Arun Agrawal, Edwin Castellanos, Rucha Gate

Protected areas are central to biodiversity conservation, but do not often meet conservation objectives on their own, while imposing heavy social costs on local residents. Complex interactions among institutional characteristics within surrounding landscapes also shape conservation outcomes, particularly in human-dominated landscapes. A better understanding of this complexity factors prominently in academic and policy debates, which increasingly seek effective strategies to maintain forest cover and biodiversity while sustaining local livelihoods.

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FOREST COMMONS AT THE INTERSECTION OF LIVELIHOODS, BIODIVERSITY, AND CLIMATE CHANGE

Ashwini Chhatre

Better forest governance has become increasingly important with the wider recognition of critical benefits forests provide in multiple dimensions. These benefits include livelihoods to millions of poor households, carbon sequestration to mitigate climate change, and conservation of tropical biodiversity. We analyzed data on 1) woody biomass, 2) tree diversity, and 3) contributions to rural livelihoods from 123 forest commons in 11 tropical countries across Asia, Africa, and Latin America. We find no cases with high outcomes on all three dimensions, and no association between any two benefits. We found significant clustering of benefits in three dimensions, resulting in four groups of forest commons with different combinations of biomass, biodiversity, and livelihoods: 1) Disturbed Forests, 2) Conservation Forests, 3) Plantation Forests, and 4) Subsistence Forests. The analysis demonstrates the association of forest commons clusters to various social and biophysical drivers of variation and change. We conclude that a strategy of constituting forest commons can help in tailoring of incentives to spatial heterogeneities in social, biophysical, ecological, and economic factors, complementing other policies for alleviating poverty, conserving biodiversity, and mitigating climate change.

CONSERVATION PARADIGMS AND FOREST CHANGE: THE ROLE OF POPULATION, AFFLUENCE AND INSTITUTIONS

Harini Nagendra, Elinor Ostrom

Loss of forest cover represents a serious environmental challenge. Many studies of deforestation draw strong links to underlying variables such as population, affluence, and technology. Such simplistic explanations tend to ignore the institutional aspect of forest conservation altogether. Further, these explanations are usually assessed at the national-level, and are rarely posed at more appropriate social-ecological system scales. This presentation discusses evidence from a long-term research program, the International Forestry Resources and Institutions (IFRI) program. Active across multiple countries, this program contains information from forests managed across a range of institutional contexts including open access forests, common property areas managed by communities, and protected areas managed by governments. Our goal is to compare the impacts of population, affluence and institutional context on forest change and conservation across a range of social-ecological contexts. We find that institutional factors such as tenure regime, monitoring and group size play a key role in determining the direction of forest change. Thus, more nuanced approaches to forest conservation need to be developed that acknowledge the powerful capacities of people to organize themselves into collective groups to combat problems of natural resource degradation, and determine the conditions under which such collective action tends to be most successful.

Symposium: Cost of Ensuring Biodiversity Security: Making the World Protected Areas Network Resilient to Climate Change, 68238

Organised by: Rebecca Shaw

The ability of ecosystems to adapt naturally to climate change lies at the heart of the objectives of the United Nations Framework Convention on Climate Change (UNFCCC). Biodiversity provides the raw material necessary for the natural adaptation of ecosystems, and the UNFCCC thus places biodiversity security at a level equivalent to energy, climate and food security. Biodiversity security can be defined as the variation of ecosystems and species such that there is an unimpaired flow of ecosystem services under current and future anticipated conditions. We have made significant investments in the conservation and management of this biodiversity security and the resultant ecosystem services necessary for human well-being. These investments are based on a static view of the world, while the world is changing. Changing climates are causing species ranges to shift and are also affecting the dynamics of processes, thus changing levels of ecosystem service supply. We need to adapt our existing management strategies to safeguard our biodiversity and ecosystem service security in the face of climate change. In this symposium, we present the first global estimate of the cost of ensuring biodiversity security in the face of climate change and use a suite of case studies from Madagascar, Chile, South Africa and California, to assess the implications of climate change for biodiversity security, the most effective adaptation strategies, the costs of adaptation; and mechanisms to finance these costs.

No More Business As Usual For Conservation Under Climate Change

Guy Franklin Midgley

We suggest a definition of biodiversity security which is prompted by the necessity to balance the consideration of ecosystems with food, climate and energy security, as defined by the objective of Article 2 (the Objective) of the United Nations Framework Convention on Climate Change (UNFCCC). We demonstrate a direct dependence between a key requirement of Article 2 “[to] allow ecosystems to adapt naturally [to anthropogenic climate change]” and biodiversity, because it is the variation of genetic material imbued in biodiversity that provides the raw material necessary for “natural adaptation”. This direct link, and the previously unrecognized implication in Article 2 of the UNFCCC that biodiversity lies at its heart, could help to justify a step increase in investment in ensuring biodiversity security, especially for the benefit of securing ecosystem services for human well-being. This might happen partly through a radical reassessment of conservation strategies to improve their pre-emption of climate change impacts, and by harnessing emerging signs of natural adaptation by wild species to ongoing climate change.

The Cost Of Providing Biodiversity Security Under Climate Change In Madagascar

Jonah Morris Busch, Lee Hannah

The existing global protected area network represents a substantial investment by societies worldwide to ensure biodiversity security for future generations. Protected areas cover more than 11.5% of the Earth’s land surface and provide protection for 88% of the world’s vertebrates and 80% of all threatened species. Given the critical role of protected areas in ensuring biodiversity security, it is essential to understand both the geographic pattern and the magnitude of projected climate change impacts on protected areas and their associated biodiversity. Our analysis shows that globally, more than half of the world’s protected areas are at risk from climate change. Humid tropical forests – containing more than half the species described on Earth and storing 80% of the carbon found in terrestrial vegetation – are especially vulnerable. Seventy-seven percent of protected areas in the humid tropics are vulnerable to climate change, and in 27% of tropical forest reserves current climates are projected to disappear entirely. Thus, our research suggests there is a significant risk that the existing global reserve network will fail in its primary objective - to safeguard biodiversity security - unless the world’s governments and conservation agencies implement additional policies and climate adaptive conservation strategies.

Cost Of Ensuring Biodiversity Security: Making The World Protected Areas Network Resilient To Climate Change

Sandy J Andelman

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BIODIVERSITY SECURITY IN THE FACE OF CLIMATE CHANGE: BUILDING BRIDGES TO PREVENT SPECIES FROM FALLING INTO CHILE'S WIDENING SCIENCE-POLICY GAP

Pablo A Marquet, Sebastian Abades, Fabio Labra, David Panitz, Juan Armesto

The Chilean government has made a substantial investment in assuring biodiversity security, reflected in a network of Protected Areas (PAs) which cover around 20% of continental Chile. Recent evidence, however, shows that the current PA network does not provide adequate coverage of key biodiversity areas such as the Valdivian Forest ecoregion.

Here we provide an example of the interaction between Food, Energy and Biodiversity security and how a lack of balance and regulation in investment among them can have negative results, and in this case imperil Biodiversity security. We do this by analyzing how much safeguarding of Biodiversity Security will the PA network in the Valdivian ecoregion, provide in the face of Climate Change. To do this we assessed the response of 104 species plant, and vertebrates species whose distribution encompass the area under analysis. We found that a large percent of the species will change and /or reduce their current distribution. However, if we add the existence of a hostile matrix of human land-used, the results show a tantamount increase in the number of affected species with 10% of them becoming critically endangered.

We evaluate how much would it cost to prevent species to become critically endangered. Making this happen will require bridging a widening science-policy gap and creating awareness of the importance of restoring the balance between security components.

DETERMINING THE COSTS OF CONSERVATION RESPONSES TO CLIMATE CHANGE: A CASE STUDY FROM A GLOBAL BIODIVERSITY HOTSPOT

Russell Wise, Belinda Reyers

Little is known about the costs and implementation context of conservation responses to climate change. We investigate a set of responses in the Cape Floristic Region of South Africa using a conservation plan developed for 316 Proteaceae species tracking climate change until 2050. These responses include expanding current protected areas by 240 000 ha using on- and off-reserve mechanisms, as well as seed banking. Using a cost function and existing data from the region we find that the costs of the off-reserve responses are \$310 million

and \$1 231 million without and with compensation of opportunity costs respectively, while the cost of the on-reserve response is \$483 million. The seed banking costs total \$18 144 for species with no future suitable habitat and \$159 264 for all species as a precautionary response, but this does not include the costs of reintroductions as these data do not exist. These costs are much higher than existing budgets. We propose that if, like other adaptation responses, they were examined in relation to: their benefits, the planning environment and partnerships for building sustainable futures, then the costs themselves become less of a barrier to implementation. We highlight funding sources for future leverage and action.

CLIMATE CHANGE TRIPLES THE COST OF ENSURING CALIFORNIA'S BIODIVERSITY SECURITY

Rebecca Shaw

With impacts of climate change, costly new land protection and species management strategies are needed to achieve current conservation goals. In an analysis of a 780,000 acre (320,000 ha) landscape around Mount Hamilton, California, we found 43% of the endemic, highly-restricted species at high risk of local extinction requiring assisted migration strategies to new suitable areas and 41% of the wide-ranging species in need of new climate-adaptive conservation strategies, such as new land use, land acquisition and land management contracts, in order to persist in the future. The total cost of sustaining the biodiversity security of this landscape under a current climate would likely exceed \$300M during the next 40 years. Under scenario planning for climate change, the total cost could exceed \$750 million, or a 2.5 times increase. With considerable emphasis on the adoption of new policies to incentivize implementation of lower-costs climate-adapted strategies in place of traditional, resource-intensive strategies such as land acquisition, the costs can be reduced considerably.

Symposium: New Approaches to Monitoring Biodiversity,68432

Organised by: Richard Primack, Keping Ma

The theme of the session will be innovative approaches for monitoring biodiversity. Monitoring biodiversity has been one of the central activities of conservation biology, allowing scientists to determine the health and status of particular species, the composition and structure of biological communities, and critical ecosystem processes. Past approaches are now being expanded in a number of new directions. For example, scientists are currently developing networks of citizen scientists, in many cases linked by the Internet, both to gather data over wide areas and to help educate the public about environmental issues. Scientists are also developing long-term perspectives by seeking out historical and overlooked data sets to determine how species composition has changed over time in specific places. Increasing concern for climate change also has encouraged the joint analysis of monitoring data and climate data; in many cases the impact of climate change can already be seen in changing phenology and abundance. The use of remote sensing, combined with field studies, allows monitoring over wider areas than previously possible. Improving technology and analysis allows monitoring of habitat degradation and loss with greater precision and at a finer scale. The final approach that will be using a phylogenetic approach to determine if closely related species are responding in a similar way to environmental threats, such as climate change, and can potentially be helped with similar conservation measures.

LONG-TERM AND LARGE SCALE FOREST BIODIVERSITY MONITORING NETWORK IN TAIWAN

I Fang Sun

Taiwan, with 36,000 km² in area, is an offshore island located 150 km off the coast of southeastern China. Situated between 24°N to 22°N in the subtropical region, Taiwan has mild weather all year round. The monthly mean temperature is 20 degree Celsius and the annual rainfall exceeds 2500 mm. Though small in size, the topography on the island is rather complicated with elevation ranges from sea level to 3952 meters asl. Blessed by the mild weather and huge topographic variations, almost all the main vegetation types in the world, such as mangrove, lowland broad-leaved evergreen forest, montane evergreen-deciduous mixed forests, conifer forest and alpine can be found in this small island. In order to understand forest diversity and monitor forest dynamics, more than 10 Forest Dynamics Plots (FDP) that followed the CFS protocol was established since 1989. These FDPs ranged from 1 ha to 25 ha and distributed throughout Taiwan. Many research projects, including seed traps, seedling study, litter decomposition, and soil analysis were carried in these plots. In this talk, I will briefly introduce Taiwan Forest Dynamics Research Network and discuss some of the spatial distribution patterns and the impact of extreme weather events on phenological patterns from Fushan FDP.

PARTICIPATORY MONITORING FOR CONSERVING AND MANAGING BIODIVERSITY

Kamal Bawa, Pashupati Chaudhary, Siddappa Setty

Conservation action requires widespread participation of civil society. The society not only can benefit from conservation action, but also contribute to the resolution of our most pressing conservation problems. Monitoring changes in biodiversity has been a critical part of efforts to conserve and manage biodiversity. Such efforts can be enriched and strengthened by participation of local communities in the design and implementation of monitoring programs. Participatory monitoring can increase effectiveness and scope of monitoring, and rapidly advance scientific frontiers in this era of accelerating changes in biodiversity as well as in interactions between society and biodiversity. We describe the use of participatory approaches and traditional knowledge in monitoring changes in climate, biodiversity and the impact of climate change on biodiversity in two biodiversity hotspots, the Western Ghats and the Himalayas. The results represent the work of several researchers associated with the Ashoka Trust for Research in Ecology and the Environment (ATREE), India. Based on these results, and experiences and considering the increasing pace of biodiversity change, we argue for a new framework for monitoring biodiversity that cuts across various stakeholders, knowledge systems, disciplines, and scales, and links results with action.

LOT-BASED DNA BARCODING AND PHYLOGENETIC APPROACH TO MONITORING SPECIES INTERACTIONS AND CO-EXISTENCE IN SUBTROPICAL FOREST IN CHINA

Ge Xue-Jun

With the advent of molecular phylogenies, the phylogenetic thinking reaches all branches of biology. Analysis

of the phylogenetic structure of communities can help reveal contemporary ecological processes that structure community composition, as well as link community ecology with biogeography and the study of character evolution. The phylogenies reconstructed by community ecologists were usually based on the software Phylomatic. Although the phylogenetic relationship among the higher plant taxa could be reconstructed using this software, species-level phylogenies are rare in the absence of sufficient molecular information, especially for those species from tropical and subtropical forest. In recent years, DNA barcoding provides a new scaffold for the accumulated taxonomic knowledge and sequence database. The sequences from plot-based DNA barcoding could be used to reconstruct highly-resolved phylogenetic structure of the community studied. In China, two subtropical evergreen broad-leaved forest dynamic plots (Dinghushan, Gutianshan) were established. The flora of Dinghushan and Gutianshan consist of 210 (119 genera, 56 families) and 159 woody species (103 genera, 49 families) (DBH \geq 1 cm), respectively. In this study, the woody species in both dynamic plots were DNA barcoded and the community phylogenies were reconstructed based on the DNA barcode sequence data. And the species interactions and co-existence in both plots were compared.

THE BIODIVERSITY EXPLORATORIES AS A MODEL FOR INTEGRATED BIODIVERSITY MONITORING

Markus Fischer

The potential scope of biodiversity monitoring is tremendous. Biodiversity comprises genetic and species diversity of all taxa, interactions among these, and the diversity of ecosystems and landscapes. Biodiversity matters not only in itself, but also because it sustains vital ecosystem services. Usually, however, biodiversity monitoring ignores most of these facets, is limited to few taxa living aboveground, excludes genetic diversity and interactions, and is done independent of the monitoring of ecosystem processes. Moreover, entirely observational monitoring does not identify causal relationships. In the German "Exploratories for large-scale and long-term functional biodiversity research", we are monitoring selected taxa of plants, vertebrates, invertebrates, fungi and microorganisms in forest and grassland plots of different land use intensity. Monitoring of ecosystem processes and manipulative experiments complement observational biodiversity monitoring in numerous plots distributed in three regions of the country. The first two years reveal that diversity of different taxa is not necessarily positively related across plots. This partly reflects that different taxa respond differently to different land use and land use intensity. Moreover, these patterns differed between regions, and so did diversity - production relationships for plants. The Biodiversity Exploratories could serve as a model for a future international network for integrated biodiversity monitoring.

DETECTING THE IMPACT OF CLIMATE CHANGE IN LONG-TERM MONITORING OF PLANT COMMUNITIES IN CONCORD, USA.

Richard Primack, Charles G. Willis, Abraham J. Miller-Rushing, Brad Ruhfel, Charles Davis

Concord, Massachusetts, is an extensively protected of major historical and cultural significance. Repeated monitoring of plants shows changes in species composition and abundance over the past 150 years. Species

have also been monitored for their ability to adjust their flowering time in response to a warming climate. Using a phylogenetic approach, groups of related species that cannot adjust their flowering time in response to a changing climate are more likely to decline in abundance and go locally extinct. This result is robust even when accounting for the habitat of species and herbivory by deer, and may explain which non-native species, which tend to have flowering times that are more responsive to temperature, have the potential to become invasive. The conserved evolutionary history predisposes certain plant families, such as orchids (Orchidaceae), mints (Lamiaceae), violets (Violaceae), and bladderworts (Utriculariaceae), to greater declines in abundance. Protection of plant species will require habitat management measures at the local scale, such as clearing trees and mowing meadows to maintain open habitats, reducing deer grazing, and controlling invasive plant species. However, climate change, a factor external to Concord, is already affecting Concord plants and should be included in conservation plans.

Symposium: Measuring Progress Towards Achieving CBD Targets in the Lead up to 2010 ,68311

Organised by: Jorn Scharlemann, Neil Burgess

Meeting room:77

The theme of SCB 2009 is reconciling the needs of a still rapidly-expanding human population with the imperative of conserving what remains of biodiversity. One of the most important policy mechanisms the world has is the Convention of Biological Diversity (CBD) with its 191 parties. The CBD provides a framework of agreed conservation targets to support biodiversity conservation, which are supposed to be completed by the 10th Conference of the Parties in Tokyo in 2010. Protected area targets cover representation of biodiversity within ecological regions, forests, islands, drylands, and mountains. How well are the world's nations doing at meeting these targets and can we already predict which targets will be met, and which will be not? Moreover, can we already assess where conservation scientists might be able to assist with analyses that will be needed for the CBD CoP 10 meeting? The aim of this symposium will be to present results of recent analyses of progress towards different CBD targets, undertaken by UNEP-WCMC and a variety of conservation NGOs including WWF, TNC, CI, and BirdLife. Work will focus on protected areas, but will also encompass forest conservation and building a global network of protected sites of high biodiversity value.

Protected areas in 2008: status, coverage, and achievement of the 10% protected area target

Charles Besancon

Recognizing the establishment of national parks and protected areas as an important strategy to protect biodiversity, associated ecosystem services, and local livelihoods, the the 7th Conference of the Parties of the Convention on Biological Diversity agreed the following target: 'At least 10% of each of the world's ecological regions effectively conserved' (Decision VII/30, CBD 2004). This presentation will report from the latest global protection analysis conducted at the UNEP World Conservation Monitoring Centre (UNEP-WCMC) using data from the globally agreed mechanism for monitoring the growth, establishment and effectiveness of the world's protected areas is the World Database on Protected Areas (WDPA), a joint project of UNEP-WCMC and

IUCN, the International Union for the Conservation of Nature. Progress in reaching marine, terrestrial, forest and biodiversity targets will be reported on as well as figures on the effectiveness of protected areas management and the results of the latest global protected carbon analysis. Results will be broken down by geographic region as well as by IUCN protected area management category.

Progress towards assessing the effectiveness of management of the worlds protected areas

Neil Burgess

More than 113,000 protected areas have been established around the world. They cover more than 12% of the land of the planet, and this is increasing. However, there is far less knowledge on the related issues of a) how well managed these areas are and b) how effective they are at delivering conservation outcomes in terms of species, habitats and ecological services.

This paper will use a newly compiled data on management effectiveness of around 6,000 protected areas globally - linked to the UNEP-WCMC World Database on Protected Areas - to assess the status of knowledge on management effectiveness globally, the achievement of CBD targets for assessing management effectiveness, and to explore if there are potential explanations in the observed patterns of effectiveness. The linked issue of whether more effective reserves deliver better conservation outcomes will also be discussed and some potentially useful studies of the link between 'effectiveness' and 'conservation outcomes' outlined.

Focus on forests : global status, protection and trends

Christine Schmitt

In 2008, the Parties to the Convention on Biological Diversity reconfirmed the target to conserve "at least 10% of each of the world's forest types". This study presents an assessment of progress towards this target based on a 2005 update of the Global Forest Map. It was overlaid onto the WWF ecoregions framework to obtain information on the biogeographic distribution of forest cover. Subsequently a protected area gap analysis was performed by overlaying the 2008 World Database on Protected Areas, which calculated the percentage of forest cover protected globally, within biogeographic realms and ecoregions, and in areas of global conservation importance. At the 10% tree cover threshold, around 7.7% of the world's forests were within protected areas with IUCN management categories I-IV. If IUCN categories V and VI were included, the level of global forest protection rose to 13.5%. At IUCN I-IV, 67% of the 742 ecoregions with some forest cover failed to meet the 10% target. Protection was also inadequate in regions of global conservation importance where significantly more than 10% of the forest cover should be protected, or conserved through other means. The results underline that, in addition to global analyses, regional evaluation of forest protection is necessary to ensure conservation of the full range of global forest biodiversity. To monitor progress towards achieving the CBD 10% forest protection target, we recommend regular updates of the analyses presented here.

Focus on marine : marine protected areas in the coastal and high seas

Colleen Corrigan

Global coverage of marine protected areas (MPAs) falls short of the target set by the Convention on Biological Diversity to protect at least 10 per cent of each of the world's ecological regions. An analysis of ecoregions and spatial areas at various distances from the shoreline was conducted to understand the extent of marine protection that is currently afforded to coastal and marine habitats, with particular attention given to areas beyond national jurisdiction (ABNJ). Less than 6 per cent of the ocean that sits within 12 nautical miles of the high water mark is currently under protection whereas only 0.5 % of the ocean beyond this point is protected. With around 4500 MPAs currently recognized in the World Database on Protected Areas, fewer than ten are in the ABNJ and most are located relatively near coastal zones. Furthermore, little is known about how these areas correspond with species diversity, though the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) is currently working with the Census of Marine Life (CoML) to correlate the coverage of MPAs with information from the global marine species census. Thus, it is critical that more immediate attention is given to the establishment of effectively managed MPAs that represent the ecological connectivity and biological diversity of marine life, including habitats and species, across the entire ocean.

Protected Areas as stores of global carbon : patterns and trends

Jorn Scharlemann

Forest clearance contributes c.20% of total global emissions of CO₂ to the atmosphere. Reducing forest loss is therefore of importance for climate change mitigation. As protected areas (PAs) are one tool for achieving these emission reductions, it is important to understand the extent to which PAs are in fact subject to land use change, and whether improving the effectiveness of their management could contribute to reducing emissions from deforestation. Combining best available data on carbon stocks and deforestation with PA data we estimated forest and carbon loss within the PA network of the humid tropical forest biome during 2000-2005. Carbon emissions resulting from deforestation are estimated according to 4 scenarios of land use following clearance; ranging from complete loss of biomass to pasture, crop, or oil palm development on a regional basis. Between 2000 and 2005 over 1.7 mio. ha were cleared within protected areas in the humid tropics. Globally, more strictly PAs had lower rates of forest loss than the PA network as a whole. PAs of the humid tropical forest biome contained an estimated 70Gt of carbon in 2000, over half of which was in the Neotropics. We estimate that forest loss from within PAs resulted in 822-990 Mt of CO₂ equivalent emissions, accounting for around 3 % of total annual emissions from tropical deforestation during that period. Reducing deforestation within PAs by improving their effectiveness could provide significant emission reduction benefits.

Symposium: Conservation Challenges on the Roof of the World,68381

Organised by: Andrew Smith, School of Life Sciences, Arizona State University

Meeting room: 87

The high alpine grasslands/steppe of the Tibetan plateau cover approximately one quarter the area of China. Historically, the region has been characterized by a close relationship between wildlife and local pastoralists, as the high meadows are not conducive to other forms of sustainable agriculture. The theme of the SCB meeting is Harmony for Nature and Society; however, the current winds of change on the plateau more closely represent a disharmony of nature and society. In the recent past the plateau has been transformed by huge and well-funded public works projects -- fencing, construction of re-settlement villages and the concomitant re-location of the region's pastoralists, poisoning of native species, etc., all generally in the name of biodiversity conservation and sustainability. In contrast, the actual policy decisions to engage in these activities lack a clear rationale and are based more on prejudice or convenience than evidence they will work; many appear counter-productive. This symposium is designed to review the current conservation and biodiversity status of these high alpine grasslands, to show how contemporary conservation science can approach the issues of biodiversity conservation and sustainability on the plateau, and to integrate this approach with the cultural and social dimensions of the plateau's inhabitants – primarily the pastoralist Tibetans who occupy this landscape. The participants are western scientists with vast experience working in the region, Chinese scientists, and Tibetan specialists.

EXPERIMENTAL WARMING, GRAZING, ENVIRONMENTAL GRADIENT AND PLANT DIVERSITY OF ALPINE MEADOW ON TIBETAN PLATEAU

Zhao Xinquan

We investigated the independent effects of grazing experimental warming and environmental gradient on plant species diversity on Tibetan Plateau, a region highly vulnerable to ongoing climate and land use changes. Experimental warming caused a 26-36% decrease in species richness, a response that was generally dampened by experimental grazing. The deep-rootedness of medicinal plants resulted in lowered sensitivity to warming, whereas the shallow-rootedness of non-medicinal plants resulted in greater sensitivity to warming.

Appropriate grazing increases the complexity of plant community and plant diversity which supporting the hypothesis of intermediate disturbance.

The relationship between species diversity and productivity of natural communities on four alpine meadow types showed that the species diversity and productivity pattern was linearly increase in *Kobresia pygmaea* meadow, *K. humilis* meadow, *Potentilla fruticosa* shrub, while there was no significant linear relationship in *K. tibetica* of swamp meadow, which indicated that the species diversity of natural community could influence the productivity. At the same time, different environmental resources and environmental heterogeneity contributes to the productivity as well, which form discrepant structural characteristics of community and distribution of species diversity.

GRASSLAND POLICIES MAY REDUCE ECOLOGICAL RESILIENCE TO CLIMATE CHANGE ON THE TIBETAN PLATEAU

Julia Klein

Ongoing vegetation changes on the Tibetan Plateau have often been attributed to overgrazing. However, research suggests that climate change may be responsible for important ecosystem changes on the Plateau. Climate warming has already been documented on the Plateau, a region where warming is predicted to be greater than the global average. We established an experimental warming and grazing study on the northeastern region of the Tibetan Plateau to examine the separate and combined effects of these factors. Warming led to a reduction in 1) vegetative production; 2) plant species diversity; and 3) the diversity of medicinal plants and palatable forage, two provisioning ecosystem services on the Plateau. Warming also led to the expansion of shrubs at the expense of the meadow vegetation. These climate-induced vegetation changes have important implications for livestock, wildlife, and human livelihoods on the Tibetan Plateau. Importantly, grazing could buffer the system from these warming-induced changes. Current grassland policies, which are removing grazing from the rangelands in certain regions of the Plateau, may not address the underlying drivers of change. Moreover, this grassland policy may be mal-adaptive with respect to climate change and actually reduce the ecological resilience of this system to the effects of climate warming.

CLIMATE ADAPTATION STRATEGIES ON THE TIBETAN PLATEAU AND THEIR SOCIAL AND ENVIRONMENTAL IMPLICATIONS

Emily Yeh

The likely effects of climate adaptation strategies relevant to the Tibetan Plateau, as outlined in China's National Climate Change Program and the White Paper on China's policies and actions on climate change, will be to exacerbate rather than alleviate problems of livelihood and environment, as well as having serious implications for Tibetan society and cultural continuity. Ecological evidence suggests that policies including fencing, grazing removal, and ecological migration are not well coordinated with the needs and goals of adaptation. New tools need to be developed in addition to the current focus on ecological migration, to mitigate the effects of future crises expected with climate change.

RIDDLE OF ASIATIC GAZELLES: PHYLOGENY, STATUS AND CONSERVATION

Jiang Zhigang

Asiatic gazelles *Procapra* are endemic to the steppes of Asia; the Mongolian gazelle mainly lives on the Mongolian steppe, whereas the Tibetan gazelle and Przewalski's gazelle live in steppe habitat on the Qinghai-Tibetan Plateau where part of their ranges overlap. There are places where the three Asian gazelles plausibly occur within 300 km of each other. After one and a half decades of protection, the endangered population of Przewalski's gazelle is expanding. Why are there three gazelles? What role do gazelles play in the steppe ecosystem? How did they survive the expansion of human settlements? Will gazelles adapt to the

landscape as steppes continue to be modified into pastures? Will the gazelles merge into one species or will they become subdivided into more species? What are the conservation implications of their population genetic structure? We spent 15 years in field work on the Asiatic gazelles to determine their phylogeny, population and habitat status. Maintaining steppe biodiversity should be integrated into the management of the grassland ecosystem. We put forward our ideas for conservation actions in a global change framework.

LARGE MAMMALS ON THE QINGHAI-TIBET PLATEAU: UNIQUE, DIVERSE, BUT NO LONGER WELL-PROTECTED BY REMOTENESS

Rich Harris

Despite low primary productivity, the Qinghai-Tibet Plateau (QTP) has a surprisingly rich mammalian fauna. It has higher diversity and larger populations of many species than nearby, similar ecosystems such as the Tianshan and Pamir. Until recently, the QTP was also characterized by levels of human activity that had, by Asian standards, low impacts on native ecosystems. As humans increased in number and ability to access remote areas, poaching of ungulates and carnivores became a serious concern; central and provincial governments responded by increasing enforcement of laws prohibiting hunting and by establishing large nature reserves. During the past 2 decades, two changes have occurred: 1) Human-caused mortality has declined in importance as a threat as pastoralists have been disarmed and poaching by officials has become unacceptable; and 2) human activities that reduce the value of wildlife habitats have increased dramatically. In short, wildlife on the QTP has lost its unique status as remote and pristine; it increasingly faces the challenges of persistence in the face of increasing human demands on habitat more familiar elsewhere in Asia. Institutions to deal with this new reality have yet to develop on the QTP, and should emerge from a partnership of national and local entities.

PLATEAU PIKAS – PEST OR KEYSTONE SPECIES?

Andrew Smith

Preservation of native species so that they can benefit the functioning of ecosystems in which they evolved is an essential component of conservation biology. This is particularly true in the case of keystone species because by definition they play a central role in the maintenance of biodiversity and ecosystem functioning. The Plateau Pika (*Ochotona curzoniae*) functions as a keystone species on the Tibetan plateau: it acts as an ecosystem engineer through the construction of burrows that support many endemic birds and lizards; it creates microhabitat disturbances that result in an increase in plant species richness; it serves as the principal prey for nearly all of the plateau's predator species; and it contributes positively to ecosystem-level dynamics. However, current policy throughout much of the plateau is to poison pikas under the assumption that they contribute to degradation of the grasslands. How should the Plateau Pika be managed - as a pest or as a keystone species? What role does the pika play in the complex interactions among native pastoralists and their animal husbandry, health and sustainability of the plateau's alpine grassland, and biodiversity conservation? A long-term project to address these issues has been initiated.

EMERGING CHALLENGES TO SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES WHEN POLICIES ARE NOT CONDUCTIVE TO CONSERVATION OR SOCIAL HARMONY ON THE PLATEAU

Marc Foggin ,Gongbo Tashi

Successful conservation of natural resources in regions of the world with low human population density often depends not only on high-level (government) environmental and development policies, but also on resource management practices of local people and communities, community-based (grassroots) conservation initiatives, and local awareness and goodwill vis-à-vis government policies and programs. In the source area of the Yangtze river in southwest Qinghai Province, both national policies and grassroots conservation initiatives have now been shaping the "conservation scene" for more than a decade. However there is still serious lack of stakeholder integration, vertically and horizontally. Official policies do not always reflect or integrate local peoples' needs, aspirations, or priorities (cf. pika poisoning, fencing, ecological migration). Sometimes government bureaus also have competing priorities (e.g., grassland versus wildlife conservation). Additionally, some programs may have unintended effects counter-productive to conservation (cf. emergence of human-wildlife conflict). In an attempt to redress this situation, Plateau Perspectives has been working closely with local communities, local NGOs and the Sanjiangyuan National Nature Reserve to trial a new model of "community co-management" in the Tibetan plateau region. Remaining challenges include enhanced communication and cooperation between all stakeholders, including engaged non-profit organizations.

GREEN NETWORK ON THE TIBETAN PLATEAU: OVERVIEW OF COMMUNITY INITIATIVES FOR CONSERVATION ACTION IN THE SANJIANGYUAN REGION, SOUTHERN QINGHAI PROVINCE

Zhadou

Community involvement in environmental protection is a fairly recent phenomenon in China as a whole, and at an even earlier stage of development in rural 'minority' areas. In the source area of the Yangtze, Yellow and Mekong rivers (i.e., the Sanjiangyuan region), several community initiatives have now just begun their second decade, in effect on the verge of entering their adolescent years. What has been learned so far? What have been some of the main challenges to date? Drawing on experiences of the Snowland Great Rivers Environmental Protection Association in Yushu Tibetan Autonomous Prefecture, an overview is presented here of environmental education in schools, community involvement in investigations of climate change, conservation of sacred mountains, community co-management, local festivals for ecology and culture, and other innovative projects. Through this work, not only have local communities been involved in the Association's work, but more importantly about a half dozen new local initiatives have been spawned as well, thus multiplying the impact and enhancing the sustainability of these interventions.

Symposium: Conserving Southeast Asia's Imperiled Biodiversity – Scientific, Management, and Policy Challenges, 66450

Organised by: Lian Pin Koh

Southeast Asia was almost entirely covered by rainforest 8,000 years ago. Today, this region is experiencing

the highest relative rates of deforestation and forest degradation in the humid tropics. Every year, an estimated 15.4 million ha of tropical forest is destroyed, with an additional 5.6 million ha being degraded. If deforestation were to continue at the current rate, Southeast Asia could lose 13-42% of regional populations of all species by the turn of the next century, at least 50% of which could represent global species extinction, given the high concentration of endemic species in the region. In this symposium, we will discuss the drivers of forest destruction (logging, industrial agriculture, invasive species, climate change, and fire), threats to the region's unique ecosystems and taxa (limestone karst, peat swamp forest, and large mammals), and key conservation challenges (importance of secondary forests, challenges for forest restoration, socioeconomic and legislative challenges, and challenges for carbon payment schemes) to provide a comprehensive review of the science, management and policy issues concerning biodiversity conservation in Southeast Asia. SCB 2009 in Beijing, with its theme "Conservation: Harmony for Nature and Society" provides the perfect opportunity to highlight the need for a multi-pronged strategy requiring all major stakeholders to work together to achieve the ultimate goal of reconciling biodiversity conservation and human well-being in the region.

BIOGEOGRAPHY OF SOUTHEAST ASIA

David S. Woodruff

Southeast Asia is a global biodiversity hotspot and home to 30% of all known species on the planet. Comprising the Indochinese, Sundaic (Indomalay), Philippine, Wallacean and part of the Papuan bioregions, 18% of the land area is afforded some protection, but freshwater and marine communities are still largely unprotected. The speaker will introduce the geographic and paleogeographic factors that underpin the diversification and distribution of today's biota. The last few million years were characterized by significant oscillations in seasonality, forest extent, and sea levels, which may account for the distributional patterns of Indochinese and Sundaic mammals, birds, and plants. In the next 100 years, the threats to this rich biota include the predicted loss of 90% of the original forest and 25–75% of the species, destruction of the Mekong River flood-based ecosystem, submergence of coastlines and river deltas, and changes in seasonality. Other regional challenges for conservationists include convincing governments and the public of the social and economic value of ecological services provided by protected areas. In addition, regional governments need to be persuaded to establish transboundary protected areas, develop instruments for regional environmental management, and resolve the social problems of people who live in and near protected areas.

THE VALUE OF LOGGED TROPICAL FORESTS: LESSONS FROM NORTHERN BORNEO

Keith Hamer

Timber concessions cover about 20% of all tropical forests but are often viewed as having only low residual value after logging, in both economic and other terms. As a result, tropical production forests are coming under increasing pressure for conversion to other land uses such as agriculture and agro-forestry. However, such forests could play an important role in terms of landscape-scale sustainability, particularly if they were managed appropriately post-harvesting. Here, I use an extensive data-set from a single well-studied site in northern Borneo to examine impacts of selective logging and subsequent forest regeneration on both carbon stores and biodiversity across a wide range of plant and animal taxa. I then examine in greater detail how

post-harvest management affects both species and functional diversity of selected groups. Results indicate that selectively-logged forests can retain surprisingly high residual value in these terms, which may then be further enhanced by post-harvest rehabilitation. These data support the notion that international policy objectives relating to net carbon emissions and biodiversity are each likely to be more attainable through proper recognition of the full value of logged tropical forests.

IS OIL PALM THE BIGGEST THREAT TO SOUTHEAST ASIA'S BIODIVERSITY?

Lian Pin Koh

Oil palm agriculture is the biggest immediate threat to Southeast Asia's biodiversity. In Malaysia, Indonesia, and elsewhere in the region, millions of acres of primary and secondary forests have been cleared to grow oil palm. Surveys of birds and butterflies in primary forests, secondary forests, and oil palm plantations in Malaysia demonstrate that oil palm plantations harbor very few forest-dwelling species, even fewer than occur in heavily logged forests. Moreover, efforts to enhance the biodiversity within oil palm plantations by, for example, retaining patches of native forest or planting native plants for ground cover, result in negligible increases in forest-dwelling birds and butterflies. Given the profitability of oil palm and the reluctance of governments to curb its expansion, preventing further forest losses will be difficult. Options for addressing the issue include (1) working cooperatively with progressive oil-palm producers; (2) stockholder pressure on multi-national oil-palm producers; and (3) public pressure on oil-palm purchasers to reject producers who engage in forest conversion.

IMPACTS OF INVASIVE SPECIES IN SOUTHEAST ASIA

Richard T Corlett

A billion people, rapid economic development, and massive trade flows make Tropical East Asia (TEA) a worst-case scenario for tropical invasibility. I use information on invasive aliens in terrestrial habitats to test the continental-oceanic contrast in invasibility, assess the conservation impacts of invasives, and suggest ways to mitigate these. On the densely-populated continental islands of Hong Kong and Singapore, alien species often dominate in disturbed sites, but few have invaded closed forests, except birds in Hong Kong. In less densely populated areas, continental forests appear to resist invasions by all taxa, with few known exceptions. Forests on oceanic islands isolated by < 100 km during the last glacial maximum appear no more susceptible to invasions, except by mammals. The Ogasawara Islands, > 1000 km from the nearest continent, have a native biota of East Asian origin and suffer from forest invasions across the taxonomic spectrum. These patterns are consistent with the idea that alien invasion is facilitated by the absence of native species in the same functional group. Alien invasives are not yet a major conservation problem in TEA, except on remote islands, but their dominance on disturbed sites may slow or prevent recovery of native biodiversity. Strict quarantine is impractical in TEA, although some major introduction routes could be blocked. Management efforts should focus on early recognition and immediate control of potential problem species.

BIOMASS FIRES, HUMANS AND CLIMATE CHANGE IN INTER-TROPICAL SOUTH EAST ASIA

David Mark Taylor

Fire is an important factor affecting cultural landscapes. This paper discusses biomass fires in the context of inter-tropical Southeast Asia. Anthropogenic fires are generally thought to be relatively recent phenomenon in the region, particularly those fires that directly impact rainforests. By comparison, large extents of vegetation in Africa and Australia are fire-adapted, and humans there may have deliberately used fires in hunting, to encourage new growth of plants and to suppress the spread of disease for tens of thousands of years. Possible areas of interest to researchers are introduced, including methodological problems in the reconstruction of fire histories, separation of the complex causes and outcomes of biomass fires, and the extent to which different cultures and vegetation types are fire-adapted. The paper finishes by stressing the need to place biomass fires within their full social and physical environmental contexts and by adding support to the argument that broadly based multi-disciplinary studies of environmental history have an important role to play in unpacking the complex interactions between people, fire and the environment, and in the conservation of fire-susceptible vegetation types.

TRIO UNDER THREAT: IS THERE HOPE FOR RHINOS, ELEPHANTS AND TIGERS IN MALAYSIA?

Reuben Clements

Three of Malaysia's charismatic large mammal species are experiencing diverging fates. Populations of the Sumatran Rhinoceros (*Dicerorhinus sumatrensis*) have been decimated (due to chronic hunting and loss of lowland forests) to an extent where costly management interventions (e.g., combined ex and in situ breeding programmes) are currently being developed to prevent its extinction. Conversely, populations of the Asian Elephant (*Elephas maximus*) appear to be stable and even increasing in some areas, but escalating levels of human-elephant conflict (due to land conversion into plantations and dams) will eventually threaten their long-term survival. The tiger (*Panthera tigris*), however, is at the crossroads where the National Tiger Action Plan for Malaysia was recently initiated by the federal government to double the current wild population by 2020; this can only happen if their decline (due to illegal hunting of tigers and prey) in important tiger habitats such as selectively logged forests is arrested. Apart from discussing the abovementioned threats and associated scientific, management and policy challenges, we will highlight recent conservation initiatives (e.g., the Borneo Rhino Sanctuary, Malaysian Conservation Alliance for Tigers) that can help secure the future of these species in Malaysia, as well as other range states within Southeast Asia.

IMPOSING GOVERNMENTALITY AND LIMITING LIVELIHOODS: THE EFFECTS OF CREATING A 'CONSERVATION SUBDISTRICT' IN THE LORE LINDU NATIONAL PARK, INDONESIA

Gregory Lawrence Acciaioli

Conservation interests in Indonesia have recently harnessed the trend toward proliferation of new administrative units – an unanticipated consequence of regional autonomy – to establish 'conservation

districts' in Sumatra and Sulawesi. This paper focuses on consequences of the establishment in 2007 of a 'conservation subdistrict' based on the Lindu enclave within the Lore Lindu National Park, Central Sulawesi. Using an extended case study methodology based on participant-observation, it discusses the failure of subdistrict officials to implement such plans as limiting land cultivation to 2 ha./person, stopping opening of gardens outside the enclave, and controlling in-migration of new cultivators. Ironically, the operation of this new subdistrict has led to a retrenchment of the sphere of authority of local customary officials in environmental regulation, even though the strengthening of customary institutions of the dominant indigenous group –the To Lindu – was a major rationale for establishing the subdistrict. This result is investigated through analyzing the court trial of a group of local men accused of opening garden land beyond the enclave boundary, a circumstance handled before the subdistrict's establishment by the customary council. The paper concludes by discussing how this administrative strategy of conservation undermines previous initiatives in co-management of the national park, suggesting that such a strategy exacerbates conservation conflicts.

LOOKING BEYOND: CONSERVING SOUTHEAST ASIA'S IMPERILED BIODIVERSITY – SCIENTIFIC, MANAGEMENT, AND POLICY CHALLENGES

Navjot S Sodhi, Lian Pin Koh

The biodiversity of Southeast Asia is imperiled due to unprecedented loss or disturbance of its natural habitats. The documented impacts of habitat disturbance on Southeast Asian biotas indicate a general and accelerating trend of species declines and extinctions. In this symposium, drivers of forest destruction, threats to the region's unique ecosystems and taxa, and key conservation challenges to provide a comprehensive review of the science, management and policy issues concerning biodiversity conservation in Southeast Asia will be discussed. We will recap conclusions based on presentations in this symposium and review of literature.

Symposium: Balance, Harmony, Power: Evaluating Trade-offs in Resource Conservation, Conversion, and Extraction in Protected Area, 68389

Organised by: Paul Hirsch

This symposium brings together researchers from several countries who are partnering to develop conceptual and practical tools that address the issue of trade-offs between conservation and development. We are particularly interested in trade-offs that have been under-appreciated or under-communicated, such as those due to the multi-scalar nature of social and natural systems, and those due to disparities in values, perspectives, and power. Our exploration of trade-offs will be developed around a series of case studies involving either resource extraction (e.g. mining and hydrocarbons) or resource conversion (e.g. bio-fuels, oil palm production) activities taking place in and around critical protected areas. Following a conceptual overview, we will explore the ways in which trade-offs are treated in recent, pending, or historic decisions, and explore the extent to which disparities in scale, values, perspectives, and power might be reconciled through 1) mechanisms that strive for "balance" by placing an economic value on natural systems and compensating those that protect or produce that value; 2) processes that seek "harmony" by promoting fairness and inclusivity in conservation and development decision-making and/or 3) the positioning of the

issue within the public debate to involve a broader audience. Crucially, presenters will also explore the extent to which the influence of power (whether in overt or subtle forms) may cause even the most enlightened attempts at achieving either balance or harmony to be ineffective, manipulative, or counterproductive.

FACTORS SHAPING PUBLIC POLICY IN THE ARCTIC NATIONAL WILDLIFE RESERVE, USA

Thomas McShane

The history of the Arctic National Wildlife Refuge (ANWR) in Alaska provides a lens on how different conservation and development narratives influence public policy. To date, and despite increasing pressures to open the north slope of the reserve to drilling, there has been no change to the status quo of no drilling. Using a timeline dating from 1960 to the present, this study explores values (economic performance, changes in caribou numbers, the price of oil, cultural views of nature, etc.), process (access to information, knowledge, effective communication, participation by interest groups and key actors, etc.), and power (political influence, wealth, job creation, perceptions of national security, etc.) to analyze how public policy is driven in different directions.

14:15-14:30 DONOR SUPPORT FOR LINKED CONSERVATION AND DEVELOPMENT 1980-2006

Daniel Charles Miller

Effective biodiversity conservation requires financial resources. However, there remains little systematic knowledge of actual funding flows over time for conservation needs in the biologically-rich countries of the global South. Nor is there much knowledge about whether funds have been used primarily for biodiversity conservation or some amalgam of economic and ecological objectives. Better empirical evidence on funding flows can facilitate understanding of how donor priorities affect the match between conservation and development goals. We conducted a keyword search using the PLAID database to identify more than 25,000 biodiversity-related projects in 117 countries funded by bi- and multi-lateral aid agencies from 1980-2006. We provide summary data on official biodiversity assistance during this period, distinguishing between “strict” biodiversity aid and aid for linked projects. We also identify major donors and aid recipients, analyze changes in funding flows over time, and examine possible reasons for discernible trends. The data suggest that overall support for linked projects has been significantly lower than support for “strict” conservation. We conclude by discussing the implications of this research for understanding the broad terrain on which trade-offs between conservation and development goals are negotiated.

14:30-14:45 GOLD MINING IN THE EASTERN ARC MOUNTAINS OF TANZANIA

Alexander Songorwa

The Eastern Arc Mountains (EAMs) in Tanzania are one of the world’s 25 global biodiversity hot spots - renowned for their high concentrations of endemic species of both animals and plants. The EAMs also offer ecosystem services, serving as catchment areas supplying fresh water to many people in the surrounding

regions and the city of Dar es salaam. In addition, it is becoming an important tourist destination. At the same time Tanzania has become a fast-emerging gold producer in Africa. The country's 2005 National Strategy for Growth and Poverty Reduction made mining a priority sector for growth and poverty reduction. And, following this economic move, and gold mining in particular, the EAMs have become victims of environmental degradation with impacts extending to different scales. As part of the "Balance, Harmony, Power: Evaluating Trade-offs in Resource Conservation, Conversion, and Extraction in Protected Areas" symposium, we will address issues of scale in EAMs.

14:45-15:00 NEGOTIATING CONSERVATION AND MINING TRADE-OFFS IN VIETNAM

Tran Chi Trung

In this presentation, the relationship between balance, harmony, and power will be explained in light of the conservation and development discourse in Vietnam, which is currently framed as "win-win." The cases of coal mining in Ha Long Bay and bauxite and wolfram mining in the central highlands will be used to show the complexity of trade-offs through analyzing the conflicts of interest between of different sectors and scales. This case will highlight the gaps between the realization of costs at the local scale and benefits realized at the national scale, and show how power exercised at the national scale shapes the process of valuing ecosystem services at local scales. This analysis will allow us to suggest new ways of balancing and harmonizing complex tradeoff problems.

15:00-15:15 CATEGORIZATION OF SIERRA DEL DIVISOR RESERVED ZONE, PERU

Bruno Monteferri

The "Sierra del Divisor" Reserved Zone, a protected natural area superimposed on an indigenous Territorial Reserve located on the Peruvian border with Brazil, faces a dilemma between different visions of conservation and development. In the area, the interests of indigenous and conservation organizations; oil, mining and timber companies; infrastructure projects; and local non-indigenous settlers come together. The negotiation between these interests occurs not only between the representatives of civil society, but also within the state between the different Ministries involved. This case shows the shortcomings of participation in the categorization processes when explicit power issues are involved. The case also highlights the importance of positioning these issues within the public debate as a strategy for achieving transparency in decision-making processes.

15:15-15:30 THIS IS NOT A TOOLKIT: REFLECTIONS ON THE ACSC FRAMEWORK

Peter Brosius

The ACSC initiative has been developing a research framework that recognizes three entry points for the analysis of conservation and development trade-offs: what we have termed valuation, process and power. Whether or not the ACSC framework is widely adopted will depend on whether it offers some to those who might potentially use it. In this discussion I will consider the utility of the ACSC framework beyond its application as just another tool in a larger conservation and development. Given a long history of emancipatory approaches (participation, community-based conservation) becoming managerial tools, I argue

that for the ACSC framework should be conceptualized and applied in a manner that (a) promotes disciplinary humility by explicitly acknowledging both the value and limitations of multiple disciplinary perspectives and (b) promotes an integrative process for understanding and negotiating trade-offs. This is particularly important given that the gradual shift from place-based to market-based conservation strategies is altering the relational dynamic between conservation and development and producing new configurations of power that both promote and constrain various options in the conservation of biodiversity.

Symposium: Long Distance Wildlife Migrations in Asia: Understanding and Conserving these Spectacular Ecological Processes , 68302

Organised by: Amanda Elizabeth Fine, Wildlife Conservation Society; Lisa Hickey, Wildlife Conservation Society

The grasslands, seas, high plateaus and mountains of Asia support some of the world's last spectacular long distance migrations of wildlife. The "harmony of nature and society" or the way we (citizens, scientists, conservationists, and local governments) work to balance the development of these regions with the conservation of the habitats that support the ecological processes of migration is one of the greatest challenges of our time. There is little global awareness of the occurrence of these spectacular Asian migrations and our understanding of the processes which drive and support them is limited. It is critical to understand all aspects of the patterns of these migrations and investigate what drives the changes (climate change, habitat fragmentation or resource availability?) observed over time. The very nature of long distance migrations inevitably means that wildlife will cross jurisdictional and geo-political boundaries in search of the resources necessary for their survival. It is critical for us as conservation scientists to collect and share the information necessary to inform management policy that will insure the protection of key resources that support these migrations. Collectively we are obliged to offer creative solutions to the conflicts between "nature and society" that threaten the harmony of these processes and our world.

Amanda Elizabeth Fine ,Ann M. Winters, Bolortsetseg Sanjaa

In recent years, the Mongolian government has recognized the immediate threat overuse of wildlife poses to Mongolia's rich natural heritage. In response, the Minister of Environment issued an order in 2006 devolving natural resource and wildlife management rights to community partnerships under contract with local governments. The Wildlife Conservation Society is collaborating with the Eastern Mongolian Community Conservation Association (EMCCA), a local NGO, to establish 12 livestock herder community partnerships and effectively protect, manage and monitor wildlife and other natural resources in community managed areas. During a participatory wildlife population assessment exercise with herder communities in summer 2008, members indicated that wildlife populations have decreased by an average of 40% in their areas since 1985. Members thought that hunting pressure increased slightly (16%) in community areas from 1995-2000, but indicated a slight decrease in hunting (17%) from 1985 to 2008. Since May 2006, WCS Mongolia has organized four meetings and trainings to introduce new legislation, train volunteer rangers and coordinate wildlife protection efforts among county inspectors, protected areas rangers and volunteer rangers. With the proper skills, herder communities will be able to take action to sustainably manage and protect wildlife in Eastern Mongolia.

CONSERVATION PLANNING FOR MIGRATORY SPECIES: BIG CHALLENGE, BIG PAYOFF

Karl Didier, Eric Sanderson

Migratory species represent one of the most difficult yet exciting challenges in conservation. Their enormous spatial requirements, reliance on multiple seasonal habitats, and need for movement corridors bring them into conflict with humans. As a result, conservation practitioners usually have to address multiple threats, engage a huge range of stakeholders, and work across multiple spatial scales (from local to regional and even global). However, because of their spatial requirements and their tendency to fill important functional roles in ecosystems (e.g., nutrient transport), successful conservation of migratory species probably carries with it relatively large benefits for other biodiversity. We review the basic steps of conservation planning, with respect to migratory species, including engaging stakeholders, setting goals and quantitative objectives, compiling critical spatial information (biodiversity distribution, threats), selecting and prioritizing conservation areas, and monitoring progress. We highlight some aspects of conservation planning as it is currently practiced that need further development, including consideration of threats (especially climate change) and incorporation of corridor design principles into area selection strategies.

SATELLITE TRACKING OF MONGOLIAN SAIGA (*SAIGA TATARICA MONGOLICA*) IN WESTERN MONGOLIA

Buuveibaatar Bayarbaatar, Julie K Young, Joel Berger, Kim M Berger

Saiga antelope are critically endangered, suffering a decline of >95% in the last 20 years. The Mongolian saiga is a unique subspecies isolated from the more numerous populations in Kazakhstan and Russia by the Altai Mountains. Only two subpopulations of a few thousand individuals remain within Mongolia. Main threats to the persistence of Mongolian saiga include poaching, habitat degradation by excessive livestock numbers, and possibly severe winters. Besides these threats, conservation of saiga has been challenged by a lack of knowledge about movements and locations at which to focus conservation efforts. Thus, information on migration routes and potential impediments to movement may reduce the loss of corridors and facilitate saiga persistence. In 2006, we used drive nets to capture 8 adult female saiga and fitted them with GPS or satellite radio collars to understand their movements and survival. Handling time was 6.62 ± 2.47 minutes; mean chase time was 6.10 ± 2.51 min. Body mass averaged 23.38 ± 2.93 kg. Home ranges of collared females were between 3,000 and 4000 km² during the one year period. Our research on adult female saiga identified the use of a narrow corridor connecting the two subpopulations north of the Altai Mountains in western Mongolia. Therefore, conservation of the migration bottleneck is urged to maintain persistence of meta-population structure for saiga antelope in western Mongolia.

THE GREAT BUSTARD - CENTRAL ASIAN MIGRATIONS

Aimee Elizabeth Kessler, Tseveenmyadag Natsagdorj, Nyambayar Batbayar, Andrew Thomas Smith

With a maximum weight of approximately 20 kg, Great Bustards (*Otis tarda*) are among the heaviest extant birds capable of flight. A greater tendency to migrate and migrations of longer distances are noted along the range of the Great Bustard from west to east in Europe. This research represents the first telemetry study of the migratory behavior of the Asian Great Bustard (*Otis tarda dybowskii*), at the eastern end of this species' range in Mongolia. Migration routes identified for Asian Great Bustards in the first two years of research are up to twice as long as those identified in Eastern Europe; this represents a phenomenal achievement for a bird of this size. We will present these routes, along with suggested routes of Great Bustards in Kazakhstan, as revealed by field surveys, interviews, and archival work in Central Asia. Migration stopovers and overwintering locations identified thus far fall outside of the protected areas network and some are near large human population centers, presenting challenges for the conservation of a species which is a desired target for hunters.

UPDATED INFORMATION FOR THE DISTRIBUTION AND MIGRATION OF THE TIBTAN ANTELOPE (PANTHOLOPS HODGSONI)

Aili Kang, George Schaller

Information of the status and distribution of Tibetan Antelope (*Pantholops hodgsoni*), or chiru, has been updated through field surveys made within the Tibetan Plateau areas of Qinghai, Xinjiang and Xizang provinces of China during recent 5 years. In 2005, movement and birth behavior of a migratory population of female Tibetan antelope was studied in the western Kunlun Mountains (SCHALLER, et al. 2005. Migratory and calving behavior of a Tibetan Antelope population. *Acta Theriologica Sinica*. 26(2):-105-113). In 2006, the distribution of chiru was studied in the north part of Chang Tang area which had not been visited for more than 100 years (SCHALLER, et al. 2007. A winter wildlife survey in the northern Chang Tang of Tibet and Qinghai. *Acta Theriologica Sinica*. 27(4):-309-316). During 2007-2008, migratory and resident population of chiru in Tibetan Autonomics Area of China was surveyed. Migration direction of different chiru population, distribution of resident population and changes of population from migration to residence has been updated. Conservation of chiru in China has obtained great progress, but conflict caused by demands on rangeland resources between human and chiru is a new problem for conservationists.

DISTRIBUTION AND MOVEMENT PATTERNS OF MONGOLIAN GAZELLE

Badamjav Lhagvasuren, Kirk A Olson, Thomas Mueller, Peter Leimgruber, William Fagan, Takehiko Y Ito, Craig Nicoloson, Amanda Elizabeth Fine, Todd K Fuller

Mongolia's eastern steppe is one of the world's largest remaining grasslands in the temperate zone.

Mongolian gazelles are the dominant wild large herbivore in this ecosystem. The species has experienced a major reduction in range during the past century, and is further threatened by continued habitat loss, fragmentation and excessive hunting. We investigated gazelle habitat use and movement patterns by relating gazelle presence to remotely sensed data of vegetation productivity and by tracking individual movements via GPS telemetry. We found a high spatiotemporal variability of gazelle habitat areas across broad spatial scales. The tracking data also revealed that gazelle movements are wide ranging and show high inter-individual variation; individuals marked at the same location moved in different directions with dissimilar patterns within weeks. This behavior is likely tied to the unpredictability of the foraging resources of gazelles. Our analyses suggest that variability and predictability of resources across broad scales have important conservation and ecological implications. The nomadic movements of gazelles are too far ranging and too unpredictable for the species to be protected within single protected areas. Conservation strategies are needed that pertain to the entire steppe and promote open landscape allowing for the nomadic movements of gazelles.

THE EASTERN STEPPE'S LIVING LANDSCAPE

Ochirkhuyag Lkhamjav, Amanda Elizabeth Fine, Karl Didier, Eric Sanderson

WCS' Living Landscapes Program strives to conserve the valuable biodiversity, ecosystem services, and functional integrity of large wild places through the implementation of a participatory, wildlife-based strategy for landscape conservation. This approach, called the Landscape Species Approach, is designed to identify and map the needs of a representative suite of focal species (e.g., the Mongolian gazelle), across both political and ecological borders.

The Eastern Steppe of Mongolia is perhaps the world's largest intact grassland ecosystem. In the Eastern Steppe, we identified a suite of eight Landscape Species that represent the threats to biodiversity and diverse habitats of the Eastern Steppe landscape, including the Mongolian Gazelle (*Procapra gutturosa*), White-naped Crane (*Grus vipio*), and Saker Falcon (*Falco cherrug*). We modelled the potential distribution of these three species (Biological Landscapes) and the human activities which have the largest impacts on the ecosystem, including hunting/nest predation, livestock grazing (competition for resources) and fire. By overlaying the needs of species and human activities, we were able to identify key conflicts (e.g., livestock competing with gazelle) and prioritize conservation resources to help resolve them with input from local stakeholders including livestock herder community members, local wildlife managers and national-level policy makers.

Symposium: Making Ecosystem Services Count: Real-world Progress from Africa , 67956

Organised by: Andrew Balmford, Conservation Science Group, Dept of Zoology, University of Cambridge; Neil Burgess, Conservation Science Group, Dept of Zoology, University of Cambridge, WWF-US, Conservation Science Programme ;Brendan Fisher, Centre for Social and Environmental Research on the Global Environment, University of East Anglia;Belinda Reyers,Natural Resources and the Environment, CSIR

As the theme of SCB 2009 makes clear, reconciling the needs of a still rapidly-expanding human population with the imperative of conserving what remains of wild nature is perhaps mankind's most pressing challenge.

One promising approach involves integrating the value of ecosystem services into mainstream decision-making. There has been much recent progress in developing concepts and frameworks for achieving this, but the practical application of these ideas remains limited by patchy understanding of how services are generated, a shortage of empirical data, and inexperience in engaging with relevant decision-makers. This Symposium will show how a raft of state-of-the-art projects working in Africa are together addressing these challenges. Beginning in South Africa, presentations will critically examine ecosystem service interventions in the agricultural sector; quantify the impacts of land cover change on ecosystem services and human wellbeing in a semi-arid landscape; explore ways of integrating ecosystem services into conservation planning; and set out a bold new, national-scale initiative focused on commercial users paying for watershed restoration. Moving on to Tanzania, the remaining four talks will explain how a major programme in the Eastern Arc Mountains is building sophisticated models of seven key services; report progress on parameterising two of the most significant; illustrate the use of participatory scenario-building to explore the consequences of alternative development decisions and climate change; and explain how this work will inform REDD and other Tanzanian policy priorities.

BIODIVERSITY AND ECOSYSTEM SERVICE INTERVENTIONS IN SOUTH AFRICAN AGRICULTURAL LANDSCAPES

Belinda Reyers, Patrick O'Farrell, Philippa Anderson, Brian van Wilgen

Agricultural ecosystems provide real opportunities for conserving biodiversity and ecosystem services outside protected area networks. Past management actions in these landscapes have generally favoured agricultural intensification and ecosystem simplification. However, close-up examination of various agricultural sectors in South Africa provides insights into interventions aimed at sustaining farm production, ecosystem service retention and biodiversity conservation. Several such interventions - particularly those targeting soil erosion, land degradation, hydrological integrity and water use - have a long history. More recently, new initiatives have targeted on-farm conservation and stewardship, and the sustainable use of indigenous biological resources. These initiatives are mostly still newly emerging and demonstrate small ecosystem service, conservation and social welfare gains: there are few large-scale initiatives of this nature and intensification trends dominate agriculture. Our work also reveals that labelling strategies and product differentiation are widely used and offer potential gains, but are possibly flawed from a conservation perspective. Our analysis enables us to define the preconditions necessary for establishing sustainable agricultural initiatives, and to conclude there is a need for multi pronged approaches combining guideline development, knowledge dissemination, payments for ecosystem services, certification processes and marketing campaigns.

ECOSYSTEM SERVICES AND LAND COVER CHANGE IN A SEMI-ARID BIODIVERSITY HOTSPOT

Belinda Reyers, Patrick O'Farrell, Richard Cowling, Benis Egho, David Le Maitre, Jan Vlok

Management of ecosystems is limited by a lack of knowledge on ecosystems, their services and consequences of ecosystem change for human wellbeing. Where information does exist, traditional methods used to collate and communicate this information often represent an obstacle to ecosystem management. Embedding science in a social process is necessary if we are to ensure that knowledge results in the desired outcomes. This study attempts to co-develop this knowledge for ecosystem management with stakeholders. It aims to

quantify the local scale consequences of land cover change for ecosystem services in a semi-arid biodiversity hotspot in South Africa - the Little Karoo. We map the potential supply of and changes in five ecosystem services: production of forage, carbon storage, erosion control, water flow regulation, and tourism. Changes in land cover have resulted in substantial (20-50%) declines across ecosystem services. Of particular concern to the region's agricultural economy are the 20% declines in the water flow regulating service and the 44% decline in erosion control. We link these changes in services to the political and land use history of the region. We propose a way forward for the region which includes immediate action and restoration, mechanisms to fund this action, the development of future economies including tourism and carbon markets, and new ways that the science and stakeholder partnership can foster these changes

SAFEGUARDING BIODIVERSITY AND ECOSYSTEM SERVICES IN SOUTH AFRICA'S LITTLE KAROO: SYNERGIES AND TRADE-OFFS

Benis Egoh, Belinda Reyers, Josie Carwardine, Michael Bode, Patrick O'Farrell, Kerrie Wilson, Hugh Possingham, Richard Cowling

Declines in biodiversity around the world together with widespread degradation and unsustainable use of ecosystem services, have led to urgent calls to safeguard both. The benefits of safeguarding these include the justification of conservation actions, as well as increases in the resources available for conservation interventions. Although these benefits appear to be clear, the additional costs and potential trade-offs are poorly understood. In this study we investigate the amount of ecosystem services captured incidentally when planning for biodiversity alone, examine the opportunity costs of adding ecosystem services into this plan and explore trade-offs between biodiversity and ecosystem services at a fixed cost. At least 30% of each ecosystem service (carbon storage, water supply and forage production) was captured incidentally when all biodiversity targets were met. Including data on ecosystem services into the biodiversity plan captured at least 20% more of all services with no additional opportunity costs. When biodiversity targets were reduced by 8%, an extra 40% of each service could be captured for the same cost. The study highlights the benefits of integrating biodiversity with ecosystem services in conservation planning, while pointing to the need for markets and institutions for ecosystem services.

FROM CARBON TO WATER NEUTRALITY: LESSONS FROM SOUTH AFRICA

Jeanne Nel, Deon Nel, Christo Marais, James Blignaut

The concept of Water Neutrality, based on its carbon equivalent, was first coined during the World Summit on Sustainable Development in 2002. Since then the term has been loosely used, with little quantitative validation. Here we present a first quantitative framework for a Water Neutral Scheme that allows a water user to balance its water account through both demand and supply side interventions. In a chronically water-stressed country, facing significant development challenges, such as South Africa, incentives to improve both water demand and supply side management are becoming essential. The South African Water Neutral Scheme provides a mechanism for harnessing private sector investment for the wise-management of South Africa's scarce water resources, by allowing investors to quantitatively balance their water account based on

sound scientific rationale. Investors are required to engage in a three step process of: Reviewing their water-usage, implementing a reduction strategy, and investing in projects that will replenish hydrological systems with the water that investors use. Initially, replenishment is through investment in clearing water-intensive invasive alien plants. The project, however, encourages the development of further quantitative mechanisms for offsetting water usage, and proposes an operational model for promoting a Water Neutral market in South Africa

EXPLORING ECOSYSTEM SERVICE DELIVERY AND CHANGE IN THE EASTERN ARC MOUNTAINS OF TANZANIA

Andrew Balmford, Taylor Ricketts, Neil Burgess

Ecosystem services offer exciting opportunities to link biodiversity conservation to human wellbeing, yet progress is hampered by major limits to our understanding - of how services are generated, how much they're worth and to whom, how sensitive they are to climate and land-use change, and how far conserving them will also safeguard wild nature. We have developed a generic conceptual approach to these questions which we are now testing in Tanzania's Eastern Arc, a region of exceptional importance for service production as well as biodiversity. This involves

- *identifying a series of tractable, policy-relevant services (including carbon storage, water flow regulation, and provision of non-timber forest products);

- *collating existing data and supplementing them with fieldwork to parameterize spatially-explicit models of service production and value as a function of land cover, climate, population distribution, etc.;

- *developing mapped scenarios of how these input variables may plausibly change under alternative development trajectories;

- *and then using our resulting estimates of potential changes in service flows and values to inform the Tanzanian policy process.

Early results confirm the usefulness of this framework for policy makers but also highlight key gaps in data availability and theoretical understanding.

MAPPING CARBON STORAGE AND WATER FLOWS ACROSS A BIODIVERSE LANDSCAPE

Ruth Swetnam, Pantaleon Munishi, Sue White, Nasser Olwero

Carbon storage and water flow regulation are among the major ecosystem services provided by the Eastern Arc Mountain forests in Tanzania. In order to inform policy and management decisions that affect these services we need to be able to quantify them fairly accurately and understand how they may respond to climate and land-use change. To do this, we first compiled existing data on above-ground biomass (for carbon storage), and on climate, topography, soils, land cover and streamflow (for water regulation). Supplementing this information with additional field data, we have since begun parameterising spatially-explicit models that enable us to estimate carbon storage and hydrological flows across our entire study area. We present the preliminary results of these analyses. We are also exploring the consequences of different management and development decisions, by building spatial models of how land cover and land use may change which can in turn generate alternative inputs for our models of each service. This work will help us inform decisions about

forest management and possible Payment for Ecosystem Service schemes including carbon trading under the expected REDD mechanism.

Building scenarios to explore the future of ecosystem services

Ruth Swetnam, Brendan Fisher

Successful ecosystem service analysis requires the integration of economic valuation techniques with biophysical models to produce outputs that are firmly rooted in local socio-economic conditions. A key component of this process is the building of plausible, spatially explicit scenarios for evaluating changes over time. We describe a scenario-building process implemented in eastern Tanzania, which bridges the current gap between qualitative participatory approaches and quantitative biophysical modelling. The method comprised an assessment of Tanzanian policy in key sectors complemented by a series of interviews with policy makers, academics and environmental agencies. Two workshops followed: the first developed preliminary scenarios to understand which socio-economic factors were important in Tanzania. The second refined these scenarios and assessed the general magnitude of change in each of the main sectors allowing the development of spatially explicit rules to govern future land cover distribution for Tanzania. The resulting land-cover map enables us to link the qualitative scenarios to our ecosystem service models. By refining and applying the rules to this map, changes in the potential distribution of ecosystem services could then be explicitly modelled. Such scenario-building allows both the magnitude of change and its economic impact to be assessed.

FROM DATA TO DECISIONS: HOW UNDERSTANDING ECOSYSTEM SERVICES CAN SHAPE POLICY DECISIONS IN TANZANIA

Neil Burgess, George Jambiya, Shadrack Mwakalila

In Tanzania, ecosystem goods and services provided by wild nature are of central importance to the economic fabric of the country: from subsistence farmer to government ministry. However, valued habitats continue to be degraded through land conversion and unsustainable levels of resource extraction. This has impacts beyond Tanzania too - most notably through the contribution that forests and woodlands make to carbon storage and climate amelioration. The Valuing the Arc (VtA) programme is measuring, modelling and valuing ecosystem services generated across the country's Eastern Arc Mountains, but as well as producing conventional scientific outputs it is critically important that the programme's key findings are used to inform conservation actions at the national level. The valuation aspects of the work - understanding both the current benefits provided by ecosystems, and how these may change under different policy interventions - are particularly pertinent. These provide essential information for many emerging funding initiatives: most notably the opportunities offered by REDD and industry-led PES schemes. As well as exploring these examples the paper will describe how the science of VtA is being developed with and disseminated to appropriate levels of government within and outside Tanzania.

Symposium: Lessons Learned from the International Marine Conservation Congress and Future Directions in Marine Conservation , 66566

Organised by: John Anthony Cigliano, Ellen Hines

The International Marine Conservation Congress (IMCC), the first stand-alone meeting of the Marine Section of the Society for Conservation Biology, is an interdisciplinary meeting that will engage natural and social scientists, managers, policy-makers, and the public. The congress will also serve as the 2nd International Marine Protected Areas Congress (IMPAC2). The goal of the IMCC is to put conservation science into practice through public and media outreach and the development of science-based deliverables that can be used to drive policy change and implementation. Themes to be addressed in the congress include global climate change, land-sea interface, ecosystem-based management, and poverty and globalization. The congress will also be organized by cross-cutting issues that encompass topics of global relevance and importance to marine conservation and relate to the major themes: marine protected areas, education, outreach and capacity building, governance arrangements, fisheries and aquaculture, and economics. This symposium will report on the lessons learned from this congress and, through interactive discussions with symposium participants, identify gaps and future directions in marine conservation science and practice. Many of these issues are of critical importance to marine conservation in China and will be addressed during the presentations and discussions. Participants will be chosen from IMCC events and plenaries.

FISHERIES AND AQUACULTURE

John A. Cigliano, Olaf Jensen

Most fisheries around the world have declined to a fraction of their historical levels. This talk will summarize presentations given at the IMCC on fisheries and aquaculture and focus on the cause of fishery declines and possible solutions. Examples will be global in nature and will include invertebrate and vertebrate, and industrial and artisanal fisheries.

ECOSYSTEM-BASED MANAGEMENT

Dorothy Dick

Ecosystem-based management (EBM) has emerged as a potentially powerful tool in marine conservation. However, within marine systems, EBM is still in its early stages of development and implementation. This presentation will not only discuss new methodologies for the application of EBM but also provide real-life case studies of EBM implementation. Examples are global in nature and cover tropical to sub-arctic ecosystems. The examples further explore the synergistic relationship between fisheries management and marine protected areas within EBM as well as the multidisciplinary approaches necessary to achieve EBM (biological, social, economic and political). The presentation will further highlight the major challenges ahead

MARINE PROTECTED AREAS: THOUGHTS FROM IMCC/IMPAC2

Amber Himes

Spatial management in the form of marine protected areas (MPAs) has become a popular method for preserving marine biodiversity and managing uses of the marine environment. This presentation will discuss the development, implementation, and assessment of the ecological, biological, economic, and social effectiveness of MPAs and MPA networks as recently discussed at second International Marine Protected Area Congress (IMPAC2) as part of the IMCC in May 2009.

POVERTY AND GLOBALIZATION AS GOVERNANCE CHALLENGES

Katheryn Patterson

Poverty and globalization can affect marine conservation by both contributing to the decline in marine biodiversity and fisheries and by constraining conservation efforts. This presentation will discuss the relationship between poverty and globalization and marine conservation. Drawing from the interactive governance perspective, the presentation will also illustrate how to analyze poverty and globalization in terms of governability and present examples of how to break down such barriers to conservation.

GLOBAL CLIMATE CHANGE

Leslie Anne Cornick

Anthropogenic warming of the planet will have significant and wide-ranging impacts on the oceans. This presentation will summarize these impacts as discussed at the IMCC and discuss ways to mitigate and manage these impacts.

Symposium: Restoration of Large River Ecological Functions for Biodiversity Conservation: Case Studies from China and USA ,66525

Organised by: Robert Jacobson

Large rivers like the Yangtze, Mississippi, Missouri and Colorado are at the forefront of conservation because hydrological alteration and other human activities are known to be serious threats to the rich biodiversity in these freshwater ecosystems. While the issues on each river are unique, there has been a common trend towards restoring ecological functions as one way to conserve and restore freshwater biodiversity. This symposium will provide a platform for scientists from China and USA to share their research and management experiences from completed studies and to help design future experiments.

The proposed symposium will bring valuable lessons learned in the realm of adaptive management to the international audience. The speakers are respected, active experts of their respective rivers. Collectively, they bring successful stories of multi-disciplinary scientists (e.g., biologists, hydrologists, engineers) working

together to solve a common problem. The societies of China and USA are substantially different in many aspects, including social structures, stages of economic development, and near-term national priorities, and their shared experiences will be of great interest to a broad audience.

A BLUEPRINT FOR BIODIVERSITY CONSERVATION IN THE UPPER YANGTZE RIVER BASIN

Longzhu Wang, Michael Heiner, Qian Yu, Xinhai Li, Ruidong Wu, Peng Zhao, Jing Bi

The Yangtze River Basin is a global center for aquatic biodiversity. The sustainable management of this basin is critical to the continued growth of China's economy and maintenance of ecosystem goods and services, however, which requires information and a vision towards which to manage. As a case study, based on ecoregional assessment, we present an approach to developing information in a spatial analysis framework to define a conservation blueprint based on available data in the Upper Yangtze River Basin. With this approach, the areas of freshwater biodiversity significance are selected including sites meeting representative targets for ecosystems with lower cost through the MARXAN model, and expert focal areas on where endemic fish assemble in good condition in this basin, which totally represent 89% of the 131 threatened and endemic fish species evaluated. This blueprint will be a portfolio, designed according to available data and knowledge now, which will produce information and strategies to advance the development of protected areas, dam design and watershed management. With new data and knowledge added, the initial portfolio and supporting information system will serve as a first step and guide in the adaptive process of review and revision for the Upper Yangtze River Basin.

PROPAGATION AND RESTORATION OF FRESHWATER MUSSELS (BIVALVIA:UNIONIDAE) TO RECOVER THE BIOLOGICAL DIVERSITY OF RIVERS IN THE UNITED STATES

Dan Hua, Richard J. Neves,

Propagation has been recommended as a strategy to recover and restore populations of endangered mussel species. During the past 12 years, researchers at the Freshwater Mollusk Conservation Center (FMCC) at Virginia Tech and other facilities in the United States have developed a range of methods to culture juvenile mussels, including indoor water recirculating systems with continuous feeding technology to rear juveniles in captivity during all seasons, and outdoor pond culture systems to maximize growth during the summer. Since 1996, biologists at FMCC have released 50,000-100,000 juveniles per year into rivers of the southeastern United States. A total of ~570,000 juveniles representing 13 endangered species have been released, ranging in age from one week (0.5 mm long) to >1 year (20-30 mm long). Recapture rates of common species *Villosa iris* and *Lampsilis ovata* after 1 year at release sites were >20%, and shell growth exceeded 50%. Release of cultured juveniles is being compared to translocation of wild collected individuals to develop a broader suite of population restoration methods and a better understanding of mussel growth and demography. Propagation, release and monitoring of juveniles represents a viable set of tools to recover endangered mussel species and restore populations damaged by anthropogenic impacts.

ADAPTIVE MANAGEMENT OF THE COLORADO RIVER IN GRAND CANYON: INTEGRATING SEDIMENT, FLOW AND TEMPERATURE MONITORING WITH MODELING AND FIELD EXPERIMENTS

Theodore Steven Melis

Adaptive ecosystem assessment and management assumes that responses to management policies are highly complex and unpredictable. If managers embrace uncertainty and policies are considered experiments, then scientists may provide new information about options for achieving measurable objectives. The influences of Glen Canyon Dam operations on downstream resources of the Colorado River have been studied for 35 years. Physical and biological models have been developed, including an ecosystem model in 2001, to support experimental and monitoring designs. However, uncertainties about dam operations and resource responses persist. Some resource trends have been opposite to initial predictions, such as increasing abundance of native fishes despite continued loss of sandbar habitats under diurnal fluctuating flows. Current aquatic models cannot predict future native fish trends; hence scientists recommend more costly experiments, such as a temperature control device. Meanwhile, learning continues under variable warmer dam releases caused by drought. New suspended-sand transport monitoring techniques now provide more data than ever, yet models still cannot predict the future of sandbars under approved dam operations combined with the remaining downstream sand supply (10 percent of the predam supply). It is now clear that new sandbar modeling strategies are also needed. Integrating consistent monitoring with experiments and modeling is critical to adaptive management success.

DESIGN OF A NATURALIZED FLOW REGIME: AN EXAMPLE FROM THE LOWER MISSOURI RIVER, USA

Robert Jacobson, David Galat

In an initial step in adaptive management of the Lower Missouri River, managers, stakeholders, and scientists met in 2005 to design a naturalized flow regime to support reproduction of the endangered pallid sturgeon (*Scaphirhynchus albus*), while minimizing losses in social-economic benefits. Hydrograph requirements for pallid sturgeon reproduction are unknown, hence design and evaluation were based on environmental flow components (EFCs) of the natural flow regime (NFR). The design process included a primary stage in which stakeholders developed conceptual hydrographs based on general understanding. The second stage accounted for hydroclimatic variation by coding the conceptual hydrographs into reservoir release rules, adding constraints for flooding and storage, and modeling the rules through 100 years of simulation. The output flow regimes were evaluated for ecological benefits based on resemblance to EFCs in the NFR. Flow regimes also were assessed for social-economic costs related to flooding and reservoir storage. This experience underscored the lack of confidence stakeholders place in existing scientific understanding. Stakeholders desired proof of ecological benefits commensurate with their certainty of economic losses. Although the effort failed to reach consensus, the process was successfully tested a design approach, defined a starting point for management, focused science on key gaps, and demonstrated potential for future collaborative decision making.

BIOLOGICAL RESPONSES TO EXPERIMENTAL NON-FLOW TREATMENTS AND GLEN CANYON DAM RELEASES IN THE COLORADO RIVER, GRAND CANYON, ARIZONA, USA

Matthew Eric Andersen

The largest known population of the endangered cyprinid humpback chub *Gila cypha* is found in the Colorado River and its tributaries below Glen Canyon Dam in Marble and Grand Canyons, Arizona, USA. Since 1990 the Bureau of Reclamation has variously released high, fluctuating, or steady flows from the dam with the goal of restoring some pre-dam Colorado River disturbance and variability thought to create habitat conditions that benefit humpback chub and other natural resources. Multiple experimental treatments, the years-long response times of organisms, and basin hydrologic variability confound determination of natural resource responses to dam releases. Some initial generalizations regarding resource responses seem to be warranted. Larger diurnal winter fluctuating flows appear to temporarily suppress a spawning rainbow trout (competitive/predatory nonnative) population, but this population exhibited compensatory responses, potentially limiting any benefit to native fish. Low summer steady flows allowed for expansion of nonnative plants, especially tamarisk *Tamarix ramosissima*, but returning to modified low fluctuating flows limited this expansion. High flow releases temporarily and disproportionately displace nonnative fishes, but the overall impact on natives is uncertain. Recent drought-induced warmer water temperatures combined with localized nonnative fish removal appears to benefit humpback chub, perhaps irrespective of experimental flows.

Appendix I

Author Index

- A. Gabriela de Luna, 15
 Aaron Savio Lobo, 95
 Abdul-Azim Mahamud Baba, 193
 Abdullah Khan, 129
 Abhijit Das, 217
 Ablala Alatise, 32
 Abraham J. Miller-Rushing, 323
 Achara Simchareon, 211
 Achille Ephrem Assogbadjo, 34
 Achmad Yanuar, 303
 Adaoma Wosu, 26
 Adejoke Olukemi Akinyele, 46
 Ademola Abiola Ajagbe, 236
 Adrienne M Martin, 238
 Ady Kristanto, 131
 Ahimsa Campos-Arceiz, 137, 288
 Aidan Keane, 121
 Aihong Fu, 174
 Aili Kang, 339
 Aimee Elizabeth Kessler, 339
 AJ T Johnsingh, 228
 Akhmad Rizali, 30
 Alan Lill, 97
 Alan Watson, 22
 Alejandro Calvache, 284
 Alejandro Di Giacomo, 50
 Aleksandr H. Yesayan, 29, 170
 Alex Diment, 17
 Alex S Flecker, 60, 192
 Alexander Songorwa, 335
 Alexandra Delgadillo, 220
 Alexandre Camargo Martensen, 117
 Alfons Wahabe Mosimane, 3
 Alfonso Alonso, 66
 Alfonso Lombana, 194
 Alicia Kuroiwa, 206
 Aline Tristão Bernardes, 243
 Alison Cree, 140
 Alison Wadmore, 242
 Allison Boyer, 118
 Allison Devlin, 99
 Alonso Quevedo Gil, 215
 Alvaro Soutullo, 210
 Alys Stevens, 172
 Amalesh Dhar, 102
 Amalesh Dutta, 107
 Amanda CJ Vincent, 240
 Amanda Elizabeth Fine, 337, 339, 340
 Amber Himes, 346
 Amirtharaj Christy Williams, 287
 Amit Chawla, 203
 Amy Upgren, 2
 Ana D. Davidson, 118
 Anak Pattanavibool, 103, 120
 Anand Kumar, 285
 Ana-toly Khludnev, 313
 Anders Hedenstrom, 224
 Andre Chiaradia, 54
 Andrea Manica, 95
 Andreas Wilkes, 316
 Andres Link, 15
 Andrew Balmford, 19, 95, 340, 343
 Andrew Byron Davies, 113
 Andrew Dixon, 117
 Andrew Pullin, 6
 Andrew R Watkinson, 93
 Andrew Simons, 167
 Andrew Smith, 327, 329
 Andrew Taber, 134
 Andrew Thomas Smith, 339
 Andy Kouba, 103, 295
 Andy Maxwell, 26
 Ang Khai Chung, 163
 Angelita Morales Cadelina, 161
 Angelito Cereno, 57
 Anhsany Sypasong, 201
 Anibal Parera, 50
 Animesh Sarkar, 35, 110

- Anirban Dutta Gupta, 44
Anisha Thapa, 288
Anke Fischer, 269
Ann E. Bowles, 69
Ann M Anderson, 195
Ann M. Winters, 337
Anna Clarissa Gsell, 119
Anna Lawrence, 25
Anna Mae Sumaya, 57
Anna Norliza Bt Zulkifli Poh, 125
Anna Vardanyan, 199
Annette Denzinger, 229, 249
Annette Sieg, 66
Annika Hillers, 68
Anthony Simms, 156
Antonio C. R. Cozzolino, 207
Antonio de Winter, 189
Anwaruddin Choudhury, 218
Apolinario Bernardo Carino, 161
Aralisa Shedden-González, 5, 231
Aram Aghasyan, 216
Archana Bali, 1
Ariel Cazon, 151
Arif Budiman, 88
Arif Setiawan, 231
Arjun Gopaldaswamy, 11
Arlyne Johnson, 45, 97, 120, 201
Armen M. Danielian, 29, 170
Arun Agrawal, 317
Arup Kumar Hazarika, 107
Asad R. Rahmani, 221
Ashley Young, 8
Ashok Kumar K, 109
Ashraf Hussein Salem, 13
Ashton Maherry, 85
Ashwani Kumar Thukral, 203
Ashwin Naidu, 167
Ashwini Chhatre, 317
Asier R. Larrinaga, 137, 288
Astrid Nossa Pardo, 160
Astrid Scholz, 95
Atalia Politi, 151
Atsushi Tsunekawa, 312
Audrey Muratet, 135
Augustine Ezealor, 6
Aysegul Yildirim, 149
B P Singh, 77
B. K. Dalit, 198
Badamjav Lhagvasuren, 12, 312, 339
Baek Jun Kim, 162
Bai Junhong, 108
Bambi Semroc, 87, 179, 256
Bandi Namkhai, 263
Bandung Sahari, 30
Bao weidong, 251
Baoguo Li, 227
Baoping Ren, 307
Barbara Carmen Herrero Cangas, 205
Barbara Martinez, 84
Barney Long, 26
Barry Baker, 36
Bart J. Harmsen, 99
Baskaran N, 288
Bayabaatar Buuveibaatar, 313
Belarmain Adande Fandohan, 34
Belinda Reyers, 134, 320, 340, 341, 342
Ben Collen, 134
Ben D. Bell, 140
Ben Han, 216
Ben Phalan, 19
Benis Egoh, 341, 342
Benjamin Poulter, 36
Benoit de Thoisy, 99
Bernard Coetzee, 58
Bernardo Lartigau, 50
Berndt Van Rensburg, 113, 140
Bernhard Aigner, 102
Bernie Tershy, 60
Bharat J. Pathak, 77
Bhim B. Gurung, 11
Biao Yang, 230
Bill Sheate, 242
Bin Liu, 232
Bindu Shrestha, 180
Bing Zhou, 285
Bingyao Chen, 98
Birgit Ziesemann, 54
Bisong Yue, 165
Blanca Cecilia Huertas Hernandez, 118
Bo LI, 143, 221

- Bob Pressey, 252
Bofeng Cai, 183
Bogdan Cristescu, 38
Bolortsetseg Sanjaa, 337
Bornali Dutta, 218
Bosco P. L. Chan, 303
Bosco P.L. Chan, 271
Brad Ruhfel, 323
Bradley Neil Reynolds, 65
Brandon Albrecht, 86
Brandon Van Der Heide, 186
Brant Allen, 85
Brenda Solórzano-García, 5
Brendan Fisher, 340, 344
Brendon Larson, 8
Bret Muter, 186
Brett Alan Hanshaw, 64
Brian Gurr, 256
Brian Huntley, 36
Brian van Wilgen, 341
Brian Weidel, 85
Brice Sinsin, 34, 87, 178, 189, 223
Brij K Sharma, 195
Bruce Campbell, 205
Bruce Vondracek, 124
Bruno Monteferri, 336
Budhan Pukazhenthii, 260
Buuveibaatar Bayarbaatar, 338
Byamba Munkhtuya, 265
C. Can Bilgin, 149
Cagan H Sekercioglu, 81, 204
Callie Schweitzer, 63, 310
Cang-song Chen, 219
Cao Qing, 262
Carissa Joy Klein, 95
Carl H. Oliveros, 208
Carlos A. Lopez Gonzalez, 206
Carlos A. Peres, 4
Carlos Andres Martinez Ortiz, 206
Carlos Figuerero, 50
Carlos Frederico Duarte Rocha, 196, 207
Carly H Vynne, 99, 194
Carmen Quiroga, 55
Carmen Revenga, 134
Carolina Montealegre, 154
Carolina Ximenez de Macedo, 203
Caroline Howe, 43
Carrie Roever, 38
Catherine Ann Christen, 260
Catherine H. Graham, 59
Catherine J. Shier, 75
Catherine Parr, 113
Catherine Pringle, 192
Cathy C Laurie, 48
Cecilia Bartholomew, 99
Cecilia Passadore, 43
Celia Mailand, 48
Cesar Suarez, 277
Chadwick Dearing Oliver, 249
Chaipichit Saenghaisuk, 148
Chaminda Pradeep Ratnayake, 222
Chamitha D. de Alwis, 68
Chang-Qing Ding, 126
Changqing Yu, 275, 279
Changzhi Zhang, 96
Chanpen Wongsriphuek, 250
Chanthavy Vongkhamheng, 97
Chaode Ma, 276
Charles Besancon, 256, 324
Charles Davis, 323
Charles G. Willis, 323
Charles Huang, 152
Charles Steinback, 95
Charudutt Mishra, 313
Chen Xiaoyong, 173, 225
Chen Youping, 272
Cheng Li, 300
Chenghua Zhao, 71
Cheryl-Lesley Chetkiewicz, 38
Chinaongxian Zhang, 259
Chi-yeung Choi, 197, 221
Choo Chee Kuang, 122, 125
Chris Bowden, 221
Chris Chimimba, 140
Chris Hassell, 55
Chris Shank, 160
Chris Walzer, 12, 263, 264
Chris Wilcox, 60
Chrissy Pukk, 51
Christian Dietz, 249

- Christian Kerbiriou, 244
Christian Roos, 96
Christine Dragisic, 179, 256
Christine Schmitt, 325
Christine Vogt, 299
Christo Marais, 342
Christophe Bonenfant, 16
Christopher Narinder Singh Poonian, 123
Christopher Perry Johnstone, 97
Chu Hongjun, 314
Chunhua Li, 285
Chunxiang Tang, 232
Cindy Q. Tang, 74
Claire Brown, 134
Claudio Venegas, 166
Clive A McAlpine, 38
Clive Minton, 224
Colby Loucks, 26
Colleen Cassidy St. Clair, 61
Colleen Corrigan, 326
Conrad E Savy, 162, 179, 253, 256
Courtney G. Flint, 30
Courtney Larson, 84
Craig Gordon Morley, 247
Craig Nicoloson, 339
Crickette Sanz, 171
Cristiano Campos Nogueira, 243
Cristina Banks-Leite, 117
Cristina Garcia, 136
Cristina Pomilla, 47, 99
Cui Peng, 109
Culum Brown, 76
Cynthia Adeline A. Layusa, 208
Cynthia Pinheiro Machado, 203
Da Liangjun, 79
Daira Ximena Villagrán Chavarro, 160
Dajun Wang, 3, 230, 298, 300
Dale R McCullough, 169
Damayanti Buchori, 30
Damon Sydes, 280
Dan Hua, 347
Daniel Abugattas, 206
Daniel B. Fitzgerald, 159
Daniel Charles Miller, 335
DANIEL RUBINOFF, 144
Daniel Santana Lorenzo Raíces, 196
Daniel Segan, 116, 132
Daniel Simberloff, 247
Daniela Cano, 50
Danielle Shanahan, 59
Danny Rogers, 55
Dapeng Zhao, 227
Daphna Gottlieb, 114
David A Keith, 134
David Barton Bray, 315, 316
David Boufford, 70
David D Huff, 124
David Dudgeon, 73, 101
David Flaspohler, 79
David Fulton, 25, 42
David Galat, 348
David Gilroy, 85
David H Knox, 2, 256
David Hole, 36
David Jones, 245
David L Garshelis, 3
David le Maitre, 85, 341
David Lesford Roberts, 115
David Maehr, 126
David Mark Taylor, 333
David Morgan, 171
David Panitz, 320
David Powell, 260
David Reznick, 192
David S. Woodruff, 331
David Unger, 126
Deborah J Martyr, 147
Deborah Pain, 36, 221
Debra Ayres, 200
Debra J. Murie, 121
Debra M. Shier, 16
Deepani Jayantha, 212
Dejid Nandintsetseg, 265
Demetrio Bocuma Meñe, 199
Denis Sandanov, 33, 158
Dennis Salvador, 57
Deon Nel, 342
Desheng Li, 232
Dhruva Basu, 217
Diana Obgenova, 313

- Diangha Mercy Nambu, 141
Dianne Brunton, 54, 83, 119
Didi Kaplan, 186
Diego Rodriguez, 166
Dimitar Ragyov, 117
Ding Ping, 266
Ding Wang, 49, 86
Dingcheng Huang, 58, 99
Dingzhen Liu, 71
Diogo Gaspar Verissimo, 245
Diqiang Li, 210
Djuwantoko, 231
Dominique Bachelet, 36
Don Croll, 60
Don Strong, 200
Donald M Waller, 32
Donghua Xu, 125
Dongmei Zheng, 98
Dongming Xie, 168
Donna O' Connell, 138
Donny Gunaryadi, 286
Dorothy Dick, 345
Doug Demko, 123
Douglas Daly, 190
Douglas W Yu, 4
Drew Kerr, 200
Drew Timothy Cronin, 228
Duarte Morais, 3
Dun Luo, 67
Dunwu Qi, 299
Dydee Mann, 51
E. J. Milner-Gulland, 24, 43, 121, 130, 242, 269, 312, 313
Ed Fredrickson, 134
Edgar Atwood Rudberg, 42
Edsel Amorim Moraes Junior, 230
Eduard Batotsyrenov, 158
Eduard Theodoros Niesten, 142, 186
Eduard Yavruyan, 215
Eduardo Crespo, 139
Eduardo Gallo Cajiao, 76
Eduardo Venticinque, 182
Edwin Castellanos, 317
Edy Sutrisno, 131
Ehsan M. Dulloo, 29
Elaine C. C. Fidalgo, 207
Elaine Rosamond Hooper, 190
Eleanor Jane Sterling, 201, 202, 224
Elena Castiñeira, 43
Elena Kmetova, 117
Eliana Fierro-Calderón, 154
Elinor Ostrom, 318
Elisabet Purastuti, 287
Elisabeth Whitebread, 313
Elizabeth Ann Baer, 87, 179
Elizabeth Bennett, 294
Elizabeth Boakes, 126
Elizabeth Selig, 141
Elizabeth Wallace, 167
Elizabeth Yohannes, 151
Ellen Cheng, 40
Ellen Dierenfeld, 127
Elsa Delima, 57
Elvira Duran, 316
Emeline Sessi Pelagie Assede, 87, 223
Emily Nicholson, 134
Emily Woodhouse, 269
Emily Yeh, 328
Emma Jane Stokes, 120
Emmanuelle Porcher, 135
Emrah Coban, 81, 204
Enliang Yang, 119
Enny Sudarmonowati, 131
EnoAbasi Deborah Anwana, 238
Enoka Priyadarshani Kudavidanage, 68
Enos Shumba, 129
Enrico Di Minin, 132
Enrique Crespo, 166
Eren Turak, 275, 276
Eren Turak and Hugh P. Possingham, 276
Eri Nakama, 219
Eric Omura, 169
Eric Sanderson, 338, 340
Eric Wikramanayake, 75
Erik Grijalva, 200
Erik Nelson, 282
Erika Hingst-Zaher, 166
Erika Nathalia Salazar Gómez, 160
Erin McCreless, 60
Ernesto C. Enkerlin-Hoeflich, 129

- Ernesto Rodríguez-Luna, 5, 231
Ernst Swartz, 85
Eronica Miranda, 151
Esther Bosibori Omosa, 31
Esther N Kioko, 159
Eugenia Naro-Maciel, 224
Eugenia Zandona, 192
Eun Kyung Heo, 193
Evelyn H. Merrill, 40
Evgeny Simonov, 187
Fabian Tavera Beltrán, 160
Fabio Labra, 320
Faguo Wang, 70
Falk Huettmann, 244
Fang Liu, 3
Fatolah Heydari, 217
Fei Lisong, 44
Felipe Mendonça, 243
Feng Ding-yuan, 169
Feng Ruixi, 44
Feng Zhang, 262
Fengshan Li, 289
Fenqi He, 183
Fernanda Almeida Santos, 49
Fernando Nishio, 206
Fifanou Gbèlidji Vodouhe, 178
Filemon Rioso Etingüe, 159
Fortunata Urban Msoffe, 61
Francesca Cuthbert, 56
Francis Putz, 243
Franck Courchamp, 16, 105, 114, 124
Frank Molinia, 140
Frank Schurr, 34
Frank T. Van Manen, 300
Frank Vincent Paladino, 240
Frank Wugt Larsen, 254
Franziska Roth, 261
Freerk Wiersum, 111
Fumin Lei, 91
Fuwen Wei, 295, 296, 297, 298, 299, 300, 307
Fu-Wu Xing, 70
Gabriela Ramirez, 50
Gabriela Silvina Blanco, 240
Gail Walker Hearn, 159, 199, 228
Gang Hu, 305
Gang Li, 258
Gaodi Dang, 299
Gary Kofinas, 1
Gary Roloff, 299
Ge Bao-ming, 229
Ge Xue-Jun, 322
Geeta Seshamani, 65
Genevieve Pence, 278
George Amato, 99
George Jambiya, 344
George Papov, 215
George Schaller, 230, 339
George William Archibald, 155
Georgina Mace, 126
Gerald Kuchling, 213
Gerald Oitzinger, 102
Gerardo Ceballos González, 88, 118, 134, 239
Gerry Cassis, 73
Ghassem Habibi Bibalani, 33
Gianna Minton, 47
Ginger R. H. Allington, 187
Giorgi Darchiashvili, 155
Giovanni Alberto Chaves Portilla, 160
Gisele Pires de Mendonça Dantas, 49
Glenn H. Shepard, 4
Gliceto Olarte Dagondon, 111
Gloria M. Luque, 113
Go Fujita, 106
Goddilla Viswanatha Reddy, 147
Gokarna Jung Thapa, 75
Gongbo Tashi, 330
Gopalakrishna S P, 109
Gopalakrishna SP, 112
Gordon B. Stenhouse, 38
Graham H. Pyke, 76
Graham P Hall, 145
Grant Hose, 275
Greg Keith Yarrow, 91
Gregory Lawrence Acciaioli, 333
Gretchen Daily, 283
Gu Yanchang, 108
Guang Yang, 98
Guangmei Zheng, 20, 266
Guangming He, 299, 301
Guilherme Braga Braga Ferreira, 230

- Guiming Wang, 91
Guiquan Zhang, 71, 232
Guo Qi Rong, 165
GUO Xiang-Bao, 53
Guo Yumin, 108
Guojun Zhang, 191
Guy Franklin Midgley, 319
Guy Pe'er, 117
Habib Ahmad, 129, 149
Hadas Kushnir, 27
hadi Radnezhad, 212
Haidar Ali, 33
Haitao Shi, 138
Haldre Rogers, 146
Hamid Reza Akkafi, 192
Hamish McCallum, 51
Hamta Golkarian, 133
Han Jianlin, 266
Han Jing, 290
Han Xu, 70
Hang Gi Wong, 184
Hang Lee, 162
Hannah O'Kelly, 120
Hans-Ulrich Schnitzler, 229, 249
Hao Feng, 191
Hao Wang, 300
Haobijam Meitei, 65
Harald Vacik, 102
Hari prasad Sharma, 39
Harini Nagendra, 318
Harisha Ranganahalli Puttahariyappa, 175, 214
Hariyo Tabah Wibisono, 147
Harmony Patricio, 123
Harold Weeks Avery, 92
Harriet Rankin Huber, 41
Harry C Zinn, 3, 171
He Yi, 274
Heather Tallis, 281
Hector Ball, 50
Hector Pavés, 166
Heidi E. Ruffler, 199
Heidi Gjertsen, 186
Heike Lischke, 36
Heikki Roininen, 226
Heiko Faust, 28
Helena Godoy Bergallo, 196, 207
Heliot Zarza, 152
Hemanta Kafley, 82
Hemin Zhang, 71, 232, 301
Hendra Aquan, 131
Heng Xiao, 163
Henrique Bergallo Rocha, 154
Herwig Ruprecht, 102
Hien Tran Minh, 250
Hiroshi Hashimoto, 219
Hiroyoshi Higuchi, 106
Holly Gibbs, 141
Holly M. McChesney, 231
Hong Liu, 67, 70
Hong Miao, 157
Honglin Wu, 71
Hongxuan He, 256, 258
Horacio Cardozo, 50
Hou Rong, 301
Howard C. Rosenbaum, 47
Howman Wong, 125
Hu Defu, 259, 261, 262
Hua Qin, 30
Hua Wu, 298
Huabin Yang, 119
Huai-Sen Ai, 309
Hugh Barry Ferguson, 110
Hugh P. Possingham, 7, 59, 62, 82, 95, 104, 132, 139
Hugh Possingham, 342
Huibin Zhang, 125
I Fang Sun, 322
Ian Craigie, 57
Ilia Anatolievish Domashov, 237
Imeh Kokoette Esenowo, 188
Imran Siddiqui, 167
Indrila Guha, 37, 132
Irene Zager, 134
Iris Mazurek, 52
Irving A Mendelssohn, 173
Isabelle M Côté, 93
Ishmael Nyarko, 189
J Alan Clark, 101
J. Timmons Roberts, 162

- Jack Tordoff, 255
Jackson County, 18
Jackson Efitre, 121
Jacqueline L. Frair, 40
Jake Vander Zanden, 85
Jakob Fahr, 68
Jamal Ahmad Khan, 77
James Beeharee, 123
James Blignaut, 342
JAMES BURNHAM, 291
James Edward Maxwell Watson, 63
James F Gilliam, 60
James F. Parham, 138
James H. Brown, 118
James Harris, 291, 292
James L. David Smith, 11, 211
James R. Allen, 40
James Robert Spotila, 66, 139, 240, 301
James Sheppard, 297
James Thomas Anderson, 195, 231
James Thomas Harris, 155
James Thomas Reardon, 120
Jan Barkmann, 28
Jan van der Ploeg, 2, 69
Jan Vlok, 341
Jan-Ake Nilsson, 21
Jane Gaithuma, 254
Janet Silbernagel, 202
Janneke Hille Ris Lambers, 146
Jared B Lee, 170
Jason Yu-Xiao Long, 131
Jatna Supriatna, 303
Javier Francisco-Ortega, 70
Javier Garcia Villalba, 215
Javier García Villalba, 188
Javier Ramirez, 206
Javier Rodriguez-Perez, 137
Jayant Sarnaik, 204
Jayson Carungay Ibanez, 57
Jean Paul Metzger, 117
Jean-Claude Abadie, 135
jean-dominique lebreton, 53
Jean-François Julien, 244
Jean-Michel GAILLARD, 16
Jeanne Lindsay Nel, 278
Jeanne Nel, 85, 275, 278, 342
Jeb Barzen, 290, 291, 292
Jedediah Brodie, 76, 292
Jeff Carroll, 84
Jeff Robert Muntifering, 84
Jeffrey A. McNeely, 31, 253
Jeffrey Jenness, 246
Jenifer Huang McBeath, 246
Jennifer A. Edalgo, 231
Jennifer Agnes Gill, 93
Jennifer Germano, 140
Jennifer L Keating, 69
Jennifer M Moslemi, 60
Jennifer Pastorini, 286
Jenny Koivisto, 226
Jenny Paola Gallo Santos, 160, 181
Jerrold L. Belant, 91
Jerry A. McBeath, 246
Jerry Penha, 182
Jiakuan Chen, 221
Jian Yang, 299
Jianchu Xu, 4, 316
Jiang Feng, 168, 314
Jiang Zhigang, 314, 328
Jiang Zhou, 308
Jianguo Liu, 299, 301
Jianxin Zhang, 56
Jian-Xu Zhang, 71
Jiao Shengwu, 108
Jiazi Liu, 230
Jie Cao, 261, 262
Ji'en Gong, 3
Jiguet Frédéric, 244
Jin Chen, 83
Jin Zhao, 83
Jing Bi, 347
Jing Che, 164
Jing li, 163
Jing Liu, 157
Jing Luo, 237
Jing Wang, 191
Jinhua Li, 304
Jinliang Chen, 262
Jinping Chen, 251
Jinyan Huang, 232

- Jito Sugardjito, 37
Joan Garland, 153, 290
JoAnne Simerson, 69
Joao Stenghel Morgante, 49
João Stenghel Morgante, 166
Joaquim de Araújo Silva, 230
Joel Berger, 313, 338
Johannes Penner, 68
John A. Cigliano, 345
John Beecham, 52
John Benson, 134
John Buchanan, 179, 256
John Fellowes, 247, 271, 303
John Jobe Cox, 126
John Spotila, 301
John Warui Kiringe, 148
John Zinda, 8
Jon C Sjoberg, 86
Jon Davis, 103
Jon Paul Rodriguez, 134
Jonah Morris Busch, 255, 319
Jonah Ratsimbazafy, 202
Jonathan E M Baillie, 134
Jonathan Fong, 138
Jonathan Roger Rhodes, 38
Jones M. Mueke, 159
Jorge Enrique Parra, 220
Jorge Gabriel Alvarez Romero, 279
Jorge I Velasquez-Tibata, 59
Jorge Xavier da Silva, 150
Jorn P W Scharlemann, 256
Jorn Scharlemann, 324, 326
Jose Antonio Vazquez-Garcia, 234
Joseph Larkin Fox, 314, 315
Joseph M. Northrup, 38
Joseph Mark Kolowski, 66
Joseph O. Ogutu, 61
Joseph Vattakaven, 136
Joseph Wroblewski, 74
Joshua J. Tewksbury, 146
Josie Carwardine, 342
Juan Armesto, 320
Juan Carlos Riveros Salcedo, 277
Juanita Joseph, 122
Julia Baker, 130
Julia Jones, 121
Julia Kathleen Baum, 239
Julia Klein, 328
Julia Ohl-Schacherer, 4
Juliana F. Mattos, 18
Juliana Machado Ferreira, 166
Juliann Aukema, 284
Juliano Sarmiento Cabral, 34
Julie K Young, 338
Julie Kay Betsch, 194
Julie Lockwood, 144
Julius Arinaitwe, 254
Junbao Wen, 77
Junco Nagata, 169
Junxing Yang, 173, 225
Junzhong Huang, 298
Justin Ward, 179
Justine Sulawa, 53
Jyotsna Bhagavatula, 167
Jyrki Pusenius, 226
Kai Li, 261
Kaiya Zhou, 86, 98
Kamal Bawa, 35, 322
Kamal Thapa, 75
Kang minming, 79
Kararaina Scally, 9
Karen Alexy, 126
Karen E. Hodges, 40
Karen Haysom, 124
Karen Lips, 192
Karen Noyce, 13
Karin Frank, 117
Karl Didier, 135, 338, 340
Karolina Fierro-Calderón, 154
Kartick Satyanarayan, 65
Kartik B. Shastri, 20
Kate Snaddon, 278
Katherine Holmes, 224
Katherine McFadden, 224
Katheryn Patterson, 346
Kathleen Marie Herrmann, 159
Kathleen Schuyler Gobush, 48
Kathryn M Rodriguez-Clark, 134
Katrina Brandon, 141
Katsumi Ushiyama, 106

- Kavitha Anjanappa, 214
Keavuth Huy, 26
Keith Hamer, 331
Keith Lawrence, 141
Keith Willmott, 118
Kejia Zhang, 230
Kelly Erika Gleason, 238
Kelly Spence, 201
Keming Ma, 150
Ken Gosbell, 55
Ken Norris, 221
Ken Okwae Fening, 159
Ken P. Findlay, 47
Kenneth Cameron, 171
Kenneth R Young, 27
Kent H. Redford, 243
Keping Sun, 168
Kerrie Wilson, 342
Kerry Waylen, 269
Kevin Buley, 138
Kevin Sallee, 120
Kexiong Wang, 49
Khadga Basnet, 14
Khongir Manzhiev, 313
Kim M Berger, 338
Kim O' Connor, 126
Kimberly C Cofer, 155
Kindomihou Valentin, 189
Kiragu Mwangi, 254
Kirk A Olson, 339
Kiruben Naicker, 128
Klaus Henle, 117
Koichi Goka, 114, 196
Koji Oohata, 219
Kong Dejun, 174
Kong Duong, 26
Kristen C. Nelson, 11
Kristin Brabender, 261
Kristina Timmerman, 127
Kriithi K Karanth, 57
Kulojyoti Lahkar, 218
Kumara Wakjira, 184
Kumaran Surendra Varma, 109
Kun Shi, 311
kwaku Aduse-Poku, 201
Kyoung Ho Kang, 193
L. Scott Mills, 40
Lalji Singh, 167
Lan Qie, 137
Lan Wenxu, 314
Larissa Oliveira, 166
Laura Feinstein, 200
Laura Secada, 277
Laurel Converse, 217
Lauren Chapman, 121
Lauren Dahl, 126
Lauren J Brudney, 56
Lauren Persha, 317
Laurent Gbenato Houessou, 183
Leandro Antoniazzi, 50
Leandro Silveira, 194
Lee Boyd, 263
Lee Hannah, 319
Leigh Barrett, 86
Leo John Bottrill, 152
Leon Benun, 256
Leonardo Maffei, 99
Leslie Anne Cornick, 346
Leslie Underhill, 224
Levon Aghasyan, 216
Lgnacio Moreno, 166
Lgor Glushkov, 187
Li Cong, 108
Li feng, 222
Li Shengzhi, 273
Li Xiaowen, 39, 108
Li Yong, 236
Li Yu, 52, 173
Li Yuan, 173
Li Zaiyun, 225
Li Zhang, 230, 284, 285
Li Zhong, 271
Lian Pin Koh, 330, 332, 334
Liana Nicole Joseph, 104
Liangkun Shao, 298
Lifei Wang, 145
Lifeng Zhu, 298
Li-Juan Duan, 179
Limin Feng, 285
Lindie Babara Smith-Adao, 85

- Lindsay Neuberger, 186
Lisa Hiruki-Raring, 41
Lisa Marie Gardner Barillas, 18
Lisa Nordstrom, 235
Liu Baocai, 108
Liu He, 14
Liu Lin, 285
Liu Qiang, 222
Liu Qingshen, 169
Liu Wen, 289
Lnayat Ali, 156
Lngrid Britt Hogle, 200
Loannis Vogiatzakis, 221
Longzhu Wang, 347
Loren Miller, 124
Lorena Rodriguez-Gallego, 210
Lorenzo Alvarez-Filip, 93
Lori Eggert, 45
Louisa Ponnampalam, 47
Lrene Ester Gonzalez Garay, 150
Lu Ji-Qi, 53
Lu Jun, 84
Lu Yan, 305
Lu Zhang, 176, 230
Luc Leblanc, 144
Luchezar Zlatev Pehlivanov, 122
Lucia Liu Severinghaus, 146
Lucille Palazy, 16
Luis Camilli, 94
Luis Ortiz-Catedral, 83
Luis Rivera, 151
Luis Roberto Gonzalez Torres, 200
Luis Santamaria, 137, 288
Luke Daniel Preece, 205
Lulu Cong, 153
Lynise Wearne, 280
Lynn Huntsinger, 9
M D Madhusudan, 228
Ma. Renee P. Lorica, 152
Mac Elikem Nutsuakor, 189
Madeleine Clare Bottrill, 7
Madhav Khadka, 82
Madhu Rao, 201
Mahdi Reyahi Khoram, 177, 178
Mahmoud-Reza Hemami, 217
Makamas Sutthacheep, 148, 172
Maki Lnoue, 225
Mal Ridges, 210
Malcolm L. Hunter, 310
Malvika Onial, 19
Manuel Ruiz Perez, 205
Maoulida Kamal, 123
Marc Foggin, 330
Marc Hockings, 7
Marc Steininger, 255
Marcela Beltran, 220
Marcelo Gonçalves de Lima, 203
Marcelo Juliano Rabelo Oliveira, 230
Marcos A Santos, 207
Marcus J. Hamilton, 118
Maria Adela Davison, 55
Maria Alice S Alves, 18, 207
Maria Jose del Valle Pacha, 241
Maria Lapinski, 186
Maria Lucia Lorini, 89, 150
Maria Rebecca Alviar Campos, 128
Maria Vladimirtseva, 153
Mariana Moncassim Vale, 18, 89
Mariana Nin, 43, 210
Mariana Rios, 43, 210
Marie Anne Tremblay, 61
Marie-Lilith PATOU, 247
Mariella Camardelli Uzêda, 196, 207
Marilia Borgo, 203
Marina Kolodina, 291
Marine Arakelyan, 199
Mario Herero, 61
Marissa Ahlering, 45
Mark E. Hauber, 83
Mark Gillingham, 167
Mark Infield, 72
Mark Lawrence, 12
Mark R. Lethbridge, 82, 208
Mark Rayan Darmaraj, 50
Mark S. Boyce, 38, 40, 75
Mark Spalding, 134
Mark Whitaker, 89
Mark-Oliver Rödel, 68
Markus Fischer, 323
Marlow Pellatt, 28

- Marta B Costa, 207
Martin Tyson, 45
Mary Ngozi Molokwu, 21
Maryam Ghahraman Pouri, 205
Maryati Moechlisin, 147
Masoomali Movahedi, 226
Masoomah Eslamifar, 226
Matamoro Alexis, 81
Mathieu Rouget, 134
Matt Walpole, 134
Matt Whiles, 192
Matthew Eric Andersen, 349
Matthew Linkie, 37, 147
Matthew M Sommerville, 24
Matthew N Foster, 2, 255
Matthew S. Leslie, 47
Matthew Watts, 95, 116
Matthias Herkt, 68
Max-Planck, 151
Mayra Pereira de Melo Amboni, 73
Mayuree Umponjan, 103
Mecit Vural, 149
Megan Owen, 69
Mehmet A Kirpik, 81, 204
Melanie Delion, 296
Melissa Hauzer, 123
Melissa Songer, 262, 296
Meng Yang, 235
Menna E. Jones, 51
Meraj Anwar, 41
Mercy Mwanikah Ojoyi, 198
Meredith L Gore, 186
Merlijn van Weerd, 2
Mery Sonia Villalobos, 55
Mewa Singh, 308
Micaela Trimble, 43
Michael Blecher, 104
Michael Bode, 342
Michael Heiner, 347
Michael Hoffmann, 162, 253
Michael I Westphal, 82
Michael Jennings, 134
Michael Marshall, 192
Michael O' Connor, 66, 139
Michael Riddell, 25
Michael Stüwe, 88
Michael W.N. Lau, 271
Michael Willams Bruford, 298, 299
Michael Zukosky, 264
Micheal Lau, 138
Michelle A Haynes, 32
Michelle Wieland, 23
Miguel Clavero, 280
Mike Mascia, 26
Mike Maunder, 70
Mike Vandeman, 206
Milena Nikolova Pavlova, 122
Min Chen, 227
Mina Ramezani, 226
Ming Li, 300, 306, 307
Minghai Zhang, 96, 311
Mingming Fan, 143
Miriam Melanie Hansbauer, 78, 117
Mirza Dikari Kusriani, 154
Mohamad Tarmizi, 147
Mohamed Ahmed Ezat, 233
Mohammad Ayub Alavi, 160
Mohammad Khalid Sayeed Pasha, 209
Mohammad Mehdi - ahmadi, 133
Mohammed Yahya Said, 61
Mohlamsane McDonald Mokhatla, 140
Monica F B Harris, 203
Monica Muelbert, 166
Monika Zavodna, 46, 81
Monique Van Sluys, 207
Moores Nial, 55
Moses Ole Neselle, 61
Mounir R. Abi-Said, 15
Mridu Paban Phukan, 218
Muhammad Qaiser, 33
Muhammad Zaheer Khan, 107
Mukti Roy, 133, 288
Murali Pai, 91
Mxolisi Sibanda, 129
Naamal Kaushalya De Silva, 2
Nadja Gomes Machado, 182
Nan Wang, 270
Nancy E Karraker, 73, 101
Nancy Job, 278
Narendra Man Babu Pradhan, 75, 164

- Nareth Chea, 26
Nasser Olwero, 343
Natalia Meyer, 50
Natalie Clark, 126, 270
Natalie Gooddal, 166
Natasha Stacey, 205
Nathalie Machon, 46, 81, 135
Navinder Jeet Singh, 312, 313, 314
Navjot S Sodhi, 334
Naxun Zhao, 300
Neil Aldrin Mallari, 268
Neil Burgess, 134, 324, 325, 340, 343, 344
Neil Clive D' Cruze, 52
Neil M. Furey, 229
Nelli A. Hovhannisyán, 29, 170
Neneng Sholihat, 154
Neville Ash, 134
Nicholas Andrew Rivers-Moore, 278
Nicholas J. Souter, 82
Nicholas K Dulvy, 93
Nicholas Wilkinson, 213
Nick Cox, 26
Nick William Brickle, 147
Nidia Rodríguez Gaitán, 160
Nigel Gilles Yoccoz, 314
Nigel Leader-Williams, 15, 130
Nigel Rothfels, 260
Niklaus E Zimmermann, 36
Nikolai Sindorf, 152
Ning Labbish Chao, 7
Ningning Kong, 92
Noelle Francesca Kumpel, 80
Nora Bynum, 201, 202
Noreen Marie G. Folloso, 208
Noviar Andayani, 147
nsajigwa emmanuel Mbije, 22
Nuno Ferrand, 49
Nurchalis Faldhi, 287
Nyambayar Batbayar, 339
Nyeema Harris, 62
Ochirkhuyag Lkhamjav, 340
Ode Marie Louise Kouamé, 255
Oki Hadian, 88
Ola Olsson, 21
Olaf Jensen, 85, 345
Oliver Coroza, 255
oliver krone, 53
Olivier Combreau, 12, 167
Olivier Gargominy, 81
Olivier Leon, 167
Onder Cirik, 81, 204
Ondine Filippi-Codaccioni, 21
Onja Razafindratsima, 84
Ony Malalaniaina Rabearivololona, 202
Ophelia Wang, 27
Orosco A Christine, 122
Oscar Butron, 206
Oscar Gallego Carvajal, 215
Oscar Venter, 62
Osvaldo Eric Ramirez Bravo, 175, 206
Ousmane Coulibaly, 178
Oyunsai Khan Ganbataar, 263, 264
Ozgun Emre Can, 52
Pablo A Marquet, 320
Pablo Herrera, 50
Pamela Fierro, 151
Pan Xiaofu, 225
Panchapakesan Jeganathan, 221
Pantaleon Munishi, 343
Paola Mejía, 210
Parul Gupta, 241
Pashupati Chaudhary, 35, 322
Patricia Majluf, 166
Patricia Manzano-Fischer, 152
Patricia McLENACHAN, 247
Patricia Moehlman, 265
Patricia Zurita, 142
Patricio Cowper Coles, 50
Patrick Kongo Kipalu, 108
PATRICK Munyao Maundu, 31
Patrick O' Farrell, 341, 342
Paul B Holden, 86
Paul Beier, 246
Paul G.W. Salaman, 59
Paul Insua-Cao, 305
Paul Ivory, 123
Paul J. J. Bates, 229, 249
Paul Jason Buzzard, 125
Paul R Sotherland, 139
Paul van Gardingen, 61

- Paula Laporta, 43
Peggy Olofson, 200
Peng Zhao, 347
Peng-Fei Fan, 98, 302, 309
Peng-tao Luan, 52
Pengyan Wang, 232
Pengyun Tao, 119
Pete Gober, 248
Peter Brosius, 336
Peter Cutter, 211
Peter Garson, 267
Peter Goodman, 278
Peter J Murray, 145
Peter JS Jones, 93
Peter Kareiva, 282
Peter Leimgruber, 259, 262, 296, 339
Peter Ritchie, 166
Peter Smallwood, 127
Petra Kaczensky, 12, 263, 264
Petter Erik Axelsson, 197
Pham Duc Tien, 229
Phil Battley, 55
Phil Bishop, 140
Philip Briggs, 124
Philip McGowan, 126, 266, 269, 270
Philip Nyhus, 84
Philipp Stumpe, 203
Philippa Anderson, 341
Phillip Cassey, 144
Pierline Tournant, 114
Piero Visconti, 116, 252
Pierre Legendre, 190
Pierrick Rautureau, 12
Piet Verburg, 192
Pramod Padmanabhan Nair, 45
Prithiviraj Fernando, 284, 286, 288
Priya Singh, 11
Qamar Qureshi, 41, 190, 207
Qi Yingjie, 314
Qian Yu, 347
Qianxin Lin, 173
Qing Cao, 84, 262
QUANG NGOC NGUYEN, 72
Quyét Le Khac, 17
R Raghunath, 228
Rachel Bricklin, 101
Rachel Kavanagh, 23
Rafael Luis Fonseca, 243
Raghavendra Shivalingaiah, 130
Rahul Ramesh Rao Mungikar, 204
Raiarshi Banerji, 37
Rajapaksha Haddokara Gedara Ranil, 199, 233
Rajeev Pillay, 228
Rajesh Gopal, 207
Ralph Kuehn, 12
Ram Nath kandel, 78
Ramadhani Achdiawan, 205
Raman Kumar, 220
Raman Sukumar, 80, 284, 288
Rana El-Sabaawi, 192
Ranjay Kumar Singh, 180
Raphael Klumpp, 102
Raquel Godinho, 49
Rare, 42, 156, 157
Ravi Corea, 29
Ravi Shanker Kanoje, 185
Raymond Alfred, 287
Raymond Thompson, 74
Rebeca Chaverri, 245
Rebecca Danielle Duffield, 172
Rebecca J. Foster, 99
Rebecca Shaw, 318, 321
Reginaldo Aguilar Biacho, 228
Renae Tobin, 10
Renata Brzozowska, 193
renda Solórzano-García, 231
Rene Villalon Vendiola, 161
Reuben Clements, 333
Rhys Green, 19, 221, 244
Ric A How, 100
Ricardo Machado, 243
Rich Harris, 329
Richard Cowling, 341, 342
Richard Fuller, 62, 126
Richard J. Neves, 347
Richard Maloney, 104
Richard Primack, 321, 323
Richard Reina, 54, 97
Richard T Corlett, 332
Rinjan Shrestha, 75

- Rishi Kumar Sharma, 190
Rob Dunn, 62
Robbin Elizabeth Peach, 94
Robert A Cheke, 238
Robert Baldwin, 47
Robert Edward Grumbine, 4
Robert J Smith, 132
Robert Jacobson, 346, 348
ROBERT L PRESSEY, 116, 210, 279
Robert L. Pressey, 280
Robert W. Risebrough, 218
Roberto Cavalcanti, 243
Roberto Jesus Caceres, 151
Robin Reid, 61
Robyn Denise Appleton, 13
Rodrigo Medellin, 105
Rodrigo Sierra, 27, 134
Rodrigo Sierra Corona, 134
ROGER VARGAS, 144
Rohan Arthur, 95
Rohit Singh, 1
Roian Matt, 22
Ron Abrams, 106
Ron Kegerries, 86
Ron Swaisgood, 16, 295, 296, 297
Ron Tilson, 84
Rongping Wei, 71, 232
Rosalynn Marie Anderson-Lederer, 166
Rose Peter Kicheleri, 22
Roy Ruochuan Gu, 176
Rucha Gate, 317
Rudjanta Nugraha, 147
Ruidong Wu, 347
Ruixuan Tian, 299
Runzhi Zhang, 58, 99
Rurik List, 134, 239
Russel Mittermeier, 302
Russell Wise, 320
Ru-Tao Lin, 309
Ruth Jimenez, 255
Ruth Swetnam, 343, 344
Sachiko Moriguchi, 106
Sadegh Sadeghi Zadegan, 158
Saksit Simchareon, 211
Saksit Simcharoen, 103
Sally R. Walker, 304, 306
Samad Kottur, 65
Samantha Strindberg, 120, 135
Sameer Punde, 204
Samia Carrillo-Percastegui, 99
Sampa Sarkar, 110
Sampath K. K. Ekanayaka, 288
Samrat Mondol, 47, 90
Samson Oluwagbemiga Ojo, 71
Samuel Cord Stier, 152
Samuel K Wasser, 48, 194
Samuel Kwabena Oppong, 201
Samuel L Denes, 69
Samuel Turvey, 86
Sandra Pompa Mansilla, 88
Sandra Valderrama, 220
Sandro Coneglian, 203
Sandy J Andelman, 319
Sang Don Lee, 162
Sanjay Molur, 304, 306
Santadas Ghosh, 132
Santiago Dalessio, 50
Sara Moore, 153, 290
Sarah Amy Wyatt, 162
Sarah Foster, 294
Sarah Horwath, 60
Sarah Imgraben, 275
Sarah Jane Foster, 240
Sarah Kate Papworth, 24
Sarah M. Bexell, 248
Sarah Maria Brook, 250
Sarah Marie Bexell, 44
Sarath R. B. Dissanayake, 286
Sarath S. Rajapakse, 68
Sarath W. Kotagama, 68, 222
Saw Htun, 120
Scott E. Nielsen, 38
Se Songploy, 172
Sean Anderson, 81, 204
Sebastian Abades, 320
Sebastian Gerhard Wilhelm Koch, 28
Sedat Inak, 81
Sedat Lnak, 204
SERGEI SMIRENSKI, 291
Sergei Volis, 104

- Sergio Omar Pulido Barrera, 160, 218
Setiabudi, 88
Seyed Mehdi Amini Nasab, 205
Seyyed Khalil Akbari Mohammadi, 226
Sha Jianbin, 222
Shadrack Mwakalila, 344
Shang kankan, 79
Shannon Randolph, 242
Shanshan Liu, 74
Shaobing Yang, 285
Shao-lin Peng, 72
Shaoying Liu, 300
Sharad Kumar, 77
Shawn Laffan, 73
Shaya Honarvar, 139, 159
Sheila R Colla, 248
Shelly Lachish, 51
Shem C Kifugo, 61
Shen Xiaoli, 273
Sheng Huo, 309
Sheng Li, 298, 300
Shiqiang Zhou, 232, 301
Shirin Aghanajafi, 217
Shiyang LI, 42
Shu Shusen, 173
Shu yan Wang, 237
Shui-hua Chen, 219
Shu-Jin Luo, 51
Shumiao Zhang, 183
Shuping Zhang, 20
Shuqing An, 70
Shuxin Li, 301
Siddappa Setty, 322
Sidney T. Rodrigues, 277
Silvia Carvalho, 139
Simon Hedges, 45, 286
Simon Linke, 132, 276
Sini Maaria Savilaakso, 226
Sitha Som, 161
Sitiporn Pengsakun, 148
Sokhorn Kheng, 161
Solofoniaina Nandrianina Ralaimihoatra, 245
Somphot Duangchantrasiri, 103
Song Haokun, 289
Song kun, 79
Song Xiaolong, 108
Songhai Li, 49
Songlin Fei, 92, 126
Soumya Prasad, 80
Stefanie K Graves, 69
Stephanie Cassel, 103
Stephanie Pietsch, 12
Stephanie Renee Januchowski, 252, 280
Stephen David Gregory, 124
Stephen Morreale, 240
Stephen Sutton, 10
Steve Carver, 22
Steve Monfort, 260
Steve Willis, 36
Steven Pearson, 92
Steven Thomas, 192
Steven Trent, 294
Stghik Ghazaryan, 215
Stuart Butchart, 36
Stuart C Nixon, 80
Su Liying, 182
Su Yan-hua, 169
Subir Chowfin, 217
Sudeep Chandra, 85
Sue Mainka, 214
Sue White, 343
Sumanta Kundu, 288
Sun Lixin, 71
Sun Qiu, 185
Sunny B. Snider, 60
Surendra P. Goyal, 41
Surendra Varma, 112
Suresh Jones, 248
Suresh Kumah Raina, 35, 159
Susan A. Schroeder, 25
Susan Kilham, 192
Susan Ruffo, 282
Susan Townsend, 135
Sutirtha Dutta, 223
Sylvestre Djagoun, 181
Taal Levi, 4
Takehiko Y Ito, 312, 339
Takuya Iwamura, 62
Tammy L. Mildenstein, 152
Tammy Smith, 134

- Tang Mingjie, 109
Tang Yafe, 44
Tao Meng, 298
Tao Wan, 77, 157
Tao Wang, 157
Tao Yongshan, 314
Tarnya Elizabeth Cox, 145
Taro Sugimoto, 169
Tarun Gogoi, 218
Tatjana Good, 210
Tatsuya Amano, 106
Taylor Ricketts, 343
Teak Seng, 26
Tefera Belay Endalamaw, 111
Tejo Suryo Nugroho, 231
Terry Sunderland, 24, 205
Tessa Minter, 69
Thamasak – Yeemin, 148, 172
Theodore Steven Melis, 348
Thiago Ferreira Pinheiro Dias Pereira, 154
Thierry Lusenge, 80
Thinh Van Ngoc, 96
Thomas J. Valone, 187
Thomas John Clements, 112
Thomas Matthew Brooks, 141, 162, 254, 255
Thomas McShane, 335
Thomas Mueller, 339
Thomas R Gillespie, 171
Thomas Richard Defler, 188
Thomaz C. C. Costa, 207
Tiana Jayne Preston, 54
Tiantian Feng, 300
Tiao Ning, 163
Tien Ming Lee, 236
Tigran Hayrapetyan, 215
Tilo Nadler, 307
Tim Blackburn, 144
Tim Boucher, 134
Tim Collins, 47
Timm Tennigkeit, 316
Timo O. Veteli, 226
Ting Zhou, 72
Todd Arnold, 56
Todd K Fuller, 339
Tom Dahmer, 84
Tom Hrabik, 85
Tony Whitten, 70
Toshiya Matsuura, 219
Tran Chi Trung, 336
Tran Triet, 290
Travis Sydes, 280
Tristan Gingerich, 195
Trond Larsen, 64
Tseveenmyadag Natsagdorj, 339
Tushar Saikia, 218
Ullas Karanth, 11, 90, 103
Uma Ramakrishnan, 90
Usham Somarendro Singh, 65, 77
Uttam B Shrestha, 209
Vadim Harutyunyan, 215
Vanessa Guerra Persson, 150
Victor Fabio Luna, 215
Vijay Dhinakaran Anand, 109, 112
Vincent Devictor, 21
Vincent Noe Villarin Gunot, 152, 161
Viola Kerekes, 261
Virgilio Hermoso Lopez, 280
Vivian Yan Yan Lam, 193
Vladimir V Aramilev, 169
Volodymyr Maltsev, 197
Vu Dinh Thong, 229, 249
W. Chad Futrell, 10
Waltraut Zimmermann, 259, 260, 261, 262
Wanfei Qiu, 93
Wang Ding, 272
Wang Fupeng, 108
Wang Hao, 273
Wang weihang, 109
Wang Yukuan, 283
WARREN YALDING BROCKELMAN, 250
Wayne A. Morra, 228
Wayne Linklater, 166
Wei Liu, 232, 299, 301
Wei Yang, 300
Weibang Sun, 119
weihua Xu, 176, 202, 232, 297
Weikang Yang, 12
Weixiang Xu, 70
Wen Xiao, 309
Wendy Foster, 138

- Wenjun Li, 9, 143, 157
Wilfredo Vidal Alanguí, 177
Will Turner, 141, 254
William Bradley Sutton, 63
William Fagan, 339
William Forbes, 198
William J. Platt, 234
William Joseph Clark, 48
William McShea, 3, 229, 298
William Oduro, 189, 201
William Winhall, 69
Willie Bowling, 126
Wilson A. Kerrie, 62
Wing Kan Fu, 73
Wu Fei, 190
Wu Jian Dong, 291
Wu Xianzhi, 44
Wu Zhaozheng, 14
Wynne Collins, 260
Xiangbo He, 299
Xiangdong Ruan, 257
Xiangjiang Zhan, 298, 299
Xiangyou Shen, 171
Xiaodong Chen, 301
Xiaodong Gu, 300
Xiaofeng Luan, 210
Xiaojian Zhu, 3
Xiaojing Gan, 197, 221
Xiaoming SHAO, 299
Xiaoping Zhou, 232
Xiaoya Li, 119
XIE Dong-Ming, 53
Ximin Wang, 156
Xinhai Li, 277, 347
Xinqiao Zhang, 49
Xinrong Xu, 98
Xiuhua Li, 145
Xiujiang Zhao, 49
Xiuyue Zhang, 165
Xu Jiliang, 268
Xu Ping, 44
Xuehua Liu, 299
Xuelong Jiang, 98, 302
Xuemei Han, 249
Yadvendradev Jhala, 136, 190, 223
Yadvendradev V Jhala, 207
Yahkat Barshep, 224
Yahui Zhang, 232
Yakup Sasmaz, 81, 204
Yalma Vargas-Rodriguez, 234
Yan Huang, 232
Yan Li, 237
Yanbo Li, 143
Yang Le, 202
Yang Liu, 183
Yang Xiaojun, 174, 190, 222
Yani - Saloh, 24
Yankuo Li, 96
Yanling Song, 229
Yan-Ping Chen, 142
Ya-Ping Zhang, 52, 163, 237
Yasemin Erguner Baytok, 149
Yash Veer Bhatnagar, 314
Yassir Al Kharousi, 12
Yeong Yee Ling, 122
Yi Wu, 90
Yibo Hu, 299
Yi-Bo Luo, 67, 70
Yingxiang Wang, 302
Yinting Cai, 197
Yoan Dinata, 37
Yohannes Wibisono, 231
Yong Wang, 18, 63, 221, 309
Yong Zhang, 115
Yongcheng Long, 302, 306, 307
Yonggang Nie, 297
Yonglin Wu, 230
Youko Yamamoto, 219
Youming Xiong, 285
Youping Chen, 300
Yu HongZhong, 222
Yu Zhang, 101
Yuan li, 251
Yuanbin Zhang, 300
Yubaraj Subedi, 180
Yufang Gao, 67
Yujiang Hao, 86
Yumiko Uryu, 88
Yun Gao, 237
Yun Zhu, 299

Yung-Fu Chang, 257
Yuping Meng, 262
Yuri Arylov, 313
Yuval Sapir, 104
Yuxin Zhang, 150
Yves Bas, 244
Yves Laumonier, 88
Yvonne Sadovy, 295
Zabihollah Yousefi, 226
Zaheer Muhammad Khan, 107
Zeb Hogan, 85
Zejun Zhang, 296, 297
Zeng Nan Jing, 291
Zhadou, 330
Zhang Anju, 44
Zhang Jingguo, 14
Zhang Juan, 153, 290
Zhang Shuqing, 182
Zhang Yanyun, 268
Zhang Ya-Ping, 169
Zhang Yuhong, 182
Zhang Zhengwag, 267
Zhang Zhihe, 44, 301
Zhao Jianlin, 222
Zhao Xinquan, 327
Zhaobin Song, 165
Zhao-lu Wu, 142, 246
Zhargalma Alymbaeva, 158
Zhaxi Sange, 274
Zheng Guangmei, 268
Zheng Hong Sui, 193
Zheng Yu, 108
Zhengbiao Wang, 261
Zheng-ling LI, 246
Zhenyu Zhong, 211
Zhi Feng Zhang, 193
Zhi Lu, 230, 271
Zhifang Wang, 100
Zhigang Jiang, 75
Zhiguo Dong, 165
Zhijin Liu, 307
Zhijun Ma, 197, 221
Zhimin Su, 58, 99
Zhisheng Wang, 285
Zhiyun Ouyang, 176, 232, 297, 301
Zhong Xingyao, 174
Zhongqiu Li, 75
Zhong-Sheng Wang, 70
Zhong-yong Fan, 219
Zulfiqar Ali, 19
Zuo-Fu Xiang, 306
Zura Javakhishvili, 155
Zusheng Yi, 102