Conservation Asia 2018

Mainstreaming Conservation in a Changing Asia

Book of Abstracts

Organizers and Partners:

American University of Central Asia

Society for Conservation Biology Asia Section

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ISBN 987-9967-28-567-5

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Conservation Asia 2018

The Society of Conservation Biology – Asia Section

Mainstreaming Conservation in a Changing Asia

The Society of Conservation Biology (SCB) is dedicated to advancing the science and practice of conserving Earth's biological diversity. SCB is a global community of conservation professionals, with thousands of members from more than 100 countries.

SCB's Asia Section organized its biennial international conference, called Conservation Asia 2018, which was hosted at the American University of Central Asia (AUCA) in Bishkek, the capital city of the Kyrgyz Republic. As an institution of higher learning, AUCA's mission is to carry out research, conservation, and education, with research focusing on forest ecology, conservation biology, and resource plant development as well as environmental management and sustainable development, EIA, GIS application in environmental management and R-programming. It is a therefore a hub for addressing conservation challenges and for presenting new research in conservation science and practice throughout Asia. Conservation Asia was also co-hosted by the Snow Leopard Trust (SLT), the United Nations Development Programme (UNDP), and various other regional donors and organizations.

This international conference took place over a 4-day period, from 6th-10th August 2018. The academic theme of Conservation Asia 2018 was "Mainstreaming Conservation in a Changing Asia", reflecting the intersection between AUCA's expertise and the foci of SCB, SLT, and UNDP. The conference aimed to engage conservation scientists and practitioners from Russian-speaking countries, therefore all sessions had simultaneous translations in both Russian and English.

Conservation Asia 2018 attracted 250 participants including academics, conservation agencies, and NGOs from 44 different countries. More than 200 talks and posters were presented during 15 thematic symposia. There were six plenary talks from David Borchers, Vidya Athreya, Lu Zhi, Olga Medeova, Koustubh Sharma, and Simon Hedges. Simon Hedges was awarded the Distinguished Service Award for his 30-year contribution to saving Asian elephants and their habitats. Numerous hands-on workshops were held throughout the duration of the conference, including workshops on conservation storytelling, population assessment and distribution of elusive species, conservation in Central Asia, and project management for wildlife conservation and adaptive management using the Spatial Monitoring and Reporting Tool (SMART). After the conference, participants enjoyed a selection of field trips to appreciate the spectacular Kyrgyz countryside and culture.

SCB Asia board members also ran workshops on policy, diversity and inclusion, journals, and Chapters. As a result of these engagements, participants at the conference are forming two new SCB Chapters: one for Central Asia, and another for Pakistan. SCB further expanded with many new member sing-ups, including members joining from new countries such as Tajikistan, where SCB previously had no representation.

SCB supported the travel costs of 10 international students, facilitating their journeys to Bishkek with over $6,000 awarded in travel grants. Partner organizations such as the Snow Leopard Trust supported around 10 early career conservationists working in the field of snow leopard conservation to attend the conference.

Conservation Asia 2018 was a social media storm, with the hashtag #conservationasia2018 accumulating nearly 1.5 million impressions, reaching 60,000 people in 701 posts by 301 users.

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Plenary Sessions

Abstracts

Lu Zhi

Professor Lu Zhi has worked on the natural history and conseration strategies of endangered species such as the giant panda, the snow leopard, the Przewalski's gazelle, and the ecosystems these flag species represent in China. In recent years, her interests expanded to understanding the complex interaction between ecosystems and socioeconomic systems, in order to explore practical and equitable solutions for co-existence. She is involved in conservation policy making at regional and national levels and in promoting China's positive influence in the world.

Simon Hedges

Asia is in the midst of a biodiversity conservation crisis. Protected Areas (PAs) are expected to fulfill an ever-growing list of functions, but the majority are failing in their most important goal, the protection of wildlife and wildlife habitat. Specifically, traditional PA management regimes are failing to adequately reduce the key threats of intense, unsustainable hunting, as well as habitat loss and degradation. These failings are not restricted to Asia but are seen across the planet. One response, in Africa, over the last 10-15 years, has been for countries to delegate PA management responsibility to non-governmental organizations. While the nature of the management agreements varies significantly among countries, and among protected areas, these agreements are often referred to collectively as public-private partnerships (PPPs). A number of other alternatives to conventional PAs, including private conservancies, are also common in Africa. I review the 'pros and cons' of PPPs, private conservancies, and conservation concessions and explore reasons why such approaches remain uncommon in Asia, which include differences between the two regions' legal systems, the challenges of implementing law enforcement, and cultural differences. Nevertheless, it seems possible that these issues could be overcome in at least some instances, and I contend that delegated management and other private or part-private approaches may represent the only realistic current means of conserving significant wildlife populations in much of Asia. Such alternative regimes could also serve as models of conseration success, and so potentially engender the stronger political will to effect conservation that is needed to urgently. I conclude with an ambitious proposal for promoting more effective PA management in Asia.

David Borchers

Dr. David Borchers is an academic statistician with 30 years' experience developing methods in statistical ecology. He is a current Professor and Head of Statistics for the School of Mathematics and Statistics at the University of St. Andrews. He has nearly 100 peer reviewed publications, 4 books, 6 book chapters, and 35 invited talks and workshops to his name. Dr. Borchers has developed statisticl methods and software used extensively by national, international, and private conservation and management organizations. His active research interests include ecological statistics, wildlife population assessment, distance sampling, survey design, mark-recapture, hidden Markov models in ecology, sampling theory, spatial modeling, and public understating of statistics.

Olga Medoeva

Sarychat – Ertash nature reserve in Kyrgyzstan is a home for numerous wildlife species, including birds and mammals listed in the Red Book. Located close to the reserve the Kumtor Gold Mine became a visiting point of a number of species. As part of its environmental responsibility, KGC is committed to monitor flora and fauna, and in particular impact of the production to the environment. To ensure precise, quick and on- going monitoring Kumtor Gold Company is using The Monitor-Pro System, a comprehensive and flexible suite of applications for managing data. KGC uses Monitor Pro via mobile tablets to record the number, type, and behavior of bird species observed on site. Common uses are environmental compliance, sustainability, and health monitoring data management. The system securely provides full audit trail including field, Desktop, Mobile, and Web-based versions.

Vidya Athreya

Vidya Athreya is a senior scientist at the Wildlife Conservation Society - India programme. Her interests lie in understanding the different facets of human-wildlife interactions in shared spaces. Her research on human-leopard interactions has opened up the perspective for exploring both the human and animal dimension of co-adaptations between large wildlife and people. She has also been part of the formulation of policy guidelines for human-leopard management in India. In her talk she will be touching upon the research her team does, as well as providing a different perspective on what shared spaces could look like and what it takes to ensure shared spaces in which conflict is not the dominant narrative.

Koustubh Sharma

Snow leopards serve as the ambassador of the mountains. They move freely between international borders without visas, unless bound by physical fences. Deeply embedded into the symbols, cultures, traditions and folklore of people living in the mountains of central and South Asia, the snow leopards are considered the guardians of the third pole. The snow leopard mountains provide water, clean air, medicinal plants, biomass, fodder, pest control, and tens of other provisional, cultural and regulating services to millions of people, the snow leopard's value cannot be overemphasized. Wherever a large predator interfaces with humans, there is likelihood for conflict. The relationship between snow leopards and humans has been no different, and snow leopards have been killed historically by angry herders who could lose their entire year's livelihood in a night to a rampaging snow leopard high on adrenalin. Threats to snow leopards vary from poaching and retaliatory killing to poorly planned infrastructure and climate change. The situation on the ground varies spatially as well as temporally, which is why it is imperative to analyze the local situation and develop a conservation plan accordingly. While learnings from failures and successes from other regions or time periods can help, there is no substitute to building partnership on ground to successfully implement a conservation program. Some of the most successful conservation programs in snow leopard landscapes are essentially people centric, and rely on building partnership with stakeholders at different levels, including local communities, organizations, educational institutions, governments and businesses. Photos of snow leopards are becoming a commonplace, but we still know little about these ghosts of the mountains. It is only recently that technology has enabled us to understand the diet, ranging and populations of snow leopards with relatively greater level of confidence. New advancements in technology such as artificial intelligence, satellite communication, infrared imaging, conservation genetics and drones hold promise to improve our ability to research, monitor and conserve snow leopards better. However, between conservation programs on the ground and state of the art research, organizations and conservationists are limited by capacity and resources. This is where it becomes important to engage with the Governments, which not only have the mandate, but also the resources to scale up these conservation strategies from landscapes to regional or national levels. The Global Snow Leopard and Ecosystem Protection (GSLEP) Program is a unique alliance of Governments of snow leopard range countries partnering with international organizations, conservationists and educational institutions to implement the goals identified in the Bishkek Declaration 2013 and 2017. Snow leopard range countries have identified 24 landscapes to be secured by 2020, which hold promise to protect more than 25% of the total snow leopard range. The collective efforts towards snow leopard conservation have found substantial traction, for they are not just for a species and the people living along with snow leopards, but also help align our collective commitments towards the goals Paris Agreement on climate change, Aichi Biodiversity targets, and sustainable development goals.

Oral Presentations

Community-Based Conservation

Conserving the river tigers: Golden mahseer in upper Ganga river, India

Saurabh Dewan, Jitendra Singh Rana, Ajay Pandey, Rajeev Lochan, Anand Kumar, Upendra Singh

Indiscriminate fishing of brooders, destructive fishing methods and habitat fragmentation due to dams and barrages have led to decline of Golden mahseer (*Tor putitora*) in the upper stretch of River Ganga. Once acclaimed as the 'tiger of river' the species is currently assessed as 'endangered' by IUCN. Lacking strict law and enforcements, the current regulatory framework has failed to contribute towards its conservation. With financial support under 'Conservation Leadership Programme', we initiated a project to assess its current population status in a stretch of upper Ganga River in India. We aimed to identify critical habitats which can be prioritized as conservation and restoration zones.

Extensive sampling efforts were made in past eight months to gather information on monthly variation in size composition, location, duration and purpose of migration. Some spawning grounds were identified at Nayar and Phoolchatti streams, where fry were observed while larger resident fish stock was mostly observed in lower stretches of Ganga river around Kaudiyala and Shivpuri. Water quality parameters were also assessed at these sites which can be characterized as essential habitat factors for these breeding grounds. These findings will contribute baseline data towards prediction of population structure, dynamics of this iconic mahseer species and comparison with past decade records will help us to estimate plausible future trends.

Several fishermen were also interviewed to document the locations for their fishing pursuits and their fish catch. Gatherings were organised at Baghi village, near confluence of Nayar and Alaknanda rivers. The villagers acknowledged the fact that fewer large-sized mahseers are now seen and even the juveniles are now being targeted by poachers. Awareness campaigns involving different stakeholders as villagers, local students, political leaders, regulatory authorities are planned in near future. This integrated effort will help in achieving long term conservation goal of the 'Charismatic' golden mahseer.

Evaluating the success of conservation strategies - lessons from a once-pristine fish spawning aggregation

Rucha Karkarey, Rohan Arthur, Stella James, Al Badush A, Teresa Alcoverro, Mayuresh Gangal

Conserving long-lived predatory fish with complex life-histories is often a challenge, especially in regions of high human densities. The success of conservation strategies is typically measured with metrics like compliance and species population trends, while changes in animal behaviours is rarely used as an index. We tracked density and mating behaviours in a high density fish spawning aggregation of the squaretail grouper (*Plectropomus areolatus*) in the Lakshadweep archipelago (India) over a six-year period (2011-2017), through the onset of a commercial reef fishery (2013) and the establishment of a seasonal fishing closure (2014). Despite high compliance with the closure, there was a dramatic decline in population density, a sharp shift in size-structure and the loss of a density-dependent alternate reproductive tactic (ART) from the aggregation. Changes in the mating system were observed when population density declined by less than 10% of 'unfished' densities, but most interestingly, this change was observed two years before a significant 70% drop in overall aggregation densities. This precipitous population decline can be attributed to the corresponding growth of commercial reef fishing during non-aggregation periods, which appears to be targeting smaller individuals (<40 cm). It appears that along with seasonal closures, protecting this spawning aggregation would require additional and direct regulation of threatened size-classes to ensure both the numerical and behavioural integrity of the population is maintained. Our study highlights the use of behavior as an indicator of anthropogenic disturbances in wild populations and stresses on the need to incorporate behavioural metrics while designing and evaluating effective conservation strategies.

Abstracts

Scaling-up conservation: lessons from community-based conservation approaches in Tajikistan and Kyrgyzstan

Tanya Rosen, Khalil Karimov, Zairbek Kubanuchbekov, Shirin Mykhametkadyr kydy, Kobil Shokirov, Nuzar Oshurmamadov, Rahim Kulenbekov

This presentation will in the frame of the CAMI symposium, explore how community-based conservation approaches in Tajikistan and Kyrgyzstan are advancing the conservation of snow leopards and Marco Polo sheep, two species listed under CMS and part of CAMI. It will also show how some of the same approaches can be successfully replicated to conserve other CAMI species across the region, including Asiatic cheetah; Persian leopard and Saiga.

Do Cultural Taboos Conserve Wildlife?

Sahil Nijhawan

Although cases of local conservation behaviour have been documented in many societies world over, the role of indigenous communities in wildlife conservation continues to be a contentious topic. Given rapidly changing socio-political circumstances surrounding many traditional societies, the focus is steadily shifting from labeling indigenous people as guardians or exploiters to identifying factors leading to local conservation. We empirically tested the effectiveness of cultural norms, especially taboos, in regulating hunting in Idu Mishmi community of Northeast India. Idus harvest large-bodied animals under strict taboos linked to the notion of cosmic retribution. We combined anthropological frameworks on hunting and ritual with quantitative analyses to understand interactions between ritual practices and socio-economic variables on wild meat consumption patterns. Monthly data were gathered on wild meat intake and observance of taboos with a representative sample of 90 households in January-September 2014. These variables were modeled as a function of household wealth, education, ethnicity and seasonality using a mixed-effects framework. Results show that wealthier Idus and outsiders consumed the most meat, often with little regard to taboos. Poorer Idus hunted to supply meat to the rich while observing taboos strictly. Wealthier Idus therefore used wealth to transfer the burden of taboos over to the poor. Combined with long-term qualitative data and animal density estimates from camera trap surveys, we show that in this situation cultural restrictions do impact hunting. We also observed that societal changes such as conversion to Christianity and education reduced taboo observance. However, increased westernised education may in fact lower dependence on wild meat. Finally, we argue that Idu hunting taboos do not work in isolation; rather all cultural restrictions are connected and fundamental in the construction of Idu identity. This research contributes to the debates on making conservation more relevant and effective by incorporating complex dimensions of human-nature relations.

Conservation Encounters: How Nationalism and Conservation Meet amid Myanmar's Kachin War

Laur Kiik

How does global nature conservation inspire encounters across deep cultural difference? And how do these "conservation encounters" – between conservation and other "world-making projects" – result in conflict, cooperation, or awkward social gap? This paper offers a social-anthropological perspective toward better understanding nature conservation as not only ecological, but also social, cultural, and political. Based on altogether twenty months of ethnographic fieldwork between 2010 and 2018, the paper explores the encounters between an ethnic national movement and global biodiversity conservation – in sub-Himalayan Burma/Myanmar's Kachin region. The Kachin borderland is devastated by decades of military oppression, the massive grabbing of jade and other natural resources, and a current war that has displaced a hundred thousand people. This biodiversity hotspot also keeps vast old-growth forests and diverse life-forms that have inspired major Western-based nature conservation organizations to commit to developing a national park, a biosphere reserve, "the world's

largest tiger reserve," and other protected areas. This paper explores transnational conservation's arrival to this land, specifically how the state-allied and landscape-oriented conservation actors – both expats and local-country citizens – encounter native ethnic patriots, for whom here is not a forest complex, but the central homeland of a separate nation. My paper thus asks: What kinds of worlds are the Kachin nationalists and the transnational conservationists trying to create here, as they both target the same native people, landscapes, and wildlife with a similar sense of emergency and morality? How may we understand nature conservation as a negotiation over reality, morality, and value between some of the most disparate parts of humankind?

Mainstreaming Conservation Research and Practice through Collaboration with Faith-Based Leaders and Communities

Jame Shaefer, Kit Magellan

Because approximately 84% percent of the people in the world identify with a particular faith (religious, folk, traditional, aboriginal, spiritual), leaders and members of faith-based communities profess ultimate reasons for acting ethically, and they can be mobilized to act, conservationists may find them helpful with research and practice projects and willing to advocate policies that are compatible with scientists' findings. To facilitate constructive interaction between conservation and faith communities, the Religion and Conservation Biology Working Group of the Society for Conservation Biology initiated in March 2016 a project to solicit successful practices members have used when interacting with faith leaders and communities. A highly iterative process that included a Society – wide survey, sessions at international and regional congresses, and annotations by members of their experiences in the field yielded in February 2018 Guidelines for Interacting with Faith-Based Leaders and Communities: A Proposal by and for Members of the Society for Conservation Biology when planning, initiating, launching, closing, and following up projects. Participants in this workshop will

1) examine and comment on the guidelines,
2) collaborate in drafting an outline for a case study of a conservation project that follows the guidelines,
3) consider making a commitment to prepare a case study explaining the outcome of using the guidelines in a conservation research or practice project for presentation during a symposium to be proposed for the 2019 International Congress for Conservation Biology, and
4) recommend additional venues for sharing the guidelines.

Challenges and Opportunities to Conserve the Markhor in Kashmir Himalayas

Riyaz Ahmad, Rahul Kaul, Sameer Dar, Indu Kumari, Yash Veer Bhatnagar

We have been working for about a decade in Kashmir Himalayas to conserve the markhor from local extinction. While trying to address the identified threats, new threats emerged especially in Hirpora WLS which were difficult to control. We conducted surveys to assess the new threats and changes in markhor population in the two areas as a result. We conducted Focused Group Discussions and Participatory Rural Appraisals with the livestock herders to discuss the changing grazing practices and alternatives to stop it. We interacted with forces and locals to protect markhor in Kazinag. The markhor population in Hirpora WLS has reduced to half from about 60–70 individuals in 2004–5 to 25–30 individuals in 2012 whereas it has remained more or less stable on 150–160 in Kazinag NP. The construction of a new road and increasing livestock pressure seem to be the major causes of decline. The new road is crossing through middle of the wildlife Sanctuary and has destroyed the critical spring and winter habitats of markhor. We found that the changing herding practices have doubled the livestock numbers. Livestock herders, bring livestock of landlords along with them and even sublet their pastures to non-traditional herders, to earn cash. Herders agreed to leave the non-traditional practices and continue with the traditional livestock grazing practices to conserve these pastures and herbivores. They outlined the incentives such as solar lights,

cooking gases and the school bags and books and school fees for their children to give them proper education. In Kazinag, locals used to do community hunting of markhor during winters. We worked with Wildlife Department and locals to control the community hunting of markhor by locals. We conducted awareness programmes for army to stop any poachers and poaching in the Kazinag NP.

Geoparks - the basis for the integrated conservation of natural heritage, culture and development ecotourism in Kyrgyzstan

Alexey Dudashvili, Ulan Rakhmatov

Geopark – an area with a special protected status, which reveals the geological history of the Earth, genesis of local landscapes, expressive geological formations, fossil layers.

Geopark, this is not only a geological heritage, but also the habitat of biological species and a cultural and historical heritage.

Nowadays, UNESCO supported establishment and management of Geoparks. In 2002, UNESCO launched a new initiative program – The Global Geoparks Network (GGN). Since 2004 GGN contributed management plan designed to foster socio-economic development that is sustainable based on geotourism.

This paper discusses opportunity and advantages for Kyrgyzstan to set up Global Geoparks. Kyrgyzstan has a big potential to establish global geoparks, for example: Enilchek glacier (Central Tien Shan), the Sary-Too Mountains, Mydygen canyons (foothills of the Turkestan range), natural-technogenic park Mailuu-Suu and others.

Does environmental education program work for conservation? A case study in the protected areas of Nepal

Samridhi Shrestha

In developing countries, biodiversity conservation and poverty reduction strategies remain as one of the major discourses of the environment and livelihood. Local communities see wildlife as a threat and a nuisance and they view land and natural resources as their base for livelihood. For a successful management of resources and people living around them, identification and understanding of different stakeholders and their stake in conservation is required. In this research, qualitative research method, face-to- face interviews regarding environmental education programs (EEPs) were collected from officials of governmental, non-governmental and international non-governmental organizations from three different protected areas of Nepal (Chitwan National Park, Bardia National Park, Parsa Wildlife Reserve). Published data was used to review poaching of rhinos and tigers over the last decade in Nepal. Results indicate that environmental education programs (EEPs) are provided to local communities by every organization working towards conservation. The EEPs were conducted through eco-clubs or through workshops or groups such as community-forest user group and buffer zone group. Questions regarding the EEPs given by the organizations had many issues since all the organizations did not have a structured education program despite conducting EEPs. Poaching was highest during political instability in the country. However, Nepal was able to reduce rhino poaching in 2011 and 2013 with the help of improved anti-poaching activities implemented by government agencies, NGOs, INGOs and communities. This indicates that current administration of EEPs in the buffer zone communities is inadequate, while also providing evidence that properly administrated EEPs may become a valuable investment for these protected areas to achieve long-term success.

Livestock depredation, a serious challenge in big cat conservation in human-dominated Ramnagar forest division, Corbett Landscape, Uttarakhand, India.

Harendra Singh Bargali, Kedar Gore, Tanveer Ahmed

India, with estimated 2226 (1945-2491) tigers, holds about 60% of the world's wild tiger population. With tiger populations ranging across 18 states of the country the country has been identified as a prime bioregion for the long-term conservation of wild tigers. Tiger population within Corbett Tiger reserve (17.8 tigers/100 km^2) and in Corbett block (9.4tigers/100 km^2) at landscape level serve as a source for the entire Terai-Arc landscape in the Uttarakhand. The Ramnagar Forest Division plays a crucial role in tiger conservation in Terai-Arc landscape as it shares eastern boundary of Corbett Tiger Reserve on one side and contiguous with the forests of Almora, Terai-West, Haldwani, Nainital and Terai-Central forest divisions from other sides. Even though RFD is not a Protected Area and forests of the division are interspersed with human habitations, agricultural crop fields, townships and various other developmental activities the division supports healthy populations of elephants and tigers (14 tiger/100 km^2). Owing to its location, high density of tigers and presence of other wildlife local communities are facing a number of problems due to wildlife.

During 2006-2015, a total of 2484 incidents of livestock depredation recorded from Ramnagar forest division. Most of the incidents caused by the tiger (80.56%) than leopards (19.44%). In most of the cases livestock were killed (85.55%) by the predator than injured (14.45%). Number of livestock depredation varied from year to year with maximum number of incidents recorded in year 2010 (n=334) and least in 2006 (n=182). Incidents of livestock depredation were mostly in monsoon (55%) than summer and winter. Most of the attacks were on cows followed by buffaloes and horses. Outcomes of the study will help in understanding the issue of livestock depredation and developing future conservation strategies for the division and at landscape level as well.

Species-Specific Conservation Programs

What will it take to conserve wild elephants in Peninsular Malaysia?

Ahimsa Campos-Arseiz

Elephants and other megafauna play key and irreplaceable roles in ecosystem processes but, due to their high demand for resources and lack of natural predators, are maladapted to the current human-dominated world. If we want megafauna to survive beyond the bottleneck of the 21st century, business as usual is not an option – we need to find effective ways to coexist with them.

Peninsular Malaysia is home to approximately 1,500 wild elephants that in less than two generations have seen over half of their natural habitat replaced by rubber, oil palm, and other anthropogenic land uses. This has led to a sharp decline in elephant range and increase of human-elephant conflict (HEC) in the form of crop raiding.

In this talk I will introduce the work of the 'Management & Ecology of Malaysian Elephants' (MEME), an interdisciplinary project run as a collaboration between local wildlife authorities and university researchers that aims to bring an evidence-based approach to the conservation of Malaysian elephants. Specifically, I will discuss the complex interactions between elephants and people and the approaches we are promoting to move towards human-elephant coexistence in Peninsular Malaysia. MEME is a good example of the need for holistic and interdisciplinary approaches for wildlife conservation in the Anthropocene as well as the importance of bridging the science-policy-practice gaps through collaboration between conservation scientists, decision-makers, and practitioners. Peninsular Malaysia can afford to conserve its elephants in the long-term but important changes in people's attitudes and behavior are needed for this to happen.

Prey availability and climate change contracted Asiatic cheetah's range during the last century.

Leili Khalatbari, G. Hosein Yusefi, Fernando Martinez-freiria, Hooman Jowkar, Jose Carlos Brito

Understanding how species have been affected by recent human mediated landscape transformation is crucial for designing effective conservation strategies. The Critically Endangered Asiatic cheetah (*Acinonyx jubatus venaticus*) has faced dramatic range decline and currently occurs in very small populations restricted to the mountain deserts of Central Iran. In this study, we aim to quantify temporal changes in ecological requirements and availability of suitable areas for the Asiatic cheetah. Ecological models for historical and contemporary time-periods were built based on historical and contemporary species records and using a set of 11 ecogeographical variables including climate, anthromes and prey availability of each time-period, using maximum entropy modelling. Distance to the prey G. bennettii was the most important factor related to the occurrence of cheetahs in historical time period, while in contemporary times, it was replaced by the climatic factor maximum temperature of the warmest month. Predicted areas of high suitability occur within the borders of Iran; when compared, suitability decreased 72% from historical to contemporary periods causing the current loss of suitability in some protected areas. Our results suggest that the fundamental niche of Asiatic cheetahs has not changed but the realized niche has changed over time. When environmental correlates of species distribution for each time period are analysed in detail, changes in realized niche are likely related to depletion of cheetah's main prey, temperature variation and landscape transformation of its habitats. Conservation measures should start urgently to improve protection for gazelle species (prey) and wildlands (habitat), especially in temperate areas, to ensure the survival of the last Asiatic cheetahs. Further research on cheetah's interaction with other predators and preys, and gene flow dynamics between populations would also benefit its long term conservation.

Abstracts

Segregated conservation units for *Bufo gargarizans* in North East Asia

Siti Norhidayah Binti Othman, Amael Borzee, Spartak Litvinchuk, Kevin R. Messenger, Irina V. Maslova, Yikweon Jang

Amphibian populations are alarmingly declining globally. Understanding the so-far poorly-resolved population structure of the Asiatic Toad, *Bufo gargarizans*, will provide valuable information for effective conservation strategies and adequate genetic management. Accordingly, an accurate phylogeny is the first step for such analyses. In this study, we revealed the population structure for 126 *Bufo* individuals collected across South Korea, China and Russia. In congruence with the literature, we hypothesised the species to be monophyletic across the eastern part of its range. We subsequently estimated gene flow and clade boundaries across North East Asia via networks analyses. Phylogenetic reconstructions were based on mitochondrial inferences for two loci: 335 base pairs (bp) of the control region and 659 bp of the NADH dehydrogenase subunit 2. Following the best-fitting Bayesian Information Criterion models, we found the absence of intraspecific variations between populations of *B. gargarizans* in Russia. This indicates genetics homogeneity between Sakhalin Island and mainland populations, despite the Tartar Strait. Then, we described allopatric divergence with high Bayesian posterior probability values between B. gargarizans populations of Russia and China, with the Korean clade clustering with the Russian clade. The resolved population structure implies phylogenetic relations restricted by geographic factors, establishing a north-south connectivity between the Korean and Russian populations. The isolation of the Chinese clade is explained by the longitudinal restriction on dispersion due to the Yellow Sea and mountainous landscapes. Therefore, three conservations units need to be defined, in Russia, Korea and China, and we recommend treating each of them as separate populations in case of translocations for conservation purposes.

The distribution, diversity and conservation status of Mongolian ants

Ulykpan Aibek

Mongolia stretches across central and north-east Asia, and occupies several vegetation zones where the Siberian taiga forest meets the Central Asian steppe and desert. It is an upland country, with an average elevation of 1,580 m (range of elevation: 535-4390 m), and about 85% of the country area elevated over 1,000 m a.s.l. Ants are common, almost ubiquitous insects in Mongolia, and they can be found in all ecosystems and main terrestrial habitats. The ant fauna of Mongolia comprises 72 species belonging to 17 genera in three subfamilies. Based upon vegetation, floral composition, topographic and climatic characteristics, Mongolia divides into 16 phytogeographical regions. We assessed the multiple regression analysis was used to examine relationships of ant diversity versus plant diversity and area size. Species richness of ants and total land area of phytogeographical regions of Mongolia were not correlated (Pearson's correlation, n = 16, r = 0.42, p =0.101). Diversities of ants and vascular plants within phytogeographical regions showed a significant positive correlation (Pearson's correlation, n= 16, r = 0.61, p = 0.01). The ant fauna of Mongolia shares relatively few species with those of the surrounding regions as balanced with the total number of species in compared regions or countries; hence the estimated faunal similarity was very low. The Russian Far East, Ural region of Russia and Gansu Province of China show the closest similarity with Mongolian ant fauna. Japan and Iran have the lowest faunal similarity with ants of Mongolia. Finally, it is noted that seven ant species found in Mongolia are listed as threatened species in the Red List of the International Union for Conservation of Nature. Thus, *Harpagoxenus zaisanicus, Lasius reginae* and *Polyergus nigerrimus* are categorised as Vulnerable species, whereas *Formica aquilonia, F. lugubris, F. pratensis* and *F. uralensis* are treated as Near-threatened species (IUCN 2012).

Conservation of a recently discovered breeding population of critically endangered Gharial *Gavialis gangeticus* in the Gandak River, a tributary of the River Ganga, India

Samir Sinha, Subrat Behera, B C Choudhury, Poonam Chandel, Adrish Poddar, Rahul Kaul

The Indian Gharial *Gavialis gangeticus* – the only member of the family *Gavialidae* and endemic to Indian subcontinent has suffered a loss in distribution and nearly 98% decline of population. From the reported populations in India, Nepal, Pakistan, Bangladesh, Myanmar, and Bhutan, now the critically endangered breeding population is reported only from India – in National Chambal Wildlife Sanctuary, Katerniaghat Wildlife Sanctuary and Son River in India, and the Narayani-Rapti River systems in Nepal. Chances of their revival are bleak unless bigger stretches are made available or disjointed habitats are connected; and sand mining, change in land-use, and poaching of eggs are halted. Same was the case in River Gandak of India, a transboundary river system downstream of River Narayani, Nepal. A multi-organizational population estimation survey in 2010 reported only about 10-15 left.

With the Bihar State Government initiative, restocking process was started, and in 2014-15, 30 juvenile gharials (captive-reared in Sanjay Gandhi Biological Park, a Zoo located in the State capital), fitted with VHF and satellite transmitters, were released. Henceforth, their breeding, nesting and congregation sites along 320-km long Gandak River were closely monitored and in tandem, efforts were made to facilitate maximum survival. Recent survey based on employing direct sightings of basking individuals in the river stretch divided into 2 km long segments confirmed the presence of at least 166 gharials. Moreover, records of juveniles and yearlings and detection of gharial nests in the Gandak confirms a thriving breeding population of the species. The monitoring also revealed of transboundary movement and long-distance ranging (above 1000km) of gharials.

This communication would narrate the journey of the process to recover a critically endangered riverine species, the challenges faced to revive the dwindling population and eventually make it the country's second highest breeding population would also be discussed.

Development of regional climate envelopes for the American bullfrog and red-eared slider for population regulation in South Korea

Desiree Andersen, Yikweon Jang

American bullfrogs (*Lithobates catesbeianus*) and red-eared sliders (*Trachemys scripta elegans*) have become invasive in South Korea since their introduction through food and pet trade. One of the first steps to their population regulations is to determine each species' distribution in the country, which will allow for identification of problem areas. In this study, we used climate envelopes as a preliminary method for identifying regions of likely species presence. We utilized presence points of both species across their range in South Korea from GBIF (Global Biodiversity Information Facility) and the Korean citizen science website, Naturing.net, with five extracted bioclimatic factors. These were annual mean temperature, minimum temperature, maximum temperature, temperature range, and annual precipitation. We then created a climatic envelope by intersecting ranges of 100% suitability for these five factors. After geographically reducing presence points to reduce observation bias, we used the BIOCLIM method of ecological niche modelling in DIVA-GIS to determine suitability envelopes incorporating all 19 available bioclimatic variables. We found that climatic conditions for American bullfrogs are suitable for 52,810 km^2 of South Korea, or 53.7% of the landmass, and highly suitable for 19,460 km^2 (19.8%); for red-eared sliders climate is suitable for 61,329 km2, or 62.4% of the landmass, and highly suitable for 24,015 km^2 (24.4%). Further modelling using detailed survey data and environmental variables will reveal landscape and spatially dependent distributions of the two species along with likely vectors of spread.

Abstracts

Understanding the gliding squirrels of Indian Eastern Himalayas - A look into Diversity, status and threats.

Murali Krishna Chatakonda, Awadhesh Kumar

Forests of South and Southeast Asia retain the greatest gliding squirrel diversity and these regions have less literature available on gliding squirrels. Arunachal Pradesh is a portion of Indian Eastern Himalayan belt and is also a part of global Bio-diversity hotspot. It harbours numerous forest types and these forests inhabit an array of gliding squirrels i.e., 14 species viz., *Biswamoyopterus biswasi; Hylopetes alboniger; Petaurista caniceps; Petaurista elegans; Petaurista magnificus; Petaurista nobilis; Petaurista petaurista; Belomys pearsonii; Petaurista nigra; Petaurista mishmiensis, Petaurista yunanensis, Petaurista philippensis, P. siangensis, P. alborufus*. Arunachal Pradesh is a land of tribal groups and about 26 major and 105 ethnic sub-tribes inhabit the state making it culturally rich. These tribes hunt several wildlife including gliding squirrels for bushmeat purpose, ethno zoological and for religious rituals which is the main threat to the species. Apart, habitat loss was observed as the conservation threat to the species in this part of the country as most portions of the forests are cut for jhum cultivation. There is an urgent need to promote research studies on these lesser studied gliders not only in India but also in Southeast Asia inorder to better understand the diversity, ecology of the species but also to conserve them.

Conservation of the Pallas's cat (*Otocolobus manul*) through capacity building, research, and global planning

Emma Nygren, David Barclay, Gustaf Samelius

This presentation aims to introduce delegates to the Pallas's cat International Conservation Alliance (PICA), highlighting its current activities relating to strategic planning and field research. Following the internationally recognised "One plan approach" to species conservation PICA, established in 2016, has continued to strengthen the global Pallas's cat network to ensure a focused and collaborative approach to species conservation. Currently PICA, in partnership with the International Union for Conservation of Nature Cat Specialist Group (IUCN CSG) are undertaking the first Pallas's cat status review which will act as a framework for continued conservation planning. This status review will be followed by the first Pallas's cat global action planning meeting, facilitated by the IUCN CSG chairs in November 2018. In addition to global planning PICA, with support from Fondation Segre and global Zoological collections, continues to support multiple field research projects across range countries with activities ranging from distribution surveys, threats surveys, temporal and spatial activity patterns and educational campaigns. Like many small cat species Pallas's cat conservation suffers from limited scientific knowledge and limited strategic planning. PICA aims to reverse this trend and in doing so establish a collaborative and effective approach to its long-term conservation.

Breeding Biology of Purple Sunbird (*Cinnyris asiaticus*) in District Okara, Pakistan

Muhammad Ansari, Bushra Rakha, Muhammad Zohaib

The breeding biology of purple sunbird (*Cinnyris asiaticus*) was studied in district Okara, Pakistan. Twentyone nests were located in the study area, from which 17 active nests were used by birds for breeding. The successful nests placed on fork, middle and other position of the plant were counted as 14%, 36% and 50%, respectively. The nests were preferably constructed on plant at the height of 1-2m (64%) followed by 0-1m (36%). The preferred plant species used by purple sunbird for nest construction was Bubul (*Vachellia nilotica*; 36%) followed by Bougainvillea white (*Bougainvillea spectabilis*; 29%), Honey mesquite (*Prosopis glandulosa*; 7%), Grapes (*Vitis vinifera*; 7%), Neem (*Azadirachta indica*; 7%), China rose (*Bougainvillea spectabilis*; 7%) and Vann (*Salvadora oleoides;* 7%). The nests with clutch size 2 and 3 were recorded 12% and 88%, respectively. Hatching and fledgling success were recorded highest in nests with clutch size 3 (86%) followed by clutch size 2 (14%). Although no predation of eggs was noted but other losses to eggs were calculated as 6%.

The fledgling success was recorded as 90% and only 8% of the nestlings were predated and 3% fell out of the nests. It is concluded that ecology of the Okara district is highly favourable for breeding of purple sunbird.

Scat detection dogs in pangolin research and conservation

Ambika Prasad Khatiwada, Chiranjibi Prasad Pokheral, Wendy Wright, Kyran Kunkel, Fredrik Dalerum

Pangolins are threatened with extinction. The Chinese pangolin (*Manis pentadactyla*) and the Indian pangolin (*Manis crassicaudata*) inhabit Nepal. While both species are experiencing rapid declines in population due to demand for their scales and meat, surveys in Nepal indicate declining but still healthy populations of pangolins. Due to pangolins' elusive and nocturnal nature, studying pangolin populations in detail is important but difficult. Hunters throughout southeast Asia including rural Nepal have confirmed their successful use of dogs to track and hunt pangolins providing evidence that dogs can also be used for pangolin conservation. By collecting feces of pangolins, we can determine the species of pangolin and identify individuals providing information on populations, ecology, and genetics. The objectives of our study were to

1) expand the knowledge of pangolins to guide management policies, and
2) to build a framework to combat illegal trade in pangolins using genetic signatures to determine source of poached pangolins and possible trafficking routes.

We used scat detection dogs trained to identify and collect pangolin droppings. Two detection dogs and two handlers along with pangolin researchers and local supporters were involved to collect the samples from eastern to western Nepal in 2017. Altogether, we collected 35 pangolin droppings over 203 km of transects and extracted the DNA from each sample. The sequencing indicated all the samples are of pangolins. We are conducting further analysis to prepare genetic signatures and to develop a population baseline so that we can monitor trend over time and also to identify important core conservation areas. We found that the dogs were more effective and efficient to collect samples than were humans alone or camera traps. In some cases, they dug to find the scat. Overall, the use of detection dog is a very efficient and cost effective method for pangolin research and conservation.

Conservation Genetics

The used DNA-based markers in plants, domesticated animals and soil microorganisms to access genetic diversity

Sergey Hegay, Anara Umralina, Asankadyr Junushev

Biotechnology Institute is a leading organization of using biotechnology tools in Kyrgyz Republic. At the Institute located gene bank of seed collection, herbarium, and tissue culture of rare, endemic and valuable plants species. For present time specialist works to establish DNA bank of Kyrgyz flora. For this propose Institute developed own protocol for DNA extraction techniques which can adapted for not only agricultural crop but also for wild crop relatives and wild plant species. To archive successful laboratory work we use universal method for fingerprinting animals and plants thought of using IPBs (Inter-primer binding site) retrotransposon. Microsatellite markers showed opportunities to see in high-resolution genetic structure of various biological materials. Twenty-eight common bean accessions were evaluated with 9 polymorphic microsatellites (SSR: Simple Sequence Repeat). Results of STRUCTURE analysis at K = 2 to K = 3 for 28 common bean accessions (including common beans from Kyrgyzstan as referee) indicate the sub-groups (races) based on Andean and Mesoamerican gene pools at structure analysis K = 3 Mesoamerica and Durango-Jalisco race grouping, respectively. The study of cattle was done by 11 microsatellite markers (STR: Short Tandem Repeats) from 9 Asian countries representing 272 individuals (Bos taurus indicus, Bos taurus taurus, dwarf Lulu). Cluster analysis of PCoA (Principal Coordinate Analysis) using Nei's similarity matrix, and STRUCTURE at K=2 showed that Kyrgyz cattle had the genes with castles from Nepal and Indonesia. Population statistics was made using Arlequin 3.5 software and analysis of molecular variances showed variation within individuals (87.72%) P=0.001 than group was higher than among individuals within populations (0.17%) P=0.001. For metagenomic analysis was used soil samples from Kara-Balta, Kadjy-Say and Maili-Suu regions thought novel two-stages PCR with specific fungi primers ITS1 region (internal transcribed spacer) with universal barcode for fungi and second PCR was using amplified gene region by using Illumina-specific sequence

Conservation and genetic characteristics of the dung beetle, *Gymnopleurus mopsus* (Coleoptera: Scarabaeidae)

Badamdorj Bayartogtokh, Yeon Jae Bae

The dung beetle species,*Gymnopleurus mopsus* Pallas, 1781 is distributed throughout the Palaearctic region, but this species has not been found in South Korea since the 1970s. However, this species is common in Mongolia, where the herders still keep their traditional nomadic animal husbandry. This beetle is a typical inhabitant of lowland grasslands, short-grass steppe and semidesert grazed mainly by cattle, sheep, goats, horses and camels. We studied distribution, abundance, habitat pattern of this species in Mongolia. We investigate the extent and nature of the genetic variation of mitochondrial COI gene of *G. mopsus* in South Korea and Mongolia. The average nucleotide composition of the mitochondrial COI gene (658 BP) from 64 specimens of *G. mopsus* was adenine 32.16 ± 0.16 % (mean ± SD), cytosine 15.09 ± 0.19 %, guanine 16.19 ± 0.19 %, and thymine 36.57 ± 0.16 %. A total of 48 different haplotypes were identified from South Korean (6 haplotypes) and Mongolian (42 haplotypes) samples and no haplotypes were shared between two countries. The number of base substitutions per site, which was calculated by averaging the number of base substitutions between all sequence pairs, was 0.0078±0.0014 (mean±SE). The pairwise genetic distances between the sequences ranged from 0.023±0.0057 to at least 0.000±0.000. We measured average genetic distance: among individuals in each population; among populations; and between two groups (seven populations for Mongolia, one population for South Korea). The average genetic distance between the Korean and Mongolian populations was 0.0093±0.0021. The genetic distances between the South Korean and Mongolian populations lay within the intraspecific level and the phylogenetic reconstruction showed that all individuals belonged to a single clade. This result indicates that the current Mongolian population of *G. mopsus* is a good candidate source population to restore the locally extinct population of the species in South Korea.

Abstracts

Genome-wide differentiation among grey wolf populations in Asia in comparison with Europe and North America

Malgorzata Pilot, Abdulaziz Alagaili, Osama Mohammed, Innokentiy Okhlopkov, Eduard Yavruyan, Nina Manasaryan, Vahram Hayrapetyan, Natia Kopaliani, Wieslaw Bogdanowicz

The grey wolf's geographic range covers most of Asia. Although this continent contains the largest part of the species range, relatively little is known about Asian wolves as compared with European and North American populations. We analysed genetic differentiation among grey wolf populations from across Asia in the context of global diversity of the species across the Holarctic. Using 170,000 single nucleotide polymorphism loci, equally distributed across the nuclear genome, we found that wolves from West Asia (the Caucasus and the Arabian Peninsula) are more similar genetically to wolves from Europe than to wolves from East Asia (Mongolia and Yakutia). The main genetic subdivision within the species was observed between Eurasian and North American wolves. Wolves from East Asia did not show closer genetic similarity to the geographically most proximate North American wolf population from Alaska as compared with other wolf populations from Canada and the contiguous United States. This is consistent with an earlier study based on mitochondrial genomes, showing that modern North American wolves originate from a single colonisation from Asia. Our study shows that Asian wolves represent a large proportion of the global genetic diversity of the species, which warrants further research covering yet unstudied parts of their range in Asia in order to fully understand their patterns of genetic differentiation. This knowledge will enable delimitation of evolutionarily significant units for wolf conservation in Asia.

Ecosystem-Based Conservation

Abstracts

Conservation of the evolutionary unique Himalayan wolf

Geraldine Werhahn

The Himalayan wolf is uniquely adapted to life on the Asian high altitudes of the Tibetan Plateau and the Himalayas. This wolf lineage is genetically distinct from the Holarctic grey wolf found across other regions of Eurasia. The Himalayan wolf (proposed as *Canis (lupus) himalayensis*) has been largely overlooked by science and conservation to date.

I research the phylogeny and ecology of the Himalayan wolf. Together with my collaborators at RZSS WildGenes we conduct conservation genetic research to inform the required taxonomic decision on this wolf and to understand its genetic adaptation to the high altitudes. This knowledge I combine with ecological research and social studies on human-wolf relations to develop conservation action for this wolf and its unique high altitude habitats.

During different field researches I have collected non-invasive samples from free ranging wolves from the Tibetan Plateau of China and the Himalayas of Nepal. These samples combined with previous studies show that the Himalayan wolf forms a genetically ancient wolf lineage distinct from the Holarctic grey wolf complex (*Canis lupus* spp.) based on mitochondrial and nuclear DNA. We found a genetic adaptation to life at high altitudes where hypoxic stress asserts selective pressure. And we shed light on its previously little understood distribution range and finding indications that it may be restricted to the Asian high altitude habitats. My ecological research reveals the social life of this wolf living in small packs and insights into important prey species. And the social surveys with local mountain communities provide us with the human perspective of living with these wolves. Based on this interdisciplinary research we propose the evolutionary unique Himalayan wolf along with the snow leopard as a powerful conservation ambassador for nature conservation in the specialized Asian mountain habitats.

Mesopredator spatial and temporal response to large-predators and anthropogenic activities in a Central Indian Reserve

Nilanjan Chatterjee, Madhura Davate, Anil Dashahre, Parag Nigam, Bilal Habib

Large predators play important role in shaping community structures and dynamics across diverse ecosystem. Decline in large predator occupancy and shift in activity can influence release of mesopredators from intraguild competition. Differential human activity in the landscape also affects the activity of both predator and prey species, depending on their degree of specialisation in feeding and habitat use. This may result in change in community structure and impact other ecological processes. We hypothesized that temporal and spatial partitioning among meso and apex predators would be affected by different levels of human use. Motion-detecting camera traps were systematically deployed throughout Tadoba-Andhari Tiger Reserve in Maharashtra, India following a systematic grid sampling. The study area spreads over an area of 1700 sq.km with a gradient of human use. Temporal activity overlap was calculated using non-parametric kernel density distribution of photo capture time in camera trap. We found that the effect of apex-predators on mesopredators decreases spatially and temporally as their difference in body size increases. Species altered their activities temporally at sites with higher human activity. This change in activity was reflected in higher temporal overlap between predators in locations with high human use. Species centric conservation measures may help to conserve a species but overpopulation of predator may disturb the stability of an ecosystem. Tiger centric conservation actions may lead to decline or local extirpation of other sympatric carnivores. Absence or decline of some predators may trigger the increase in number of certain prey. Human movement should be restricted at areas with high intensity of predators. Effective community conservation requires an understanding of how large, mesopredators and prey interact in temporal and spatial scale with varying anthropogenic influences.

Biodiversity and mining development in Central Asian Desert of Mongolia

Batsaikhan Nyamsuren, Bayarsaikhan Uudus, Michael Stubbe, Annegret Stubbe, Lkhagvasuren Davaa, Samiya Ravchig, Altangerel Tsogtsaikhan Dursahinhan

The Mongolian Gobi Desert occupies the most eastern region of Central Asia and is the refuges for many endemic species including *Equus h. hemionus, Gazella subgutturosa, Euchoreutes naso, Chlamydotis macqueenii* and *Falco cherrug* etc. Protecting the Central Asian Gobi Desert ecosystems, biodiversity, and endemic species requires realistic diagnostics of the current threats and the establishment of feasible action plans. The specific focus of our ongoing biodiversity research is to determine and document the vertebrate taxa distribution patterns and endemism hotspots in the eastern part of Central Asia by conducting long-term monitoring and extensive fieldwork. We analyzed spatial distribution data collected between 2001 to 2017 from the south, and southeastern Gobi Desert of Mongolia using the ArcGIS geostatistical toolbox. Our study shows the following results:

1) the deposits of economically attractive mineral resources are overlapping the Central Asian endemism hotspots,
2) multiple plant communities that carry endemic species are located outside of the current protected areas,
3) over 60% of the world's Asiatic wild ass (*Equus h. hemionus*) population lives in Mongolia, and the effect of poaching is significant; however, an emerging threat is targeting these populations due to mining infrastructures in their critical habitat and causing suppression of its gene flow,
4) exploration and mega mining projects constitute the habitat fragmentation of goitered gazelle (*Gazella subgutturosa*), and poaching pressure is still high on this species,
5) The current protected area network design is flawed. Thus, this study suggests possible solutions for future research and long-term monitoring, law enforcement, and community-based conservation actions.

Cattle grazing as a tool for invasive weed management and endangered species support on former pastures in mountain nature reserve

Josef Holec, Michaela Kolarova, Marie Mrazkova-stybnarova

Grazing is considered as a suitable tool to maintain biodiversity of grassland. Once the pasture is abandoned, natural succession take place with highly competitive species expanding their dominance. As a result, many herbs including rare and endangered species may disappear. In 2012, grazing was restored in the Hrubý Jeseník Mts. (the Praděd National Natural Reserve) in northeastern part of the Czech Republic. The aim of the study was to estimate changes in plant species occurrence in the locality of Švýcárna (1304 m a.s.l.), where the cattle grazing after the long-term management cessation was introduced on the pasture area of 3.6 ha in 2012. The pasture was divided into two grazing plots: P1 (Nar) with dominance of Nardus stricta and Avenella flexuosa and P2 (Des) with dominance of Deschampsia cespitosa. For grazing, Highland cattle was used with stocking rate up to 1 livestock unit per ha and year. Floristic composition vas evaluated and statistically analyzed. After six years of restored grazing the overall species richness enhanced and a higher occurrence of rare and endangered species was found. The occurrence of some common and often dominant species like Avenella flexuosa, Vaccinium myrtilus, and Calamagrostis villosa tended to decrease within a grazing period in favor of new species colonisation.

On most of the plots, an increase in the number of rare and endangered species was noticed. For some species like Allium schoenoprassum subsp. schoenoprassum L., however, grazing seems to be probably unsuitable as it disappeared on the grazing plot within a study period.

Supported byTechnology Agency of the Czech Republic project No. TH02030144.

Abstracts

Impacts of commercial harvesting of the caterpillar fungus *Cordyceps sinensis* on snow leopards

Gopal Khanal, Koustubh Sharma, Per Wegge, Hem Raj Acharya, Kulbhushan Suryawanshi

Natural resource use and extraction from protected areas are often believed to impact native wildlife populations. In the mountains of the Nepal Himalaya, extraction of the Chinese caterpillar fungus *Cordyceps sinensis*, a highly valued parasitic fungus, is a dominant form of natural resource extraction activities. However, nature and extent of ecological impacts of this activity on native wildlife is poorly understood. We investigated the relative influence of cordyceps extraction, availability of bharal *Pseudois nayaur* prey and terrain ruggedness on the probability of site use by snow leopard *Panthera uncia*,a flagship species of the mountain ecosystem, in c. 900 km^2 of Api Nampa Conservation Area of Nepal. We surveyed 314 km of transects for snow leopards signs in 16 km^2 sampling cells (N=57) and analyzed the resulting sign encounter data using site occupancy models. Cordyceps extraction negatively influenced the probability of site use by snow leopard (βCORDYCEPS = -3.71 (SE 1.74), whereas bharal availability and terrain ruggedness had relatively weaker but positive effects (βPREY = 1.68 (SE 0.94) and βRUGGEDNESS 1.11 (SE 0.66)). Reduced probability of site use in areas subjected to cordyceps extraction suggests that cordyceps extraction may have had a lasting temporal impact on snow leopards, possibly due to habitat degradation and consequent reduction in bharal prey. Rise in demand for cordyceps in the international market is likely to result in more pervasive extraction, severing snow leopard habitats in Nepal, India, China and Bhutan. Income generated through cordyceps extraction is a major contributor for subsistence of mountain communities in these countries. Hence, minimizing negative impacts of cordyceps collection on native wildlife while also sustaining the livelihood of the region will require identification of areas of overlap with snow leopard distribution and site-specific regulation to ensure sustainable natural resource management and conservation of native wildlife.

Protected area effectiveness in a sea of palm oil: A Sumatran case study

Erin Poor, Emmanuel Frimpong, Marcella Kelly

Globally, agriculture has become one of the primary drivers of deforestation as the human population continues to grow. Despite the establishment of a national protected area system at the beginning of the 20th century to protect some of the world's most biodiverse forests, Indonesia recently surpassed Brazil with the highest deforestation rate in the world, largely due to the expansion of the global palm oil industry since the mid/late 1990's. The endemic ecosystems of Sumatra, Indonesia still provide habitat for Critically Endangered Sumatran tigers (*Panthera tigris sumatrae*), Sumatran elephants (*Elephas maximus sumatrensis*), Sumatran rhinos (*Dicerorhinus sumatrensis*) and two species of orangutans (*Pongo abelii, Pongo tapanuliensis*). In this study, we use a matching method with generalized boosted models to determine the effectiveness of three protected areas, Tesso Nilo National Park, Bukit Tigapuluh National Park, and Rimbang Baling Wildlife Reserve, in preventing deforestation from 2002 – 2016. We also examine leakage – an increase in deforestation directly outside of protected areas – in this landscape to provide a clearer picture of the potential effects of the global palm oil industry on these endemic systems. We found that Tesso Nilo National Park, with its lowland habitat and condition suitable for oil palm, had the lowest avoided deforestation rate (4.10%, $p < 0.05$ 97.5% CI [2.09% – 6.66%]) and that Bukit Tigapuluh National Park had the highest (27%, $p < 0.05$ 97.5% CI [24.42 – 29.24]), but experiences relatively high leakage (10.51%, $p < 0.05$ 97.5% CI [7.61 – 14.05]). The quantitative evidence of deforestation and effectiveness of protected areas in this heavily modified landscape, supports increased enforcement around protected areas throughout the landscape and the implementation of the government's current plans to restore Tesso Nilo National Park. These actions are critical in the preservation of this landscape's endemic and globally significant flora and fauna.

Thailand's Protected Areas in Response to Land Use and Climate Change Drivers

Yongyut Trisurat

Only limited research on conservation planning to mitigate the impacts of deforestation and climate change have been conducted in Asian tropics. The objectives of this research were to determine shifts in habitats of mammal species resulting from land-use and climate change scenarios in 2050 in northern Thailand, and to assess the proposed expansion of existing protected areas to mitigate the predicted impacts. Distributions of 17 selected medium- to large-bodied mammals were predicted using the Maxent species distribution model. Future land use maps were models according to different future land demands, while future climate patters were obtained from WorldClim database. Qualitative vulnerability assessment of species was determined by using national conservation status, shifts in distribution and coping capacity of protected areas. In addition, potential expansion areas were identified using gravity model. The results indicated that the existing protected areas cannot guarantee the long-term survival of many species. The average shift in species distribution of all selected species was greater than 40%. They would substantially shift their current distributions towards large protected areas situated in southwest direction and 12 species will be categorized as moderate to very high risk species. The proposed expansion areas of approximately 5,200 km^2 or 3% of the region would substantially minimize the risk level and increase the average coping capacity of the protection of suitable habitats from 82% as the current plan to 90%. Such patches adjoining existing protected areas should be included in the current system, while patches that are relatively far should be managed as habitat corridors to facilitate movements of wildlife in the landscape. This research demonstrates that proactive conservation planning is effective for mitigating future land-use and climate threats.

Human-Carnivore interactions in the Terichmir foothills Chitral, Pakistan

Fathul Bari, Hussain Ali, Ejaz Rehman, Muhammad Waqas Khan, Shoaib Hameed, Muhammad Ali Nawaz

Chitral in the Hindu-Kush Mountain Range, stretches as the westernmost border of snow leopard range in Pakistan and contains several other important carnivore species. However, fewer areas have been explored with underlying issues such as human carnivore conflict, which negatively impacts conservation efforts.

The study aims to present the occurrence of carnivore species in the Terichmir foothills of Chitral, Pakistan. The study also assesses livestock lost to depredation with various associated factors with the issue and quantifies the consequent economic loss incurred by the community.

Camera traps (Reconyx TM Hyperfire HC 500 and PC 900) were used for a period of 40 days to document the occurrence of carnivore species in the specified area. Semi-structured questionnaires were used to assess interactions between humans and carnivores in the valley.

Five different species of carnivores including the snow leopard, jackal, fox, stone marten and wild cat were documented using camera traps. A questionnaire survey also revealed presence of wolf, lynx and leopard cat in the area. A total of 141 heads of livestock were killed by different carnivores, with an average of (0.87 animals per respondent) during 2010 – 2015. Jackals were responsible for the highest number of livestock losses (46% of the total), followed by wolves (32%). Together, these predations resulted in a loss of US$ 10,710 to the communities. A further loss of US$ 49,200 was incurred by the communities due to disease caused mortalities of 460 livestock heads. Views of most respondents were found positive towards carnivores.

Interaction between different carnivore species and people dwelling in the Terichmir valley is occasional. Whereas carnivores incur an economic loss to the people by preying on their livestock, the key factor resulting in the major loss of livestock appears to be disease led mortalities.

Abstracts

Estimating Above-Ground Biomass in Sub-Tropical Buffer Zone Community Forests, Nepal, Using Sentinel 2 Data

Santa Pandit

This study presents a new method in an attempts to explore the potential of medium resolution Sentinel-2 where only few research is focused in exploring its invaluable potential use in biomass estimation, that might be a good alternative to hyperspectral data constraint region like Nepal. This study aims to evaluate the potential of Sentinel-2 Multi-Spectral Instrument (MSI) for estimation of above-ground biomass from buffer zone community forest of Parsa National Park in lower-central Nepal. The performance of the Sentinel-2 was evaluated by using field-based AGB as dependent variable whereas spectral band values and spectral derived vegetation indices as independent variables used as input to the Random Forest (RF) algorithm. To evaluate the effectiveness of the model, 10-fold cross-validation was used to assess AGB estimation. The effect of reducing the input variables on AGB prediction was also investigated. The results of the study show that the model using all the extracted spectral information together with all the derived spectral vegetation indices provides better AGB estimates. For example, using all predictor variables the algorithm produced an R^2 of 0.81 and RMSE of 25.57 t ha^{-1}. We also noted that incorporating the optimal subset of most important variable did not improve the variance explained by the model rather it improved in reducing error by minimal value. This strong relation can be attributed due to the technical advancement provided in Sentinel-2 as it includes fine spatial resolution (10,20 m) and strategically positioned bands (red-edge) and flat topography which was further catalyst by advance machine learning algorithm RF which we applied in this study. However, assessing its transferability to other forest types with varying altitude would enable future performance and interpretability assessments of Sentinel-2. It is worth comparing the AGB between buffer zone and protected core area for sustainable management of biomass.

Vulnerability to extreme climatic events in priority areas for conservation: a trait based approach for China's terrestrial vertebrates

Eric I. Ameca

A remarkable effort is being made in projecting changes in climatic conditions and inferring their effects on species conservation through climate change vulnerability assessments (CCVAs). However, the assessment of species vulnerability to weather-associated extreme events has received much less consideration. As conservation funding is limited, it is important to tackle the risks posed by these phenomena in areas considered a conservation priority to maximize conservation impact. Following IUCN's guidelines for CCVAs and focusing on China's terrestrial vertebrates, we conducted a CCVA to flood disturbance in two stages. First we quantified species' flood exposure with emphasis in priority areas for biodiversity conservation (PABCs). In a second stage we conducted a trait-based assessment to estimate relative vulnerability to these phenomena. We found that Amphibians comprised the greatest number of species at significant flood exposure followed by mammals and birds (~90%, ~81%, ~52% of the total species richness in the country, respectively). Likewise, we found that of the total species assessed ~ 60% exhibit some degree of vulnerability to floods: ~10% of which were identified as "highly vulnerable", hence more likely to be at greatest risk, with the remaining ~50% identified as either "potential adapters" or "potential persisters". By contrast, ~39% of the highly exposed species did not exhibit any of the trait sets associated with low adaptability or heightened sensitivity to flood-related disturbance, hence comparatively of less immediate concern. The analysis is a first step towards better informing species risk assessments and inform management interventions as extreme weather events are expected to rise in the coming decades.

Mercy Release in the Modern World: Mitigating a Conservation-Religion Conundrum

Kit Magellan

Mercy release poses a paradox. Mercy release, also called prayer or religious release, is the practice of 'releasing' animals to improve the karma of the releaser and their loved ones. This traditional, mainly Buddhist and Taoist practice, dates back to the fifth or sixth century and is rooted in a deep respect for the environment and a desire to cause no harm to any living thing. It is most widespread in Asia but also occurs worldwide. Despite the intended compassion and respect, wildlife releases have several potential negative effects for the animals that are being released, the humans that are doing the releasing, and the environments into which they are being released. Animals may die during capture and in captivity. The high demand has led to a large commercial trade in captive wild animals which may result in an unsustainable rate of harvest. Many animals carry zoonotic infections considered risky to public health. However, perhaps the greatest risk is the potential for biological invasions. Invasive species are a major driver of global change and biodiversity loss and their impacts may be far reaching. Many of the species released during religious ceremonies are exotics which can have serious consequences for the recipient ecosystems, and multiple religious releases increases the propagule pressure of invasive species which enhances the likelihood of establishment and negative effects of invasions. World religions have historically advocated ethical and moral codes of conduct which can be supportive of biodiversity conservation. This is an ideal time to address the issue of prayer release and thus facilitate the potential for religion to play a positive role in promoting conservation biology.

Understanding rural livelihoods and use of natural resources in the Gobi Desert, Mongolia using direct questioning and UCT methods

Bolortsetseg Sanjaa, Odonchimeg Nyamtseren, Kirk Olson

The Oyu Tolgoi copper and gold mining project is the largest commercial project in the history of Mongolia. The operators of the mine, in the Gobi Desert, are supporting a suite of public awareness and anti-poaching measures to offset stakeholder concerns over potential negative impacts caused by an anticipated influx of people moving into the region to take advantage of economic opportunities. The potential negative impacts include, an increase in illegal hunting and collection of natural resources. Monitoring the effectiveness of these measures in terms of reductions in illegal hunting and in the collection of natural resources poses particular challenges due to the sensitive nature of these activities. In addition, understanding the socio-economic situation of local communities is critical in establishing appropriate programs intending to develop sustainable management practices and other livelihood support programs. Our socioeconomic surveys incorporated a combination of the Unmatched Count Technique (UCT) and direct questioning of rural households.

The saxaul /*Halohelon ammondendron*/ and red goyo /*Cynomorium songaricum*/, as well as potential illegal hunting of khulan /*Equus hemionus*/ and goitered gazelle /*Gazelle subgutturosa*/. Surveys were conducted in Omnogovi, Mongolia across a roughly 60,000 km^2 area within the eastern most 4 soums. Surveys were conducted in 2015 and repeated in 2017.

Median self reported income of herding households in the region was $4,170 US and ranged between $340 and $46,809 US/year. Households earning less than $2,043 US/year were among the poorest 20% of income earners while households that reported earnings of more than $6,638 US/year were among the wealthiest 20% of households.

The number of households who hunted or collected the sensitive items decreased between survey periods. Red goyo use dropped the most (20% reduction), followed by saxaul use (16% reduction) and goitered gazelle (13% reduction), while a slight decrease (2%) in khulan hunting was also observed.

Abstracts

Regional Red List of land mammals of Iran

Gholam Hosein Yusefi, Kaveh Faizolahi, Jamshid Darvish, Kamran Safi, Mohammad Nosrati, Jose Carlos Brito

Knowledge about Iranian mammal fauna has greatly increased over recent years, however, little is known about their regional conservation status. Based on an extensive updating of their geographical distribution, we estimated the regional extent of occurrence and area of occupancy of each species (using GIS tools), to assess their conservation status. The resulting regional Red List of Iranian land mammals showed that:

i) 25 out of 192 (13%) are Threatened;

ii) further 13% are near to qualifying for threatened status;

iii) 57.2% (110 species) are Least Concern; and

iv) 14.6% (28 species) are Data Deficient.

Two large felids (*Panthera leo* and *P. tigris*) are regionally extinct, and three taxa are evaluated as Critically Endangered: *Acinonyx jubatus venaticus*, *Ursus thibetanus gedrosianus*, and *Dama mesopotamica*. Important differences between global/regional conservation statuses were found in: *Acinonyx jubatus, Capreolus capreolus, Cervus elaphus, Dama Mesopotamica, Equus hemionus, Gazella bennettii, G. cf. gazella, G. subgutturosa, Panthera pardus, Ursus arctos*, and *U. thibetanus*. With 90% assessed as Threatened, herbivore species are of particular concern. 20.6% of the carnivores are Threatened and 27.5% are Near Threatened. Iran still is the last stronghold for many threatened land mammals in SW Asia, despite populations of these species being small, fragmented, and exhibiting low numbers. The efforts dedicated to conservation and management need to increase for effective inversion of the current declining trends. This work provides Iranian national legislation (Department of Environment) with a full regional assessment of conservation status that can be used to frame conservation priorities.

Empowering women from local communities through wildlife conservation: the Tajik Women and Conservation Initiative in Tajikistan

Shirin Mukhametkadyr kyzy

Societies across the world have long been undergoing important changes affecting women and advancing their rights and opportunities. Traditionally women were the "custodians of the hearth." Increasingly now women have access to the same opportunities as men. However, change is not evenly spread across the countries. In Central Asia women still have no opportunity to pursue many educational and employment opportunities, especially in remote mountainous communities like Tajikistan.

Panthera (an American NGO for the wild cats' conservation across the globe) has been actively working in Tajikistan since 2009 and understands the importance of empowering local communities for the benefit of wildlife conservation, through support of and development of community-based conservancies.

Panthera and partner organization Hunting and Conservation Alliance of Tajikistan (H&CAT) saw wildlife conservation could be a way of empowering women in remote communities. During the summer of 2017, in cooperation with two community-based conservancies, "Burgut" in Alichur village and "Parcham" in Ravmeddara, the "Tajik Women and Conservation Initiative" was launched, aiming to train women in these conservancies as rangers, trekking and hunting guides, and essentially opening up the opportunities for women to be considered alike their male counterparts.

These two conservancies are successfully protecting wildlife, conducting sustainable international hunts, welcoming tourists from different countries for wildlife observation and photographing tours,

and yak-safari. With foreign female tourists increasingly inquiring about being guided by women-guides, the conservancies themselves easily recognized there was an opportunity to empower the women in the communities, and the benefits from doing so could be used to negotiate the barriers of culture, tradition and religion. The Tajik Women&Conservation, to be eventually scaled up to other conservancies in Tajikistan and Kyrgyzstan, can become a successful model where wildlife conservation can help promote education and employment opportunities for women, with full support from the conservative communities they come from.

SHER-lock Holmes: A molecular forensic approach for identification of livestock depredators.

Himanshu Chhattani, Kaushalkumar Patel, Sanjay Shukla, Uma Ramakrishnan

Precise identification of individual predators such as tiger and leopard responsible for a conflict event is often difficult because these animals are secretive and depredation is often difficult to see. However, such information is critical for effective conflict management and a better understanding of the behavioral ecology of conflict. Camera traps are commonly used for such monitoring, but they provide information about animals that visit the kill site. Genetic samples can many a times be the only source of evidence at conflict sites and can provide a more conclusive identity of the predator. We assessed the potential of non-invasive genetic samples, collected from livestock kill sites around Kanha Tiger Reserve (in Central India) to precisely identify predator species and individuals. We sampled predator saliva, shed hair and scat samples from livestock kill sites for a period of eight months, from February to October 2017 (over three climatic seasons). A total of 174 livestock kill sites were sampled for 453 salivary swabs, 23 scat and 80 shed hair samples. We were able to identify predator species for all kill sites sampled during summer and winter. Salivary samples worked best for predator species identification. Microsatellites were used further to identify individuals from salivary swabs and were successful in 68% of the samples. We are currently using SNP markers for individual identification. Our initial results suggest that non-invasive genetic samples are successful in predator identification and therefore, can be valuable tool for understanding and managing conflict.

Wildlife and Infrastructure

Infrastructure as a threat to wildlife in Central Asia on the example of Kazakhstan and the application of infrastructure guidelines to reduce such threats

Steffen Zuther, Albert Salemgareyev

The wide landscapes of Central Asia are the home for many migratory mammals, which need large open places to survive. Long-distance migrations are important for their survival in difficult climatic conditions and habitats with low productivity. Linear infrastructure developments in the context of economic growth in the region can seriously threaten their existence. Negative effects on wildlife can be of different character, reaching from a full barrier for movements across the infrastructure, over changes in natural movement patterns through increased stress, to indirect effects, caused by changes in the natural habitat, related to the infrastructure. We show an example of serious impacts of linear infrastructure on the critically endangered saiga antelope in Kazakhstan by using movement data received from satellite tracking over several years. Changes in their migration pattern were caused by the construction of a railway across the Ustyurt population in Kazakhstan, leading eventually to a serious decline in population numbers and loss of significant habitat. At the same time, the effect of a border fence could be mitigated.

Such infrastructure projects are important for the economies of countries in Central Asia and beyond, but they can have serious impacts for the unique wildlife. In order to avoid such negative impacts, guidelines have been produced by the Convention on Migratory Species (CMS), which provide an overview of the current situation and give recommendations for an adequate assessment of impacts on biodiversity and improved planning procedures, taking into account the needs of wildlife and applying the mitigation hierarchy for any effects on wildlife. The use of these guidelines by governments and infrastructure authorities and planners would help to decrease the adverse effect of developments, which are important for people in Central Asian countries.

A Proposed Post-Closure Scientific Research Station at Kumtor Gold Mine

Ben Ferris

In 2012, Kumtor Gold Company (KGC) invited international sustainability consultancy Prizma to assist in developing a Biodiversity Management Strategy and Plan (BMSP) in line with the company's commitment to responsible integrated approaches to conservation of biodiversity and natural resources. The BMSP included engaging regional conservation experts, international conservation organizations such as Fauna and Flora International and interaction and support of the Sarychat Ertash Nature Reserve, adjacent to the Kumtor Mine. The BMSP also discussed the possibility of establishing a Biodiversity Research Center at the Kumtor Mine after closure, as a viable strategy to expand on the existing local and regional biodiversity conservation and research activities. KGC and Prizma are presently updating and revising the BMSP to include further detail on proposed Post Closure activities at the Kumtor Mine site, which includes expanding the potential scope of the Biodiversity Research Center to include a broader range of conservation issues, such as climate change, glaciers and meteorology. With established infrastructure that has supported the mining operation for over two decades and unique high altitude location with numerous ecological and natural resources, the Kumtor camp provides a significant opportunity to become a cornerstone of both scientific research and conservation for the Central Asian region and a positive legacy for the people of Kyrgyzstan.

Abstracts

Sleep-related behavior of Philippine tarsiers (Tarsius syrichta Linnaeus, 1758) in the Initao-Libertad Protected Landscape and Seascape in Misamis Oriental, Mindanao Island, Philippines

Simeon Gabriel Bejar, Perry Ong

In this study, the sleep-related behavior of Philippine tarsiers was studied. Several tarsiers were radio-tracked from December 2016 to February 2018 in the Initao-Libertad Protected Landscape and Seascape in Misamis Oriental, Mindanao, Philippines. Data were collected on their sleeping site locations and sleep-related behavior, which included quantitative descriptions of their positional behavior and ad libitum observations of activities and intraspecific interactions. Sleeping sites were variable, but mostly characterized by thickets of lianas, branches, and foliage. The tarsiers slept solitarily, in pairs, or in small family groups. They were found to have exclusive sleeping areas (ESA), which were shared only with their putative mates or with offspring. In general, adult males had larger mean ESA's than adult females. Despite static spatial overlaps in the ESA's of some individuals, spatiotemporal overlaps indicating dynamic interactions within the ESA's did not always occur unless the individuals involved were from a single family unit. In terms of positional behavior, the tarsiers were frequently observed in a prostrate position on 1 to 3 cm diameter diagonally-oriented tree branches or lianas. Interestingly, while positional behavior was consistent in all tarsiers, height use varied individually. Tarsiers that have ESA's near the forest edge frequently slept at heights greater than 8 m compared with those that have ESA's towards the forest interior who frequently slept between 3 and 5 m. In addition, evidence of direct paternal care, mainly through accompaniment and occasional huddling in sleeping sites, despite being polygynous, was observed. This study contributes to the better understanding of the ecology of the genetically distinct Philippine tarsiers in the island of Mindanao, and provides insights on how these tarsiers are able to adapt in a disturbed forest fragment.

Characteristics and predictions of endangered leopard cats (*Prionailurus bengalensis euptilura*) road-kills in South Korea

Kyungmin Kim, Hortense Serret, Celine Clauzel, Desiree Andersen, Yikweon Jang

Collision between animals and vehicles negatively impact especially on threatened or small wildlife populations. We analyzed 141 road-kill points of the endangered leopard cat and the same number of randomly generated points in South Korea from 2006 to 2012 using Geographic Information Systems (GIS) and Graphab. Then, we developed a model which predicts the leopard cat road-kill locations based on 25 factors which related with

1) landscape characteristics,
2) traffic factors, and
3) seasonal factor.

We analyzed land-cover types, topographical features, habitat suitability, and habitat connectivity to identify the landscape characteristics. We investigated traffic volume, the number of lanes, and distance from ramps for the traffic factors. For seasonal factor, we compared the road-kill frequencies for each season. We used independent t-test and chi-square test to analyze the landscape characteristics and traffic patterns. We used ANOVA to identify seasonal characteristics. We used Akaike's Information Criterion to evaluate and select the best model predicting the leopard cat road-kills. In landscape analyses, leopard cat road-kills were closer to agricultural lands ($p = 0.018$) and forest ($p = 0.006$), and within less developed areas ($p = 0.013$) compared to the random points. The result from the traffic patterns analysis showed that all variables were significant ($p < 0.01$) between the road-kill points and the random points. The road-kill frequency was also significant ($p < 0.01$) by seasons and there were two peaks in winter (31.4 %) and fall (30.0 %). Among 19 candidate models, the best model selected with the lowest AIC included five factors

with high area under the curve (AUC = 0.855) and appropriate model fit (McFadden's rho = 0.323). Our study highlights that the importance of management of highways with high risks of road-kills to minimize the future collisions and for conservation of the endangered populations.

Demography of a small recovering tiger population in Western Thailand

Rungnapa Phoonjampa, Robert Steinmetz, Worrapan Phumanee, Tawatchai Petcharaburanin, Pisit Piyasomboon, Suthon Wiengdao, Sattha Kunthong, Kittipat Tarapiban, Surachai Pokamanee

Tigers (*Panthera tigris*) are threatened with extinction. Little is known about tiger demography—the dynamics of reproduction and survival – especially in places where small tiger populations are struggling to recover from poaching and prey depletion. We used camera traps to investigate the demography of a small tiger population in Mae Wong and Khlong Lan National Parks (MWKL), Western Thailand. Field work was conducted in 2012, 2014, and 2016. Cameras covered 1200 km^2, the entirety of both parks, and trap effort was extensive (>5,700 trap nights each year). We identified 10 adult tigers (2 female, 8 male) with 2 cubs in 2012, 7 adult tigers (4 female, 3 male) with 5 cubs in 2014, and 10 adult tigers (6 female, 4 male) with 6 cubs in 2016. Although the overall adult population has not changed substantially (7-10 adults each year), numbers of adult females are increasing by 25% per year on average. The proportion of the population that was resident females also increased from <9% in 2012, to 25% in later years. The sex ratio, initially biased towards males in 2012, became increasingly female-biased, from <1 to 1.5 females per male. There was also a positive trend on cub production. The portion of the tiger population comprised of cubs has more than doubled, from 17% in 2012, to 38% recently. The survival rate of adult female tigers is very high (100%) but overall reproductive rate per female is relatively low 0.81 cubs/female/year during 2012 – 2016, and cub survival appears to be very low – mean survival rate of 28.6%, which probably reflects prey scarcity. Based on our results, the two most crucial actions to recover tiger in MWKL are: effective protection of adult female tigers in order to maintain high survival rates and increase prey abundance in order to increase tiger reproductive rate and cub survival.

Illegal Wildlife Trade and Poaching

To the Ethology of Argali Sheep (*Ovis ammon*) at the Kumtor Mine and on Adjacent Areas

Askar Davletbakov

Argali sheep subspecies (*ovis ammon karelinii*) inhabits the investigated area. Its habitat includes most of the Tien Shan (Aizin, 1977). In the 70s, its number was almost entirely extirpated on a vast territory (Yanushevich et al., 1972). According to 2010 records, Argali sheep were distributed along the Kungey, Terskey Ala-Too, Kyrgyz and Talas ridges and its number was 7-8 thousand (Davletbakov, Musaev, 2012). Argali sheep is listed in the Red Book of Kyrgyzstan (1985, 2005) and enters the IUCN Red List of Threatened Species as "vulnerable" (VU).

Argali sheep census was conducted visually on concentration areas using the "LEICA Geovid 10x24 HD-B" binoculars with distance measure. All observed animals were recorded in a wildlife census record sheet specially developed in 2010 (instruction for monitoring (census) of wild mountain ungulate population – mountain sheep and mountain goats in KR), where the following parameters were indicated: weather, precipitation, wind, GPS coordinates, elevation, species, gropu number, sex/age, behavior, distance of running, location of animla, slope exposition, soil, and vegetation.

It should be noted that we did not extrapolate these population numbers to unexplored areas. The data obtained are directly identified numbers of animals. However, these data are minimal (incomplete) compared to the actual population number. These data are very likely to reflect the number of animals close to the actual population number.

Argali sheep census was conducted on transeects within the mine and on adjacent areas.

Wildlife poisoning in Northern Cambodia: investigations and implications for behaviour-change strategies

Emiel de Lange, EJ Milner-Gulland, Aidan Keane

Hunting of wildlife threatens the survival of species across Asia. New hunting methods challenge conservationists, as they can have unexpected consequences for wildlife. Addressing and responding to such emerging behaviours requires an understanding of motivations of hunters, and the social norms around these practices. In northern Cambodia, a new threat to wildlife has emerge: the use of toxic pesticides for hunting at seasonal waterholes. I present an investigation of this phenomenon using focus group discussions, key informant interviews, and a survey of 462 individuals across 10 villages. We attempted to interview hunters directly and assess the prevalence of the behaviour using the unmatched count technique (UCT), as well as measure the perceptions, attitudes and social norms among the wider communities. We also explore the links between this behaviour and the wider spread of agricultural pesticide use. We found that wildlife poisoning is a highly sensitive issue, with strong negative norms resulting from accidental livestock poisoning, loss of access to drinking water, and perceived threats to human health. Our UCT showed a strong 'design effect', meaning it failed to provide an estimate of prevalence, due to this sensitivity. Those who continue to use poison tend to be younger, and see it as a cheap and effective method for getting meat. These results, among others, have strong implications for the design of behaviour change interventions, and we describe how they have been used to plan a proposed social marketing campaign.

Abstracts

Can we achieve Zero Poaching of Tiger? Context from Terai Arc Landscape.

Kanchan Thapa, Madhav Khadka Khadka, Rupak Maharjan, Shant raj Jnawali, Shiv Raj

With more than 200 tigers thriving in Terai Arc Landscape, maintaining population within a protected areas and adjoining areas is a challenging task. Poaching remains a threat to tiger population although protection measures are stringent enough to achieve five time – 360 days of Zero Poaching of Rhinoceros in Nepal. Rhinoceros and tiger share similar habitat in Nepal. In last five years, tiger and rhino population increased by almost 63 and 23 % with no record of poaching in recent times. Monitoring data shows approximately 10 – 15% of tigers (transient) are not detected in between consecutive camera trap surveys. There is no account of the non-detected tigers in between surveys. Tigers are found to be occupying (Psi value: 0.36 – 0.52) areas outside the protected areas. Terai Arc Landscape being a transboundary landscape where tiger share a habitat between Nepal and India. There is a need of sharing mechanism to share a data between the countries so as track on missing tigers. Protection measures, good monitoring system in place and effective transboundary cooperation collectively can help to achieve zero poaching for tiger.

Tigers, Crimes and Mobile apps

Ninad Mungi, Yadvendradev Jhala, Qamar Qureshi

In India, 70% of the world's wild tigers co-occur with one of the densest human population. This human interface aggravates the risk to tiger populations, which are already threatened by international tiger parts trade, retaliation killing, and habitat loss. A real-time flow of information and intelligence on wildlife crimes, population status and human-wildlife conflicts, is thus inevitable.

MSTrIPES (Monitoring System for Tigers: Intensive Protection and Ecological Status) is a technological network developed by India for synthesizing real-time protection and ecological information of Tiger Reserves. MSTrIPES comprise of 3 open-source mobile apps used for patrolling, ecological survey and human-wildlife conflict cases. These apps are used by frontline forest staff and field ecologists to collect geotagged data, which is transferred to MSTrIPES desktop software to link it with GIS data. This desktop software also has a camera trap image auto-recognition tool, developed to assist ecological surveys with demographic details and time activity schedules of species. The software models the trends in crimes, investigations, species occupancy, vegetation community and conflict cases. This data from Tiger Reserves is connected to a central server, where the information is synthesized at country scale. By this, MSTrIPES not only avails real-time information of the remotest forests but also transmits actions and responsibility across the administrative hierarchy for timely decisions.

We used MSTrIPES for the world's largest wildlife survey – India's National Tiger population estimate; wherein we mapped occupancy of 10 flagship carnivores and their 15 species of prey, vegetation communities and their protection status by using more than 160000 sampling plots. Due to its intelligent programming it is being adopted by Myanmar, Bhutan and Bangladesh. If implemented in desired way across the tiger/snow leopard rang countries, it will not only ensure wildlife protection, but also be the first international real-time intelligence network for adaptive wildlife management.

Improving the protection of Amur tigers with the "SMART Approach"

Michiel Hoette, Dale Miquelle

After initial pilots between 2007 and 2009, in 2010 "SMART" adaptive patrol management was introduced by the Wildlife Conservation Society (Russia Program) into two protected areas in the Russian Far East. Currently this system is operative in seven federal protected areas where tigers occur. This innovative approach for patrol management is based on spatial patrol monitoring and the use of monitoring data to improve patrols. The program has contributed substantially to increased protection quality. The presentation will explain the design of the patrol monitoring procedures and how monitoring data are used in patrol management cycles aimed at continuous improvement of patrol quality. The impact of the SMART Approach on patrol quality, patrol results, poaching pressures and Amur tiger and leopard populations will be discussed. The steps in the design and introduction of the SMART patrol monitoring and management systems for Russian protected areas will be described as well as the problems that occurred during the introduction and how these problems were addressed.

Rangelands of Central Asia

Integrated Management Of Invasive Alien Plants in Rangelands: The Role of Plant Competition and Biological Control

Asad Shabbir, Sheema Sadia, Kunjithapatham Dhileepan, Steve Adkins

Invasive alien plants are recognized as a global threat to natural and agro-ecosystems. Parthenium weed *Parthenium hysterophorus* L. (Asteraceae), a serious invasive weed of rangelands and pastures in many parts of the world. The weed is reported to decline the productivity of rangelands and native species diversity. The classical biological control is a promising weed control strategy to manage invasive species across diverse landscapes, especially in rangelands and pastures. To date, eleven biological control agents have been released against parthenium weed in Australia. Some of these are widely established and have significant impact on parthenium weed. Studies have shown that competitive pasture plants have potential to suppress parthenium weed under field and grazing conditions. The combined effect of plant competition and biological control is expected to be greater than either strategies alone. A study in Australian rangelands has shown that competitive plants worked synergistically with the biological control agents (*Epiblema strenuana* Walker, *Zygogramma bicolorata* Pallister, *Listronotus setosipennis* Hustache and *Puccinia abrupta* var. *partheniicola*) present in the field to reduce the growth of parthenium weed, by between 60 – 86%. The biomass of the competitive plants was increased by up to 23% in the presence of biological control agents. Another field study done in a parthenium weed invaded pasture in Pakistan has shown that native plant species richness and diversity was greater in experimental plots where biological control agent, *Z. bicolorata* was not excluded. Based on above findings, it is suggested that the classical biological control and plant competition are effective and environment-friendly weed control strategies that should be considered for the integrated management of invasive plants of rangelands.

Biology, Ecology and Management of Parthenium Weed

Steve Adkins, Ali Bajwa, Asad Shabbir

Parthenium weed (*Parthenium hysterophorus* L.) is one of the most aggressive invasive weeds, threatening the natural and agro-ecosystems in over 43 countries worldwide. Parthenium weed is inflicting losses to rangelands and pastures, degrading the biodiversity of natural plant communities, causing human and animal health risks and seriously inflicting economic losses to people and their interests in many Asian countries. Several of its biological and ecological attributes contribute towards its invasiveness. Various management approaches (viz. cultural, mechanical, chemical and biological control) have been used to minimize losses caused by this weed but most of these approaches are ineffective, uneconomical and/or have limitations. Although chemical control using herbicides and biological control utilizing natural enemies has been found to contribute to the management of the weed, the weed remains a significant problem. An integrated management approach is proposed for the most effective management of weed on a sustainable basis.

In search of the greener side: Do wild ungulates avoid optimal grazing habitats due to pastoralism in Himalayan rangelands?

Ankita Bhattacharya, Bilal Habib, G.S. Rawat

The Greater Himalayan region supports a rich biodiversity and provides various ecosystem services. Traditional transhumant pastoralism is one such service that has benefitted both humans and mountain ecosystems. In the last few decades, however, growth in livestock holding and loss of traditional resource use patterns have affected the wildlife ecologically. Therefore, it becomes important to assess whether grazing pressure exists in a landscape to the extent of excessive competition to wildlife. Our study aims to find if wild ungulates avoid pastoralism influenced areas and if topographic features affect the selection of similar resource units. The study was conducted in the alpine habitats of the Johar Valley in Western Himalaya at the tri-junction of India, Nepal and

Tibet. We calculated habitat utilization and resource selection probabilities of Near Threatened Himalayan tahr (*Hemitragus jemalhicus*), Blue sheep (*Pseudois nayaur*) and Livestock (goat and sheep) based on topographic variables. Our results suggested a visible separation of resource selection between wild and domestic ungulates (Figures 1 and 2). Himalayan tahr owing to their ecological traits select steep slopes and landslide zones which are inaccessible to the pastoralists, keeping them separated from livestock (Table 1). Blue sheep, which has similar habitat type preference as livestock (Table 1) are found to select less rugged habitats at higher elevations and closer to cliffs (escape terrain) (Figure 1). Our analysis suggests that in order to avoid pastoralist occupied areas, Blue sheep select resources in less disturbed areas, inaccessible to humans. This might lead to their exclusion from better habitat patches. Thus, livestock has a competitive advantage due to the human presence who lead them to the optimal grazing areas and wild ungulates have to take refuge in suboptimal areas. We posit that conservation of threatened and important prey species in Himalayan rangelands depends on managed pastoral practices and community participation.

Success and failure at conserving focal species in two Asian protected areas

John Linnell, Petra Kaczensky, Diana Bowler, Erlend Nilsen

Protected areas are often created with a few species, often charismatic mammals, in focus, both to conserve these species and in the hope that their conservation will serve as an umbrella for the conservation of other species. In this paper we examine how two protected areas, Badkhyz Strict Nature Reserve in Turkmenistan and Shwesetthaw Wildlife Sanctuary in Myanmar, have succeeded at their assigned tasks. Both were created in the 1940's with the intention of conserving a large herbivore, Asiatic wild ass or kulan (*Equus hemionus*) in Badkhyz and Eld's deer (*Rucervus eldii*) in Shwesetthaw. For both areas we have obtained access to a time series of census data for the focal species and been involved in field surveys (including several years of camera-trapping) in recent years. In Shwesetthaw, the population of Eld's deer has increased, and now represents the largest surviving population of this species. However, most other species of large mammal (e.g. tiger, leopards, dhole, gaur, banteng, hog deer, serow) have gone extinct during recent decades. In Badkhyz, it appears that the population of Asiatic wild ass has declined to local extinction in recent years, although most other species of medium and large mammal (e.g. leopards, wolves, stripped hyaena, urial, goittered gazelle) have survived. Thus, the two protected areas demonstrate contrasting experiences at their ability to protect their focal species and serve as umbrellas for other species. The multiple reasons behind these different outcomes are discussed.

Animal Diets

Abstracts

A Study on Diet and Relationship of Indus Valley Spiny-Tailed Lizard (*Saara hardwickii*) with Vegetation

Sididqa Qasim, Muhammad Rais, Faraz Akrim, Tariq Mahmood

The Spiny-tailed Lizard (*Saara hardwickii*) is widely recognized as a herbivore lizard inhabiting arid areas, but less is known about association of the lizard abundance with different vegetation type and lizard's diet using stomach content flushing method. We conducted the present study to see relationship of woody and non-woody vegetation with abundance of Spiny-tailed Lizard in Chakwal District, Punjab, Pakistan, and to see if proportions of food item species were similar in the samples of stomach contents and fecal samples. We found a weak significant relationship with woody vegetation cover (trees and shrubs) but relatively strong significant relationship with non-woody vegetation cover (herbs and grasses). Herbs such as *Chenopodium album* and *Peganum hermala* accounted for most of the volume and frequency in stomach content and fecal samples followed by grasses *Cynodon dactylon* and *Desmostachya bipinnata*. We found significant difference in the number of food item species recorded from the samples of stomach contents and fecal samples. We recorded *Acacia modesta* (tree) and *Eruca sativa* (herb) only from samples of stomach contents while *Ziziphus nummularia* (shrub) and *Cymbopogon jwarancusa* (grass) only from the fecal samples whereas the other food item species were the same. Of all the food items, only the proportion of *Peganum hermala* (herb) in the stomach content samples and fecal samples were different. We concluded that the lizard abundance was more related with non-woody vegetation than woody vegetation. The lizard did not selectively forage on the vegetation rather it fed on herbs and grasses common in its habitat and might have ingested insects incidentally. The stomach content flushing method is less tedious and yield similar result as that of a more robust fecal pellet analysis method. On contrary, fecal pellet analysis is relatively harmless while flushing the stomach contents may put the lizard under stress.

Spatial distribution and dietary niche breath of common leopard (*Panthera pardus*) in north-eastern Himalayan region of Pakistan

Tariq Mahmood, Faraz Akrim, Shaista Andleeb, Sajid Nadeem, Hira Fatima

Knowledge of a predator's diet is important for understanding its ecology and for predicting its influence on the dynamics of prey populations. The common leopard (*Panthera pardus*) is "Critically Endangered" in Pakistan while IUCN Red list categorizes it globally as "Vulnerable". We investigated the spatial distribution and diet composition of common leopard in a north-eastern Himalayan region of Pakistan. The cat species was recorded at thirty different surveyed sites with an altitudinal range between 757 m – 1891 m. A high sign density of was recorded at Pir Kana and Sairi sites. Scats of common leopard (n = 39) were found at seven different sites, while livestock depredation by leopard was reported from 22 sites. Diet of common leopard comprised of 17 prey species including both wild and domestic prey. Frequency of occurrence of wild prey was approximately 35 % of total diet whereas domestic prey contributed approximately 59%. The dietary niche breadth of the species was found broad during spring season (0.76) but narrow during winter season (0.46). Common leopard was responsible for financial loss estimated approximately at US$ 80,000 for the current study period and local perception was hugely negative (86%), resulting in killing of fifteen leopards. Results highlight that approximately 60% diet of leopard comprises of domestic animals and this heavy dependence of leopard on livestock results in human-leopard conflict. However, if leopard does not consume domestic prey, its survival could be threatened because less available wild prey cannot sustain leopard. We suggest that local communities should be educated to conserve common leopard as well as and its prey species, to increase acceptance towards the cat species in their surroundings. In addition, payment of compensation to the local community for their livestock attacked by leopard can result in successful conservation of leopard in the study area.

Effect of Dietary Vitamin E on Semen Quality of Indian Red Jungle Fowl (*Gallus gallus murghi*): An ex situ Cryoconservation Perspective

Bushra Rakha, Muhammad Ansari, Shamim Akhter, Samia Bashir

Indian red jungle fowl is native sub-species of South-East Asia, facing extreme decline due to habitat destruction and genetic hybridization with domestic chicken in its distribution range. Hence, captive breeding is an appropriate option for the conservation of this unique and precious species. However, in captive breeding programs, inbreeding is a major hindrance and can be ameliorated through semen cryopreservation techniques. Nevertheless, overcoming cryodamages during cryopreservation is needed for the successful application and improving genetic diversity. In cryopreservation, oxidative stress affects semen quality due to insufficient defensive system. Therefore, present study was designed to elucidate the impact of dietary vitamin E on post-thaw semen quality parameters. A total of eight birds were divided into four groups (4 dietry treatments x 5 replicates). The birds were fed with 0mg (T1), 40mg (T2), 100mg (T3) and 200mg (T4) of vitamin E/kg body weight. Semen was collected and assessed for initial motility and concentration. Qualifying ejaculates were extended (1:5) in red fowl extender and cryopreserved. Post-thaw semen parameters viz; motility, plasma membrane integrity, live/dead ratio, acrosomal integrity, biochemical parameters viz; antioxidant activity (DPPH) and lipid peroxidation (MDA concentration in sperm and seminal plasma) were studied. Dietary vitamin E has no effect ($P>0.05$) on sperm motility, whereas sperm plasma membrane integrity, viability and acrosomal integrity were significantly higher ($P<0.05$) in T4 group compared to other groups. The free radical scavenging activity in T4 group (200mg E) was higher ($P<0.05$) compared to other groups and control. Lipid peroxidation was found less ($P<0.05$) in T4 group in sperm and seminal plasma compared to control and other treatments. In conclusion, dietary vitamin E (200mg) has positive impact on post-thaw quality of Indian red jungle fowl semen by ameliorating the oxidative stress. Therefore, regular use of vitamin E is recommended for cocks maintained for captive breeding program.

Species Interactions

Land Cover Change-Detection of Doroot Korgon Area, Kyrgyzstan

Zheenbek Kulenbekov, Sagynbek Orunbaev, Beksultan Sharipov

Agriculture and livestock are main sectors of Kyrgyzstan's economy that makes sustainable pasture and land management critical for human well-being, economic stability, social welfare and ecosystem resilience. Both human-induced and natural factors play key role in the sustainability issues of rural mountainous communities in Kyrgyzstan that rely heavily on land resources. This study focuses centrally on finding linear interrelationship between NDVI and climatic variables that mainly include air temperature, land surface temperature and precipitation. This helps to understand the idea behind seasonal and inter-annual behavior and dynamics of vegetation characteristics. Besides, secondary goal of this research is to prepare land cover classification of Daroot Korgon area. Overall, implications of this study are directed towards the general understanding of interaction between terrestrial ecosystems and climate change. Study encompassed two time periods (1993 – 1996 and 2000 – 2003) and linear relation and positive correlation coefficient was found only in two years (1994 and 2003). This might not be enough to establish a significant annual trend between NDVI and climatic variables. However, seasonal trend was found: as a rule, the lowest NDVI values are observed in May than reaches its peak at the end of July and at the beginning of August and decreases in the middle or at the end of September. In addition, trend was found in NDVI values over the last five years in Daroot Korgon area, there is an inter-annual even distribution of values without any sharp fluctuations and variations. Acknowledgement: Financial support for this research project comes from PEER NAS USAID Grant Subaward No. 2000007764.

Socio-ecological contexts of human-carnivore interactions: Sympatric wild canids in India as a case study

Arjun Srivathsa

Protected reserves constitute a mere 14% of the global land area. Many species of carnivores inhabit unprotected human-dominated landscapes, outside these reserves. Understanding the socio-ecological factors that determine humans-carnivore interactions is pertinent for conserving them. Wild canids in India exemplify this issue, but are among the least-studied carnivores, globally. We conducted simultaneous indirect sign surveys and questionnaire surveys in 2015 – 2016, across c.7000 sq. km of the Kanha-Pench forest corridor in central India. Using a grid-network of 128 52-sq. km cells, we examined distribution of wild canids, and human-canid interactions. We focused on four species of wild canids: the dhole *Cuon alpinus*, Indian fox *Vulpes bengalensis*, Indian jackal *Canis aureus indicus* and Indian wolf *Canis lupus pallipes*. We also included the striped hyena *Hyaena hyaena* in our assessment, because of similarities in their ecological requirements. Results from sign surveys indicated that wild canids occupy large parts of the landscape (dholes used 12% of the region and jackals were found in 86% of the study area). Combining information from interviews of 675 local residents and multi-state occupancy models, we estimated probability of conflict ranging from 21% for dholes to >95% for jackals. In general, scrub forests and terrain ruggedness were important for wild canid occurrence. Land-cover type and livestock-holding by local people influenced patterns of human-canid conflict. Finally, we examined spatial overlaps between the five carnivores and free-ranging dogs to understand competitive interactions and potential disease risks. Results from our study provide insights on the ecology of five data-deficient carnivores in human-dominated landscapes. Based on our findings, we provide species-specific management recommendations and propose that prioritization and zoning of locations could facilitate persistence of these species outside the protected reserve network. Our approach and findings have relevance for similar social and ecological scenarios of human-carnivore interactions in human-dominated landscapes globally.

Technology in Biodiversity Conservation

Experience of identifying the Saiga Antelope (*Saiga tatarica*) on Very high Resolution Satellite Images as a Method for estimation of their number

Anna Yachmennikova, Viatcheslav Rozhnov, Dmitryi Dobrynin, Tatiana Karimova, Anna Lushchekina

According to results of previous research (2012 – 2014) based on the analysis of high resolution satellite images taken during the cold part of the year the exact distinguish saiga from domestic ungulates has been proved and it also allow to determine the distribution of saiga herds over large areas. For maximum reliability in differentiating animal species at the satellite images three main characteristics (the color of animals, their size and shape, and herd structure) have been used. The results of this study have been applied to develop a noninvasive and highly accurate method for estimation of saiga number on the model territory.

Study is focused on the saiga population inhabiting at the territory of North-West Pre-Caspian region, Russia. Nowadays this saiga population is in a critical condition. According to estimates of experts the number of this population doesn't exceed 6000 individuals. The model territory we worked on includes two combined protected areas: Natural Sanctuary "Stepnoi" (Astrakhan region) and Natural reserve "Chernye Zemli" (Republic of Kalmykia) where freeranging saigas are inhabit. Images taken in December 2016 by Pleiades satellite (France) with the 0.5 m per pixel resolution have been used for study. The images cover territory of 1515 sq km and number of animals was estimated exactly on this territory. ScanEX IMAGE Processor software has been used for the images processing and analyzing. MapInfo Professional 8.0 SCP software has been used for determining distances between animal groups and between animals within groups. Statistical analyses have been conducted with use Statistica 8.0 package.

Predicting wild buffalo movement pathways using GIS approaches

Adrish Poddar, Poonam Chandel, Rahul Kaul, Rajendra Mishra

Developments in GIS and Remote Sensing technology have allowed conservation biologists to predict imminent anthropocene changes, empirically translate research of a vast geographic scale and prioritize actions to conserve wildlife. Human demands for natural resource often compel and confines wildlife into resource-limited 'islands'. As population exceeds carrying capacity of 'islands', newer generation animals tend to occupy (and eventually colonize) newer contiguous patches. An important principle of landscape planning allowing animal migration is to maintain such landscape permeability with corridors, linkages, and stepping-stones. Our study focused on a dwindling population of threatened wild buffaloes in Udanti-Sitanadi landscape of Gariaband district, Chhattisgarh. Study uses empirical approach to,

i) enumerate availability of suitable habitats for wild buffalo *Bubalus arnee;*

ii) index connectivity/permeability between Udanti and Sitanadi;

iii) quantify decadal change in land-use impinging the modeled 'corridor' to direct management actions.

Three predictor variable set were chosen to predict and score relative suitability of habitats using maximum entropy approach (Maxent 3.4.0). Each layer of predictor variables was built and standardised using ArcGIS 10.4.1. All-season animal occurrence locations of four free-ranging buffalo were used to build the model. Resultant 'studyscape' map with relative suitability scores was used in Circuitscape 4.0, to model the pathways connecting pre-designated source (Udanti) and sink (Sitanadi). Trend of land-use impinging the corridor was quantified and delineated comparing imageries from two different temporal scales. Prediction accuracy of resulting map was pre-validated using historically known ranging patterns. For migration, seasonal or permanent, animals tend to choose 'corridors' offering shortest path, security and food. Our study indicated buffaloes' high affinity to water and aversion to roadways. Of the two prominent corridors predicted

by Circuitscape, only one 14-km corridor aligned with the suitable habitats. Areas impinging the habitat and showing higher trend of conversion (874.1-hectares) were demarcated to direct policy and restorative actions.

Integrating remote sensing and interview data for the identification of a leopard corridor in the Alborz Mountains, Iran

Arash Ghoddousi, Benjamin Bleyhl, Delaram Ashayeri, Peyman Moghadas, Pooriya Sepahvand, Shirko Shokri, Amirhossein Kh. Hamidi, Mahmood Soofi, Tobias Kuemmerle

Globally, land-use change and infrastructure development are causing habitat fragmentation, making corridor planning an increasingly important tool for the conservation of wide-ranging species. Several approaches now allow for the top-down identification of corridors, however, the functionality of these corridors on the ground has been rarely investigated. Here, we identified a critical corridor for Persian leopards (*Panthera pardus saxicolor*) in the eastern Alborz Mountains, Iran using a combination of top-down and bottom-up approaches. This area (3,325 km^2), between Golestan National Park and Jahan Nama Protected Area, is covered by the Hyrcanian forest and connects two of the main population strongholds of the endangered Persian leopard. We generated a land-cover map from Landsat 8 satellite images, and assigned resistance values to each land-cover class using a survey among 15 wildlife experts. Then, we estimated the most plausible leopard corridor using least-cost path analysis and identified possible bottlenecks for movement. In parallel, we conducted 231 interviews with local communities in 69 grid cells (6x6 km each) to collect data on leopard and prey observations in the year prior to surveys. We estimated leopard habitat using occupancy modeling, considering potential false-positives in the data. The probability of leopard site use increased with presence of large prey (bezoar goat *Capra aegagrus*, red deer *Cervus elaphus* and roe deer *Capreolus capreolus*) and share of forest in each grid. Combining these top-down and bottom approaches showed a high spatial congruence of areas of high occurrence probability and the identified leopard corridor and confirmed the existence of several bottlenecks to movement. Major roads and the strongly modified landscapes in the eastern Alborz seem to limit leopard movement, and threaten population connectivity. We recommend expansion of conservation planning to include the identified corridors in order to stop further isolation of leopard habitats in the southwest Asia.

Deep Learning for Wildlife Conservation

Mark Hamilton, Rhetick Sengupta, Koustubh Sharma, Sudarshan Raghunathan, Elizabeth Bondi, Ilya Matiach, Eli Barzilay, Tong Wen

He health of ecosystems around the world are continuously jeopardized by human activity. Protecting and monitoring critical ecosystems is often a costly, labor intensive, and challenging task. Modern advances in Artificial Intelligence and Deep Learning have the power to safeguard wildlife and can offer researchers new lenses to explore ecosystem dynamics. Of many, monitoring wildlife populations, and combatting poaching and illegal wildlife trade are two issues that require extraordinary effort. Monitoring wildlife populations and illegal wildlife trade also generate massive datasets whose size and scale can become prohibitive for field practitioners. Microsoft is collaborating with several conservation organizations to develop novel technologies for monitoring and protecting wildlife. More specifically, we present a body of work that shows how deep transfer learning can be used to tackle the issue of snow leopard detection in remote camera trap images. By scanning through hundreds of thousands of images and using deep neural networks, our algorithms are detecting snow leopards with 95% accuracy. We also used low latency deep object detection networks for detecting poachers using Unmanned Aerial Vehicles (UAVs) and infrared imagery. The results are encouraging, and initial tests reveal that these methods dramatically outperform conventional feature engineering methods. The dramatic reduction in manual labor in conservation is paving the way for automated remote monitoring of endangered populations and combating illegal wildlife trade.

3-D camera trapping: a novel method for morphometric and locomotive measurements in snow leopards (*Panthera uncia*)

Dale Kikuchi, Kodzue Kinoshita, Kubanychbek Jumabay, Koustubh Sharma

Measurements of morphometry and locomotion of wild animals yield information about multiple aspects of a species' ecology, evolution and conservation biology. However, it is limited to measure the morphometry and locomotion of elusive species due to lack of appropriate methods.

Regarding image analysis, stereo vision is the commonly-used technique for providing 3-D information from multiple 2-D views of a scene by estimating the actual distance from the camera to objects by triangulation. The typical design for such stereo-vision system generally requires more than one cameras settle on given positioning and orientation, and simultaneous recording. This system is not a user-friendly procedure in use in the rugged nature and elusive species so far.

Here, we present a universal method for morphometric and locomotive measurements of wild animals in 3-D, based on stereo vision using a camera trap with the set of four mirrors fixed in front of the lens (3-D camera trap). The mirrors project the images of the stereo pair onto both halves of the imaging surface of the camera, yielding the equivalent of two virtual cameras with parallel axes. To test the usefulness of the 3-D camera trap, we constructed a prototype device and measured snow leopards in captive and wild conditions.

Our preliminary test in zoos shows that male snow leopards have slightly larger body size and stride length while walking than female snow leopards. These results demonstrate the possibility of sex discrimination of snow leopards by a 3-D camera trap, and footprints never before possible. Additionally, we conducted the field test in Kyrgyzstan and succeeded in recording stereo videography of a wild snow leopard. Although the limited number of individuals and preliminary findings, we show the utility of the novel system.

Recent Developments in Population Ecology

An Individual-based Model of the Population Dynamics of the Saiga Antelope (*Saiga tatarica tatarica*) in the North-West Pre-Caspian Region (Russia).

Anna Rodnikova, Tatiana Karimova, Anna Lushchekina, Anna Yachmennikova, Konstantin Gribov, Viatcheslav Rozhnov, Mikhael Goltsman

For study of the population dynamics of the Saiga Antelope an individual-based model was developed. The model is based on the published data collected in 20th century by different researchers during field studies of the Saiga population inhabiting in the North-West Pre-Caspian region in Russia. Parameters for the model have been calculated from the data collected until 1998, i.e. before the current depression period had started.

To prepare modeling scheme three main 'stages' during annual population cycle have been identified: calving stage (May), aggregation stage (August), mating stage (November-December). Exactly for these important stages, the main part of the parameters was collected, measured and calculated previously and it was a reason for their use in the proposed model.

The numerous field data, allowed us to determine such life-history parameters as mortality rates for males and females of different age classes between main stages in annual population cycle; probabilities of breeding depending on proportion of mature males in population; age-specific fertility as a calf number for females of different age classes; sex ratio for newborns and etc.

An important part of the model is addition of unfavorable conditions (according to unfavorable years) such as drought in summer, autumn and spring; an effect of melting-freezing in winter and heavy rains during the calving stage. The corresponding coefficients for mortality rates have been added for different unfavorable conditions, which can be applied using various schemes. An effect from autumn shooting, which was existed in the previous century and connected to the summer population size, has been added as well.

First results received during modeling show a strong growth of population size when the life-history parameters have been used only for favorable years and the effects at population dynamics of adverse weather conditions with excess mortality and autumn shooting can be estimated.

What counts cannot always be counted: Ungulate populations in the Trans-Himalayas of India

Shivam Shrotriya, Ankita Bhattacharya, Hussain Reshamwala, Jigmet Takpa, Dhananjai Mohan, Bilal Habib

Monitoring wild ungulate populations is among the major tasks of wildlife management practices. Although several statistically advanced techniques have been developed, population estimation in the mountainous areas such as the Himalayas remains a challenge so far due to inaccessibility, limited logistic support and low densities of ungulate populations. Therefore, we explored and applied a possible approach of adaptive simultaneous point count survey in the Trans-Himalayan landscape of India.

We divided the area into girds of different sizes depending on geography and target species and generated random survey points per grid using GIS software for equal coverage of the landscape. More than 90 wildlife and forest department staff and volunteers participated in three major phases of the survey. Primary analyses were performed in conventional distance sampling framework. In the first phase, we surveyed 23,000 km^2 area of Changthang region, Jammu and Kashmir. Population density estimates of *Equus kiang, Pseudois nayaur* and *Ovis ammon hodgsoni* were 0.86, 0.22 and 0.02 individuals/km^2, respectively. A separate survey was conducted for *Procapra picticaudata* whose density was estimated to be 2.43 individuals/km^2. In the second phase, we surveyed 9,000 km^2 area of Uttarakhand. Population densities of *P. nayaur* and *Hemitragus jemlahicus* were estimated to be 0.99 and 0.32 individuals/km^2, respectively. The third phase of the survey was conducted in

13,000 km^2 area of Nubra valley, Jammu and Kashmir. Results of the third phase for *P. nayaur, Capra sibirica sakeen* and *Ovis orientalis vignei* are currently being analysed.

Our survey method performed fairly well considering the logistic constraints. Further improvement will increase the precision and enhance the results. We suggest repeated surveys over the years to monitor the population trends. Voluntary participation by stakeholders has far-reaching implications by training and developing the skills of the participants. Such exercises also create widely disseminating awareness.

Packs in peril? Metapopulation dynamics inform strategies to conserve dhole *Cuon alpinus* populations in the Western Ghats of India

Arjun Srivathsa

With global-scale increase in anthropogenic changes to natural systems, most large-bodied wildlife species occur in highly heterogeneous landscapes, typically with source populations embedded in a matrix of human-dominated habitats. Metapopulations of many large carnivore species currently thrive in such landscapes, while their populations continue to decline. Understanding metapopulation dynamics of threatened and endangered carnivores is therefore critical for prioritizing and implementing management strategies. The endangered dhole *Cuon alpinus* is pack-living wild canid found in forests of south and southeast Asia. We conducted indirect sign surveys to examine dynamics of a dhole metapopulation across c. 38,000 km^2 area in the Western Ghats landscape of India. We adopted a grid-based design, overlaying an array of 197 188 km^2 cells across the landscape. We assessed patterns of dhole distribution in 2007 and 2015, and, local colonizations/extinctions between the eight-year period using multi-season dynamic occupancy models. Dhole occurrence was influenced by relative abundance of primary prey species and anthropogenic disturbance. Dhole occupancy in the landscape reduced from 62% in 2007 to 54% in 2015. Local extinctions were driven by loss of forest cover, and persistence was facilitated by presence of protected reserves. Perturbation analysis indicated that dhole occupancy was more sensitive to extinction than to colonization, and allowed us to identify areas for targeting management interventions. While protected reserves are crucial, dholes continue to occur outside parks where host of factors threaten their survival. Ongoing infrastructure development projects and diversion of forest lands for commercial use could adversely impact source populations through geographic and demographic isolation. The Western Ghats can serve as a stronghold for dholes, provided future colonizations are facilitated through habitat expansion outside reserves and extinction rates are offset by increasing protection measures. We propose that wildlife managers adopt a metapopulation-centric approach to monitor and conserve dholes and other large carnivores threatened with endangerment.

Preliminary results on snow leopard population monitoring using standardized monitoring program in Russia

Alexander Karnaukhov, Mikhail Paltsyn, Alexander Kuksin, Denis Malikov, Sergei Malykh, Sergei Spitsyn

The information on snow leopard in Russia has been collected by researchers for years with different and various methods without involvement of statistically sound methodologies. The application of scattered approaches and methods made the data on snow leopard numbers and distribution not complete or comparable. At the initiative of WWF Russia, the standardized snow leopard monitoring program was developed in 2016.

Previously for modelling the snow leopard potential habitats the type of Maxent modeling algorithm was used. The modelling results included the data on the total snow leopard habitat area (key and potential zones). The proposed snow leopard monitoring system for Russia is based on the permanent grid of 5x5 km spatial cells covering actual and potential habitat of the species. This concept builds on methods used for robust monitoring of large felids populations around the world.

Snow leopard monitoring approach suggests selected model monitoring sites with a network of permanent 5x5 km cells. The cameras are placed in each permanent cell selected for survey. The system allows the monitoring based on two approaches: sign-based survey with spatial replicates to estimate extent of habitat occupancy; and spatial capture-recapture approach using non-invasive genetics and camera-trapping to identify individuals.

Combining these approaches (large-scale study and local-scale survey) can enable estimating snow leopard population status at local, regional, and national level in Russia using the quality of the snow leopard habitats (index of the MaxEnt modelling) as variable.

Monitoring program was for the first time tested in Russia for two areas: Eastern Sayan Ridge in the Republic of Buryatia and the Chikhachev ridge in the Republic of Altai. Later the programme was revised and updated. The first snow leopard monitoring was carried out for three areas: Eastern Sayan, Tsagan-Shibetu ridges and the Argut river basin in winter of 2018.

Transboundary survey of the global population of Amur leopards

Dale Miquelle, Anna Vitkalova, Limin Feng, Alexander Reebin, Tianming Wang, Haitao Yang, Elena Shevtsova, Vladimir Aramilev, Jianping Ge

Political borders and natural boundaries of wildlife populations seldom coincide, often to the detriment of conservation objectives. Transnational monitoring of endangered carnivores is rare, but is necessary for accurate population monitoring and coordinated conservation policies. We investigate the benefits of collaboratively monitoring the abundance and survival of the critically endangered Amur leopard, which occurs as a single transboundary population across China and Russia. Country-specific results overestimated abundance and were generally less precise compared to integrated monitoring estimates; the global population was similar in both years: 84 (70 – 108, 95% confidence interval). Uncertainty in country-specific annual survival estimates were approximately twice the integrated estimates of 0.82 (0.69 – 0.91, 95% CL). This collaborative effort provided a better understanding of Amur leopard population dynamics, represented a first step in building trust, and lead to cooperative agreements to coordinate conservation policies.

Trend in ibex and argali in Tost, Tosonbumba State Nature Reserve, Mongolia

Chagsaldulam Odonjavkhalan, Kulbhushan Suryawanshi, Justine Shanti Alexander, Gustaf Samelius, Purevjav Lkhagvajav, Bayarjargal Agvaantseren, Charudutt Mishra

Wild ungulates play an important role in maintaining ecosystems and are an important indicator for determining large carnivores' densities. There however remains little information on wild ungulate populations and their trends, especially in the remote mountains of Central Asia. Mongolia's Tost State Nature Reserve is an important area for the conservation of species such as the snow leopard, and argali and ibex and is also used by the local pastoralists for grazing livestock. We estimate the populations of ibex *Capra sibirica* and argali *Ovis ammon* over 5 years between 2012 and 2017. Double observer surveys were conducted from October to November in a mountainous study area of 1400 square kilometers. Ibex population size reached its lowest size 649.3 (97.5% CI, 511~833) in 2016 while its highest size was estimated at 1148.4 (97.5% CI, 895.6~1494.6) in 2017. The lowest and highest sizes in argali population were estimated to be 26.6 (97.5% CI, 9~71.5) in 2016 and 207 (97.5% CI, 108~252) in 2013. Results showed that ibex and argali population remained stable across the study with no apparent growth of λ=-0.0004 (97.5% CI, -0.02±0.047) and -0.0025 (97.5% CI, -0.05~0.51.8), respectively. Previous studies have also suggested that the adult snow leopard population in the area remains stable between 2009- 2012, with no apparent growth. Our results re-iterate the importance of the Tost Mountains for both wild ungulates, ibex and argali, along with the snow leopard. We also highlight the importance of monitoring populations of ungulates over the long term in order to advice local conservation efforts.

Abstracts

"Narrative and Evidence" between Snow Leopard and Mongolian Nomadic Herders: Oral History and S.E.K. (Scientific Ecological Knowledge) for Complex Conservation Ecology

Takuya Soma

There is potentially not more than 900 population of snow leopards (*Pantera uncia irbis*) living across the Altai Mountains in Mongolia. Especially, a plenty of "snow leopard accident",

i) eyewitness,

ii) encounter, and

iii) livestock predatory, has been reported in Khovd and Bayan-Ulgii Province which has been dramatically increased from 2014.

To create well-being sustainable relation between snow leopard and local nomadic herders, this research clarifies socio-cultural context surrounding snow leopards among contemporary nomadic society. The fieldwor ~ k was carried on from 19th July ~ 22nd August 2016, with structured interview (1. hysteresis and retroactive research, 2. documentation of oral history) to 117 informants living in vicinity of snow leopard's dwelling at Mt. Jargalant (Жаргалант), Mt. Bumbat (Бунбат), and Mt. Munkh-Khairkhan (Манх-Хайрхан) in Khovd Province.

Structured interview detected total 382 cases of "snow leopard accidents" of which 72.9% encounter with snow leopards have happened within inevitable herding activities (daily-grazing and search of large livestock). In addition, livestock predatory nearby herdsmen's settlement is increased 4.7 times from 1990's. These accidents are not only happened in winter (44.5%), but also during summer (19.7%). As a result, this annual threatening may have brought about some of retributive illegal killing are still happened against livestock predatory.

Further, this research shows a various kind of ritual and folklore about snow leopard within nomadic people (mostly Uriankhai). This local oral history, legend, experiences, and any T.E.K. narratives about snow leopards need to be defined as a source of cultural heritage which is created by centuries of precious phenomena "the herder-snow leopard interaction". It will encourage subjectivity of locals to protect the entity of snow leopard and surrounding environment. Because, herder's attitude for ecological conservation and self-controlled animal grazing is also key issue for sustainable co-existence with snow leopards.

Snow leopards in large landscapes: estimating density from fecal DNA across the central Himalayas, Nepal.

Madhu Chetri, Morten Odden, Koustubh Sharma, Per Wegge, Oystein Flagstad

Although abundance estimates have a strong bearing on the conservation status of a species, less than 2% of the global snow leopard distribution range has been sampled systematically, mostly in small survey areas. In order to estimate snow leopard density across a large landscape, we collected 347 putative snow leopard scats from 246 transects (490 km) in twenty-six 5x5km sized sampling grid cells within 5000 km^2 in the Annapurna-Manaslu landscape, Nepal. From 182 confirmed snow leopard scats, 81 were identified as belonging to 34 individuals; the remaining were discarded for their low (<0.625) quality index. Using maximum likelihood based spatial capture recapture analysis, we developed candidate model sets to test effects of various covariates on density and detection of scats on transects. The best models described the variation in density as a quadratic function of altitude and detection as a linear function of topography. The average density estimate of snow leopards for the entire study area is 0.945 (SE 0.201) animals per 100km^2 with 95% LCL=0.626 and UCL=1.427, thus highlighting the heterogeneity in densities as a function of habitat types. A meta-analysis on the influence methodology (study area size, sampling method and model of estimation) on snow leopard density estimates (13 studies, 25 sites), revealed that our estimate was relatively

low, and that density variation was mainly determined by study area size. Inflated estimates in small areas are probably caused by locally high abundances in overlap zones (hotspots) of neighboring individuals, whose territories probably range far beyond study area borders. Our results highlight the need for a large scale approach in snow leopard monitoring, and we recommend that methodological problems related to spatial scale is taken into account in future snow leopard research.

Modelling of a reintroduced Asiatic Black Bear population in South Korea with recommendations for future conservation

Desiree Andersen, Yoonjung Yi, Amael Borzee, Kyungmin Kim, Yikweon Jang

The Asiatic Black Bear, *Ursus thibetanus*, which is classified by the IUCN as vulnerable to critically endangered across its range, was functionally extirpated from South Korea in the 1990s. However, the South Korean government began to reintroduce individuals into Jiri Mountain National Park, Republic of Korea, in 2004. The reintroduction program has generally been considered a success, with more than 47 individuals currently residing in the park. As the population grows, park officials must decide how to deal with dispersing individuals and how the program should progress. In this study, we use a mixed modelling approach to determine suitable habitat areas, carrying capacity for three different scenarios, and least-cost pathways. Suitability was first determined using a resource selection function (RSF) model, which was then incorporated along with life history traits into the population simulation software HexSim. We tested simulations for Jiri Mountain National Park, for South Korea with no further reintroductions, and for South Korea with a second, similarly-structured reintroduction in Seorak Mountain National Park. These simulations gave us average carrying capacities of 64, 230, and 1,111 individuals, respectively, with a maximum of 1,357 individuals possible in South Korea. Finally, we used the GIS tool "Linkage Mapper" to map least-cost pathways based on resource availability and landscape urbanization. The results of the network and map linkage tool match an actual dispersal route of one male individual which recently escaped from Jiri Mountain National Park and travelled to a location about 80 km away from this park. Based on these results, we strongly recommend a second reintroduction program in Seorak Mountain National Park and increased connectivity and habitat corridors along the Baekdudaegan Mountain Range.

Symposia

Strengthening Capacity for Reducing Illegal Wildlife Trade in Asia

Integrated technology solutions for reducing poaching and improving effectiveness of protected areas

Antony Lynam

New developments in technology are helping address the problem that significant wildlife areas are subject to poaching and unsustainable use of wildlife, and less than a quarter of protected areas globally have effective management. A partnership of conservation organizations developed the SMART (Spatial Monitoring and Reporting Tool) Approach to help measure management effectiveness. The SMART Approach combines standardized patrol data collection, site-based database management, and decision-making, with an emphasis on capacity building and best practices for protection. This approach, now adopted in >600 sites around the world, provides protected area managers and community groups the ability to empower staff, boost motivation, increase efficiency and promote credible and transparent monitoring of the effectiveness of anti-poaching efforts. We discuss the theory of change for implementing the SMART approach and illustrate its utility using examples from conservation areas around Asia, where law enforcement monitoring has helped to improve management effectiveness, adjust strategies and enhance conservation success.

Border guard cooperation for wildlife conservation in Mongolia

Odonchimeg Myamtseren, Kirk Olson, Antony Lynam

Mongolia's border protection agency patrols the world's 11th longest border, spanning just over 8,200 km's long. With a buffer zone of 30km's, the total area under their jurisdiction is ~247,000 km^2 (16% of the country) and includes 23 protected areas. A number of species of high conservation value occur within this zone including Bactrian camel (*Camelus ferus*), Snow leopard (*Panthera uncia*), Gobi bear (*Ursus arctos gobiensis*), Mongolian saiga (*Saiga borealis*) khulan (*Equus hemionus*), Mongolian gazelle (*Gazelle Gutturoza*), Goitered gazelle (*Gazelle subgutturosa*), Ussurian moose (*Alces alces cameloides*), and White-naped crane (*Grus vipeo*).

Thus border guards are well positioned to protect and secure habitat important for wildlife. The Mongolian constitution includes articles that require protection of Mongolia's sovereign border's, environmental protection and efficient organization and effectiveness of agencies thus there is constitutional justification for cooperation between border guards and wildlife protection activities. For more than 10 years, WCS Mongolia has worked with the Mongolian Border Patrol to capitalize on this potential by providing technical training and provisioning law enforcement accessories necessary to conduct wildlife law enforcement focused patrols.

During this period, just over 200 border guards have participated in this training. Their jurisdiction represents 22 border posts within 5 border divisions and overlap with 4 Strictly Protected Areas (Mongol Daguur, Numrug, Dornod Mongol, and Small Gobi). The results of this partnership are beginning to pay off; an official cooperation agreement between the Protected Areas and Border Division has been signed. This allows protected Areas Rangers are working in closer collaboration with Border Patrol Agents such as carrying out joint monitoring exercises, collecting monitoring data using the SMART reporting system. Many border guards whom completed the training have also risen through the ranks and continue to support such efforts through their leadership.

Law Enforcement Monitoring for Protected Area Management Using the SMART approach: case study from the Small Gobi SPA, Mongolia.

Ochirkhuyag Lkhamjav, Odonchimeg Nyamtseren, Bolortsetseg Sanjaa, Antony Lynam

The Spatial Monitoring and Reporting Tool (SMART) is specifically designed software for use with law enforcement monitoring and management to reduce poaching and other illegal activities in conservation areas. SMART offers a suite of best practices designed to efficiently collect, analyze, and report on anti-poaching efforts, which allows a park manager to identify hotspots where attention is needed, empower staff, and provide useful feedback to ranger teams and national park management. In Mongolia, SMART is being piloted in the Small Gobi SPA as a tool for measuring, evaluating and improving the effectiveness of wildlife law enforcement patrols and site-based conservation activities. Data collected on ranger patrols and entered into the SMART software with results discussed during monthly meetings. From September through December 2016 rangers completed 103 patrols for 185 days and travelled over 24,000 km. angers covered approximately 90% of their responsible areas during the four months' period. Results of patrols included recording carcasses of Khulan and Goitered gazelles at 71 locations. Out of 7 fresh and 6 recent carcasses recorded, one was in conservation zone, one was in limited use zone and two were in buffer zone of the Small Gobi SPA. Causes of death of two carcasses were identified as poaching and collision with vehicle while mortality cause of the remaining carcasses was identified as either natural deaths or unknown. The information provides guidance for where to allocate protection efforts for large migratory animals in and around the protected area.

Saiga Horn Medicine in Singapore: Understanding Consumer Behavioural Drivers

Hunter Doughty, Regina Tan, Diogo Verissimo, Janice Lee, Roman Carrasco, EJ Milner-Gulland

The use of wildlife for medicines is widespread, but consumer motivations and prevalence of use are poorly understood. Illustrating this fact, consumption of the Critically Endangered saiga antelope horn (*Saiga tatarica*) as a traditional Chinese Medicine (TCM) in Singapore is prevalent throughout the island nation, but there is little empirical evidence showcasing the extent of usage and reason for use. We conducted over 2250 face-to-face consumer surveys with Chinese Singaporeans to determine user preferences and demographics. 19% of respondents stated saiga is a product they use "most often" to treat fever and/or heatiness (heatiness is a TCM sick state with symptoms such as cough, sore throat, and congestion). Respondents aged 36-59, Buddhist, and holding solely a primary education, were significantly more likely to use saiga ($p<0.05$). However, analysis shows that there are important variations in sub-user groups depending on ailment, whether they are purchasing for others, and product type. For example, males preferred horn in the form of 'cooling water' (a pre-made, often chilled, drink) ($p<0.01$), while females preferred horn shavings (a more traditional format that must be prepared at home) ($p<0.01$). There were clear significances in motivation for use. "It works" followed by "someone recommended it to me" were cited more as reasons for use than all subsequent reasons ($p<0.01$). Focus groups were then held with various subgroups of the population to give further cultural and psychological insight into the motivations behind this usage. Lastly, interviews with key members of the TCM and Chinese Singaporean community contextualised saiga use in the greater setting of traditional medicine in Singapore. These findings in summary help to elucidate drivers behind a wildlife trade that has drastically impacted this central Asian ungulate, and highlight the importance for target-audience tailored conservation efforts.

Understanding human hunting behaviour in Cambodia

Harriet Ibbett, EJ Milner-Gulland, Andy Dobson, Henry Travers, Aidan Keane

Wire snare hunting occurs throughout the Tropics, particularly in Asia, a continent considered amidst a "snaring crisis" (Gray et al., 2017). Unlike other forms of hunting, snares are cheap, accessible and easy to set, making them an attractive hunting option. Reducing snare hunting is of paramount importance to Protected Area managers and law enforcers, for snares catch wildlife indiscriminately, and unlike other hunting methods they persist in the landscape long after the hunter has left.

In order to reduce snare hunting, it is first essential to understand the demographics of hunters, and their hunting behaviour (Gore, 2011). We present a case study from Keo Seima Wildlife Sanctuary, a tropical forest in eastern Cambodia. We used both direct questioning, and the Unmatched Count Technique (Nuno & St John, 2015); a form of indirect questioning, to ascertain the prevalence of collecting wildlife for consumption, wire snare use and hunting for income. We surveyed +500 households in 18 villages across the survey site and collated information on local peoples' wildlife use, knowledge of wildlife, and perceptions of law enforcement effectiveness.

Results suggest communities' both prefer and regularly consume wild meat; however, use of wire snares to catch wildlife was lower than expected; with most wildlife caught opportunistically by dogs. We provide a survey framework for understanding hunting behaviour and perceptions of law enforcement in Asia, and provide the first estimate of snare hunting prevalence within a Cambodian Protected Area.

Illegal Wildlife Trade in Big Cats

Belinda Wright, Koustubh Sharma, Jayeeta Kar, Debbie Banks

All the species of Asian Big Cats face a precarious future. While the snow leopard, clouded leopard and leopard are classified as vulnerable, the tiger and the Asiatic lion are classified as endangered.

Asian Big Cats have been listed on Appendix I of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES) since as early as 1975, and are given a high degree of domestic legal protection in most parts of their range. Their numbers continue to dwindle however, and poaching and illegal trade continue to be one of the biggest causes of their decline. Poaching of these species occurs mainly due to demand for their skins, bones, and other body parts for use in traditional medicine, tonics, and décor, and also as a result of man-animal conflict.

The demand for Asian big cat parts and products comes mainly from within Asia, particularly from China and other south-east Asian countries. The last 15 years has also seen the emergence of farming of tigers with a view to commercially trading in their parts and derivatives, despite the condemnation of this practice by the international community through CITES. Recent trade data suggests that the demand for big cat parts, particularly bones, has now begun to threaten non-Asian big cats such as the lion and the jaguar.

The proposed symposium will begin by looking at the drivers of poaching in source sites for Asian big cats, the known methods and routes used to poach and smuggle them across borders to destination sites, the strengths and weaknesses of domestic laws protecting them, and the challenges faced in enforcing these laws. The latest information on new trends, practices and trade routes for Asian big cat poaching and trade will be presented.

The symposium will then outline what the world-wide trade in big cats currently looks like, the international measures that have been adopted to protect these species, and the hurdles that these have faced. International co-operation in enforcement of big cat crime will be outlined and debated.

Demand for big cat parts and products will be the next topic for the symposium. The role that captive breeding plays in relation to demand will be a particular focus.

The symposium will also look at new methods of analysing data which could help with enforcement initiatives, and new technologies such as stripe pattern recognition, and DNA profiling which could help to better understand and combat the illegal trade.

Throughout the symposium, the speakers will use poaching and trade data gathered by government and non-governmental organisations, gathered through firsthand experience and investigations, to illustrate and illuminate their talks.

Ecosystem Financing & Resource Mobilization for Conservation

Lira Joldubaeva, Bermet Tursunkulova, Aigul Abdrazakova, Kumar Mambetaliev, Almaz Musaev, Meruert Sarsembaeva, Temir Burzhubaev, Usha Rajak,

The goal of the symposium is to provide a forum to bring together representatives of the academic, policymaking, private sector and development communities to discuss new developments and exchange cutting-edge ideas on the field of financing and resource mobilization for biodiversity and ecosystems. The symposium will give an opportunity for participants to explore more innovative financial solutions for conservation applied in Asian countries.

Financial solutions for biodiversity

Temir Burzhubaev, Meruert Sarsembaeva

Kyrgyzstan and Kazakhstan are part of the Global project Biodiversity Finance Initiative (BIOFIN), which seeks to integrate biodiversity into relevant strategic processes at the national level to create transformational policies, more equitable, efficient and effective public spending on biodiversity, and financial mechanisms to increase investment in biodiversity management. BIOFIN supports national partners in determining the status and trends of biodiversity financing at the national level and addressing resource scarcity problems. BIOFIN addresses the lack of financing for biodiversity and develops a plan for mobilizing financial resources and to integrate biodiversity and ecosystem services into sectoral budget planning and national policies. Both in Kyrgyzstan and Kazakhstan the financial deficit is 60% and 55% from the total estimated budget of national biodiversity conservation plans.

Each country selects the feasible and appropriate financial solutions for the Biodiversity Finance Plan to generate revenues, re-align existing or avoid future expenditures and deliver better. Kazakhstan includes the biodiversity and carbon offsets mechanism, supporting the positive subsidies for game farming, payment for ecosystem services in protected areas into the national biodiversity finance plan. Kyrgyzstan proposes the reforming harmful subsidies in agriculture, improve the efficiency of result-oriented budgeting in forestry and protected areas, establishment of conservation trust fund, integration of biodiversity and ecosystem services consideration into the EIA, solutions for financial sustainability for the protected areas – entrance fee, charity boxes, capacity building for the PAs employees.

Mobilization strategy for snow leopard conservation

Bermet Tursunkulova

The strategy for resources mobilization for the International Forum on Snow Leopard Conservation included steps to establish partnerships between the governmental, non-governmental and private sectors. An important part of the strategy was a campaign to raise awareness of the importance of conserving the snow leopard and the benefits of investing in environmental protection and ecosystems. Multi-stakeholder meetings were organized with representatives of major companies that sponsored the event. The concept of the Forum included a Green Investment Forum for investment promotion and resource mobilization for environmental projects, where the large business sector of the snow leopard range countries presented targeted national project portfolios to attract business attention.

Philanthropy for conservation

Usha Rajak

An understanding of the global approach to philanthropy has been taken to compare and find solutions to the adhering philanthropic obstacles in Kyrgyzstan. To understand the underlying problems to environmental philanthropy in Kyrgyzstan, the solutions to philanthropy had to be studied. It was found out by conducting interviews with the stakeholders of the private sector that although there is a basic foundation of philanthropy within the family, the Kyrgyz are quite restricted to the idea of philanthropy outside the family. Most of the societal responsibility is shifted on to the government. Also, because of the religious factors, the philanthropic activities aren't publicized for others to follow, and there is a need to encourage openness about it.

Due to the lack of fiscal benefits from philanthropic contributions, the companies opt to give to the society through Corporate Social Responsibility, despite the law not stating such compulsory act. The state of visible philanthropic sector is in need of transparency, openness and in need of governmental support.

With the philanthropic avenues still untapped, Kyrgyzstan has a great potential for philanthropic platforms. Hinderances such as mistrust, corruption and underdeveloped philanthropic state can be overcome by a transparent, open and effective approach. Creating linkages with the official development structure, private sectors, international and local nonprofits and the public is the key to success.

Exploring Collaborative Solutions for the Recovery of Globally Endangered Fruit Tree Species in Asia

Linking science with practice and sharing experiences for threatened tree conservation

David Gill

Asia's 17,050 known tree species are one of the region's most important natural resources. The region's trees, including everything from dipterocarps to durians, provide a huge variety of timbers, medicines and foods for millions of people and enrich daily lives by shaping many landscapes and cultures. However, extensive habitat loss and degradation, unsustainable harvesting and climate change threaten at least 3,000 different Asian species with extinction. For many species, the long-term future of their wild populations now requires urgent and targeted conservation action. However, such action is often limited in scope and the effectiveness of conservation interventions in situ is often constrained by limited understanding on how best to address species-specific threats or overcome major barriers to natural regeneration. Furthermore, many of the people responsible for managing the sites where threatened tree species occur have never had the opportunity to develop the technical skills required for tree conservation. The Global Trees Campaign, a partnership between Fauna & Flora International and Botanic Gardens Conservation International was established in 1999 to prevent tree species extinctions in the wild and ensure their benefits for people, wildlife and the wider environment. This presentation introduces the Global Trees Campaign, and describes lessons learned from field projects delivered in the Asia region. Specifically, the presentation explores major technical barriers faced by tree conservation practitioners and managers working on the ground and describes how effective collaboration with scientists is helping to overcome these challenges.

Unravelling the evolutionary history of apple tree domestication and its consequences on wild apple trees

Amandine Cornille

Despite its economic, cultural and historical importance, the evolutionary histories of the domesticated apple (*Malus domestica*) and of its wild relatives are poorly documented. I will present the results of our project which has started seven years ago aiming at unravelling, at different evolutionary scales (phylogeography, speciation, domestication), the natural and artificial diversification processes at play in the genus *Malus* using population genetic approaches. Our research focused on the four wild apple species distributed across Eurasia: *Malus orientalis* (Caucasus), *Malus sieversii* (Central Asia), *Malus sylvestris* (Europe), and *Malus baccata* (Siberia); and on the single domesticated species in the genus, Malus domestica. Our results revealed substantial interspecific hybridizations, particularly high level of crop-to-wild gene flow in Europe. This study revealed a complex history of apple domestication involving multiple wild species, and extended our knowledge on apple domestication history, on population structures of wild relatives that contributed to the cultivated apple genome, and more generally on processes of divergence in fruit trees. This work is crucial for the apple conservation and breeding programs.

Conservation of intra-specific tree diversity in the *Rosaceae* family in Uzbekistan

Muhabbat Turdieva, Karim Baymetov

More than 50 species of fruit trees grow in mountainous and foothill areas of Uzbekistan. Fruit tree species as apple, pear, quince, apricot, plum, peach, almond and cherry of *Rosaceae* family widely cultivated in Uzbekistan. both cultivated and harvested in wild they are a source of nutients and income for local people.

Studies carried out by Bioversity International in collaboration with national partners demonstrated that there is still rich diversity of local fruit tree varieties and genotypes in Uzbekistan. Moreover, the process of crops evolution and development of new varieties is still ongoing in farming systems to cope with abiotic and biotic stresses of environment and to meet market demands. 296 varieties

and genotypes of fruit tree species of Rosacea family were identified in commercial and home orchards in Uzbekistan, including 103 apple, 36 pear, 132 apricot and 25 almond varieties. These varieties distinguish in maturity time, shape, size, colour of fruits, pulp texture and taste of fruits.

It should be noted that this rich local diversity of fruit tree varieties is mainly maintained by smallholder famers in their home orchards and very often is represented by one or two trees.

As conservation efforts 22 demonstration plots and 16 fruit tree nurseries were established in smallholder farms to broaden knowledge of farmers on diversity of local varieties of fruit trees and their economically valuable characteristics as well to increase access of farmers to planting material of these varieties. National "Roster of local varieties of fruit trees maintained in situ/on-farm in Uzbekistan" (2011) was developed to document local varieties of fruit trees and raise recognition of farmers as custodians of this diversity.

These efforts also helped to establish communication among farmers and collaboration between farmers and scientists to join their efforts in conservation of local diversity of fruit tree varieties.

Wild pear diversity in Armenia, endemic species and challenges facing their conservation

Anna Asatryan

Armenia is remarkable for its rich flora and habitat diversity. Wild fruit trees, especially pears (*Pyrus sp*.) and their communities are of particular interest and conservation importance. 12 of total 32 pear species found in the country are endemics of Armenia and 6 – endemics of the Southern Transcaucasia. 18 pear species have been described from Armenia. Most of the species are found in the south of the republic; especially rich is Vayots Dzor province, where 25 species occur. 7 of 12 Armenian endemics are listed in the Red Data book of Armenia, 11 - included in the IUCN Red List. One of them, a narrow endemic *Pyrus gergerana* was chosen as a target species for our project, which we started in 2016 with financial upport from Fauna and Flora International in the framework of Global Trees Campaign. To estimate the species' population size, we made field trips towards the distribution areas of *P. gergerana*. Also, data on several other threatened endemics, known from almost the same area was gathered. Our work continued in 2017 with project, the main goals of which were identification of the pear diversity on the territory of Herher state sanctuary and search for *P. gergerana* and/or other endemic and threatened tree species, which might become a focus in further conservation activities on site. Local inhabitants have been involved in the following activities: education/awareness raising meetings and collection of wild pear seeds for conservation purposes. Despite certain challenges on the way to research and conservation of endemic pears of Armenia as, for example, poor data on the species or lack of it, hybridization and hard taxonomy, gap in local knowledge on this topic etc. the data revealed during the work, may allow to develop more ambitious project on in situ conservation of rare endemic pear species in Armenia.

Interventions for threatened apple *Malus niedzwetzkyana* in Kyrgyzstan and technical challenges to progress

Jarkyn Samanchina

Kyrgyzstan is home to three threatened wild apple species, the Kyrgyz apple *Malus kirghisorum*, Almaty Apple *M. sieversii*, and Niedzwetzky's Apple *M. niedzwetzkyana*. All three species of apples are listed in the Red Data Book of the Kyrgyz Republic. Two of the species have been assessed for global threat statuses in the IUCN Red List, Niedzwetzky's apple is listed as Endangered and the Almaty apple is Vulnerable. The majority of the trees are located on the slopes of Ferghana, Chatkal, Talas mountain ridges and in the walnut-fruit forests of southern Kyrgyzstan.

In 2007 Fauna and Flora International (FFI) carried out the first evaluation of dispersal and diversity of Niedzwetzky's apple trees in walnut-fruit forest of Kyrgyzstan, in collaboration with the National

Academy of Sciences. It has now been over 10 years that FFI has been supporting and implementing the Niedzwetzky's apple research and conservation activities in several forestry units and protected areas across the walnut-fruit forest. The main activities target capacity building of rangers, community awareness, direct protection measures such as: fencing, growing seedlings in nurseries and planting them back in the natural habitat; as well as collaborating with the National Botanical Garden and helping them to establish an in-situ collection. Most the work has been done in consultation and with financial support of the Global Trees Campaign. Alongside the many achievements, FFI has also encountered technical challenges in the Niedzwetzky's apple conservation work, which it has been addressing through collaboration with local scientists and experts. The purpose of this presentation is to share some of the results and lessons learned, as well as raising some of the technical challenges in the Niedzwetzky's apple conservation process; bringing them to the attention of relevant specialists in order to make the program more effective for the future.

Integrating threatened fruit tree conservation into wider ecosystem and livelihoods approaches to fruit and nut forest conservation

Ubayd Gulamadshoev, Vicky Wilkins

Childukhtaron (14,600ha) and Dashtijum (50,100ha; 13,400ha forest) reserves are identified in Tajikistan's National Biodiversity Strategy Action Plan (NBSAP) as two of the country's three most valuable walnut-maple forest sites, including species of pear *Pyrus tadshikistanica* (CR, endemic), *Pyrus korshinskyi* (CR), almond *Amygdalus bucharica* (VU) and apple *Malus sieversii* (VU). These globally significant forests provide genetic reservoirs as climate-related impacts threaten domesticated varieties. The World Bank identified Tajikistan as the country most vulnerable to climate change in Europe and Central Asia, with very low adaptive capacity.

These forests are essential to the livelihoods of 700 households, their mean income is below $1.25/person/day (SDG extreme poverty level) and Non-Timber Forest Products (NTFPs) such as dried fruit are vital for income.

Only 3% of Tajikistan is now forested, and fruit-and-nut forests are under pressure from firewood collection, hay-making, livestock grazing and over-harvesting. Forest is extremely degraded, with declining diversity and little natural regeneration. The forest is state-owned but the forest service lacks the capacity to manage it adequately.

The "Darwin Initiative" UK government funded project 'Enhancing forest biodiversity and community resilience to Tajikistan's changing climate' started in 2017 running until 2021. The project will increase knowledge and understanding of forest habitats, including agro-biodiversity and threatened species, as well as the likely impacts of climate change. Forest users will be empowered and incentivised to work collaboratively with forest service to enhance forest management. Additionally, local market actors will be supported to implement activities identified through market development workshops to improve income from NTFPs, and this increased value will be directly linked to improved forest health.

The project will integrate threatened tree species conservation, aiming to increase the value of threatened species to local stakeholders. Activities will include: surveys, GIS mapping, remote sensing, establishment of monitoring plots, establishment of nurseries, seeds collection and planting.

Mainstreaming Conservation in China's Belt & Road Initiative

The "Belt and Road Initiative" and biodiversity: impacts and opportunities

Alex Lechner, Faith Chan, Ahimsa Campos-Arceiz

China's Belt and road initiative (BRI) (also known as "One Belt One Road") is projected to be the largest infrastructure development initiative in the 21st century. At an estimated cost of over four trillion US dollars it will connect roughly half of the world's population. Impacts on the environment from infrastructure being built for BRI will primarily arise from the proposed network of terrestrial and marine transport networks, but also include a range of other types of development including dams and power stations.

BRI will cross several the world's terrestrial and marine biodiversity hotspots with the potential for significant impacts on global biodiversity. Roads, for example, open a Pandora's box of ecological impacts such as habitat loss, fragmentation, invasive species, and illegal activities such as poaching and logging. In the marine environment, increased sea traffic exacerbates the movement of invasive species and pollution, which is especially concerning as BRI's maritime routes cross the coral reef triangle, often described as the Amazon of the seas.

In this presentation we describe the range of potential biodiversity impacts and present spatial analysis describing the areal extent of impacts and conservation values. Next, we discuss the variety of ways in which BRI's negative impacts may be mitigated, which include adopting best practice environmental planning and engaging in transboundary conservation. While the BRI has the potential for immense impacts on biodiversity, it also could be a positive force, and for example, plan and implement a network of protected areas across Eurasia. Planning for biodiversity needs to be led by Chinese authorities (with involvement from other governments and stakeholders) to ensure that biodiversity is at the core of BRI's values rather than an afterthought.

Conservation in China's Belt & Road Initiative (BRI) 'outworkings' in Central Asia

Troy Sternberg

China's New Silk Road promises to transform a continent through connectivity and development. The programme, featuring railways, pipelines, energy, agriculture and roads, presents grand aspirations. In the rush to build infrastructure and economic pathways BRI landscapes – mountains, steppe and deserts, are overlooked. Yet a great challenge will be engaging with extreme environments and fragile ecosystems whilst preserving biodiversity and maintaining watersheds. This conference focuses on putting conservation at the centre of the BRI discussion as livelihoods, communities and countries are dependent on nature. Taking a social-ecological approach, BRI conservation concerns in Central Asia are evaluated, potential impacts assessed and mitigation processes discussed. Open dialogue, adherence to local practices and laws, established environmental standards and engagement with host communities and nations will be key for conservation to be part of BRI's grand agenda.

Building Environmental Network in Southern Silk Road: The Role of Qomolangma Glacier Environment Protection Foundation (QGF) in Tibet Plateau

Tashi Gongbo

Tibetan Plateau has been targeted for conservation due to its significance in water systems within and downstream of the region. However, despite recent efforts towards conservation, economic development has entailed dramatic changes to the plateau. Road construction, urbanization and population growth among other factors have contributed to environmental degradation through habitat loss, alien & invasive species, and increased human disturbances. These processes have also had social implications including an increase in human wildlife conflict and loss of ecosystem services.

Whilst people may be aware of the issues facing the environment and the threats to the ecosystems that provide many goods and services to these rural populations, local communities are poorly placed under the current socio-economic scenario to act as environmental conservationists. Therefore, empowering communities in conservation through training and enhanced communication between local people and state agencies for the environment can have significant benefits for achieving conservation in the Tibetan plateau.

QGF has been working to increase local capacity for conservation through a variety of means-training workshops, using innovative monitoring tools such as the Lapis Guides smartphone app, have been carried out in the region, aiming to enhance environmental monitoring amongst local communities. The foundation also seeks to build capacities of local educational institutes and state departments by organizing study tours for academics and governmental representatives from the region to learn about protected area governance and management in others. Furthermore, through creating networks between different sectors of society including academia, enterprise, state agencies and local people, the foundation has promoted the importance of local participation and community empowerment in conservation. Overall, the activities of QGF seek to enhance the level of environmental awareness and local engagement in conservation, in order to safeguard the future of nature and its services to greater society, including the "Southern Silk Road".

Belt & Road cat conservation: Evolution and conservation of small wild felids in the Central Asia with special references to possible cryptic extinction through hybridisation with domestic cats

Nobuyuki Yamaguchi

The wildcat (*felis silvestris*) group is one of the most successful small felids. There are two less-known branches of the wildcat phylogenetic tree in the Central Asia, which are the Asian wildcat (*F. s. ornata*) and Chinese mountain cat (*F. bieti*). The morphology of Asian wildcats from Central Asia is clearly different from that of either wildcats of Europe or those of southern Africa. Central Asian wildcats are part of the steppe cat lineage, in comparison to the forest wildcat lineage (i.e. European wildcats), based on both morphological and molecular characteristics, whilst the position of the Chinese mountain cat remains unclear due to the lack of information. We suggest that the evolution of the modern wildcat lineage probably consisted of at least three different distribution expansions punctuated by two differentiation events: the exodus from Europe during the late Pleistocene, coinciding with the emergence of the steppe wildcat lineage (phenotype of Asian - African wildcat), followed by its rapid range expansion in Africa and Central Asia. The second differentiation event was the emergence of the domestic cat followed by its subsequent colonisation of the entire world with human assistance. Introgressive hybridisations between Asian wildcats, Chinese mountain cats, and introduced domestic cats appear to have been occurring across the Central Asia, and our results suggest that the characteristics of local wild-living cat populations have been altered both morphologically and genetically. Considering the recent evolutionary history of, and morphological and genetic divergences in, the wildcat lineage, preventing hybridisation between Asian wildcats, Chines mountain cats, and domestic cats is a high conservation priority across the Central Asia to prevent the possible cryptic extinction of the wildcats along the Silk Road. For collecting necessary information and planning appropriate conservation, collaboration is essential across the countries along the Silk Road from China to Turkey.

IBAs/KBAs: Implementation of the BirdLife's Global Species-Oriented Programme in Central Asia

Perspectives of Important Bird Areas / Key Biodiversity Areas of Central Asia in the Context of the Central Asian Flyway

Sathiyaselvam P, Deepak Apte

Bird migration, one of the most fascinating aspects of the avian world has captured the imagination of humankind for centuries. The Central Asian Flyway (the Flyway) spans the breadth of Central Russia, the countries of Central Asia, Mongolia and Western China as well as the countries of the Indian subcontinent. There are 279 migratory waterbird populations of the 182 species, including 29 globally threatened and near threatened species that breed, migrate, and spend the non-breeding within the region.

Designing and implementation of management strategies in the Flyway has been a challenge as this flyway extends along regions that include highly populated and rapidly developing nations, there are numerous practical difficulties that need to be addressed for the successful implementation of the Central Asian Flyway Action Plan across all range countries.

Birds along flyways depend upon a multitude of factors; viable feeding roosting and roosting areas are most important. Many waterbird populations are declining rapidly as the wetlands, grasslands and other habitats upon which they depend are seriously threatened along the Flyway by uncontrolled hunting, habitat degradation, unsustainable water management, poor law enforcement and limited conservation capacity. Since migratory birds travel across international borders, it is vital that all the countries lying within their flyway path should come to a common understanding to cooperate on protecting the key sites for birds.

Therefore, the Important Bird Areas (IBAs) / Key Biodiversity Areas (KBAs) Programme being implemented in Central Asian countries will play a key role, and a network of 258 IBAs have been identified to date, being crucial for birds migration of a total surface area of over 22 million of hectares has been established there. Cooperation and coordinated action Phased involvement and participation of the BirdLife Partners along Central Asian Flyway could further link up other key stakeholder in this flyway.

IBA Programme as a Framework for and the Approach to Key Biodiversity Areas (KBAs) in Uzbekistan

Roman Kashkarov, Yuliya Mitropolskaya, Anna Ten, Oleg Kashkarov

Important Bird and Biodiversity Areas (IBAs) Programme in Uzbekistan was initiated in 2004 and had been supported over the previous 13 years by the Royal Society for the Protection of Birds (RSPB). By 2016, the IBA network in Uzbekistan comprised 52 internationally recognized sites covering all types of ecosystems. This was the first scientifically based and objective assessment of sites of global importance for birds and other biodiversity in Uzbekistan.

In 2016, on the initiative of the Critical Ecosystem Partnership Fund (CEPF) and Zoi Environmental Network the identification and profiling of mountain Key Biodiversity Areas in Central Asia started. The accumulated experience and up-to-date national data on IBAs made UzSPB the key partner of Zoi in KBAs identification and profiling and the leader of this work in Uzbekistan.

There are 23 IBA sites on Uzbek part of the CEPF area. National experts from the Institute of Zoology and the UzSPB identified 13 IBAs (over 50%) as KBAs. The CEPF then identified 5 out of 13 sites as priority KBAs. KBAs «UZB04 Akbulak River Basin» and «UZB05 Bashkyzylsay River Basin» are of key importance for conservation of globally threatened Menzbier's marmot *Marmota menzbieri* and Snow Leopard *Panthera uncia*. On KBA «UZB24 Nuratau Ridge» over 90% of the world population of Severtsov's (Kyzylkum) Argali *Ovis ammon severtzovi* occur.

The Uzbek-Turkmen transboundary KBA «UZB30 Talimarjan Reservoir» is the unique site supporting more than 8,000 individuals - over 30% of the world population of Sociable lapwing *Vanellus gregarius*

on autumn migration. This shows the high efficiency of the application of IBA criteria for assessing the global importance of natural areas and their relevance to the methodology of the KBA programme.

The identification of the Key Zoological Areas was defined as one of the main work directions of the Institute of Zoology during the reform.

Возможности развития и практического внедрения концепций IBA и KBA в Казахстане

Sergey Sklyarenko, Albert Salemgareev, Alyona Koshkina, Tatyana Shmygaleva

По состоянию на конец 2017 г. в Казахстане имелось 127 ключевых орнитологических территорий (IBA) международного значения, включающих все основные типы ландшафтов и экосистем страны и в той или иной мере места обитания всех глобально угрожаемых и охотничьих видов птиц. Понятие «ключевая орнитологическая территория» в 2012 г. включено в Закон РК «Об особо охраняемых природных территориях» как один из видов объектов государственного природно-заповедного фонда, а в 2017 г. оно получило в том же законе расшифровку и прямое указание на необходимость сохранения этих участков. Концепция KBA (Key Biodiversity Area, или территории, важные для биоразнообразия) в стране до настоящего времени не прорабатывалась; ее пилотное применение сделано в 2016 г. при подготовке профайла для программы CEPF по горным регионам Центральной Азии. В качестве потенциальных KBA описано 27 горных территорий, 14 из которых являются IBA (это все IBA, попавшие в регион работ). Пилотные описания выявили ряд сложностей в применении критериев KBA, включая несовершенство самих критериев и недостаток информации по численности видов для их использования. Возможность внедрения концепции KBA в Казахстане требует дальнейшей проработки, включая анализ применимости понятия к широко мигрирующим видам (например, к сайгаку), к редким видам птиц, меняющим места гнездования в зависимости от циклов заполнения озер (савка и др.), а также рассмотрение практической целесообразности включения дополнительного понятия – KBA – в нормативную базу республики. Исходя из того, что включение в законы довольно ясного понятия IBA потребовало 12-летних усилий и оно еще не начало использоваться в полной мере, можно сказать, что попытки немедленного использования концепции KBA при работе с государственными органами Казахстана будут явно преждевременными; хотя сама идея выделения участков, важных для самых различных таксонов, достаточно перспективна. Вместе с тем, необходима интенсификация налаживания реального сохранения IBA, не входящих в сеть ООПТ.

Conseration Science, Informing Designation and Management of the Koytendag and Tallymerjen as Important Bird Areas / Key Biodiversity Areas in Turkmenistan

Shirin Karryeva, Eldar Rustamov, Atmyrat Veyisov, Shaniyaz Menliev, Geoff Welch, Petar Iankov

Turkmenistan enjoys the long history of spatial nature protection. The first state nature protected area (Repetek Reserve) was established there in 1927. The national network of the Important Bird Areas (IBAs) was designated in Turkmenistan as a result of the international programme in Central Asia in early 2000s. Subsequent research based on telemetry allowed for revealing the additional sites, being important for supporting migration along the Central Asian Flyway.

Under the Turkmenistan Government's order, the international team of experts concentrated on exploration of Koytendag State Nature Reserve and adjacent areas being designated as IBA as well as the core of the potential UNESCO World Heritage Site which inter alia resulted in identification of the endemic species being potentially new to science.

At the same time, the adjacent Tallymerjen proved to be the internationally important site for the globally threatened Sociable Lapwings (Vanellus gregarious) with up to 8,000 birds being recorded. This number seems to represent the entire eastern flyway population of the species and about one-third of its global population. The site currently has no official protection status though it was identified as IBA in 2009 (even before its importance for Sociable Lapwings was known).

While the national programme of Key Biodiversity Areas (KBAs) has not yet been set, both Koytendag and Tallymerjen have been identified as priority KBAs by the Critical Ecosystems Partnership Fund (CEPF) in 2017. The recent and ongoing work prioritises research and development of the management planning recommendations. The presentation shows the biodiversity and management aspects of the internationally important Koytendag/Tallymerjen.

Ключевые орнитологические территории (IBA) в Кыргызстане.

Sergei Kulagin

Выделение ключевых орнитологических территорий в Кыргызстане проходило по принципу сохранения и защиты мест обитания птиц находящихся под угрозой глобального исчезновения. Эта работа проведена в 2006 году, при поддержке NABU Германии были выделены и описаны 11 КОТ, а в 2014 г. проведена их инвентаризация.

Цель проекта – выделить и стимулировать охрану сети ключевых территорий во всех регионах Кыргызстана. КОТ выделялись по 4 стандартным глобальным критериям.

По критерию (А1-глобально угрожаемые виды) выделены следующие КОТ: Таш-Рабат (хищные птицы), Чатыр-Куль (горный гусь), Западный Иссык-Куль (саджа), Восточный Алай (белогрудый голубь)

По критерию (А3-сообщества ограниченные биомом) выделены КОТ: Западный Алай, Токмакский заказник, Водные участки Чуйской долины.

По критерию (А4-миграционные скопления) выделены: Восточное и Западное Прииссыкулье (зимовки водоплавающих птиц и миграционные скопления журавлей), Тюлек (миграции журавлей), Сон-Куль, Чатыр-Куль (как места массовой линьки водоплавающих птиц). На этих водоемах число птиц на зимовке и миграциях варьирует от 50 до 100 тысяч.

Под охрану на КОТ попадает 49 видов птиц внесенных в Красную книгу Кыргызстана,

В результате проведенной инвентаризации были выявлены значительные изменения не только фауны, но и других экологических характеристик биотопов. Основными причинами изменения, явилось широко развитое отгонно-пастбищное животноводство. Поэтому в весенне-летний период нагрузка на удаленные, в том числе и высокогорные участки возрастает многократно, что создает серьезный фактор беспокойства для гнездящихся птиц.

Методами охраны КОТ прилегающих к территории ООПТ следует признать включение их в буферные зоны ООПТ, например Иссык-Кульский и Каратал-Жапырыкский заповедники. Озёра Иссык-Куль (1976), Сон-Куль (2009), Чатыр-Куль (2006) являются Рамсарскими угодьями, что также благоприятно сказывается на состоянии охраны КОТ.

Кроме птиц, большинство КОТ также важны для сохранения других животных и растений. Создание сети КОТ в Кыргызстане позволит сохранить и сберечь уникальные ландшафты и виды птиц находящиеся под угрозой исчезновения.

An Overview of Climate Change in Central Asia

An Overview of Climate Change in Central Asia

Michael Brody

The 2013/2014 Fifth Assessment Report of the Intergovernmental Panel on Climate Change showed significant changes to the climate and water resources of Central Asia. And three of four representative carbon pathway scenarios from this report forecast significant ongoing change. Among the most significant concerns to the natural ecosystems and agricultural systems of this region include the overall decline in mountain glacial extent and significant summer warming in areas that are already extremely hot and dry. The separate country-specific national communications to the UN Framework on Climate Change typically show even greater detail to these phenomena. This specific presentation will be an overview of the most critical analyses from these reports and would serve as a starting point for panels/symposiums specifically focused on climate change in this region.

Vegetation and climate interaction patterns in Kyrgyzstan: spatial discretization based on time series analysis

Maksim Kulikov, Udo Schickhoff

Spatio-temporal variations of climate-vegetation interactions in Central Asia have been given a lot of attention recently. In order to avoid the limitations and improve the analysis we used spatially explicit time series of NDVI, temperature and precipitation which were decomposed to seasonal and trend components. Trend and seasonal components of NDVI, precipitation and temperature were assessed pixelwise for temporal correlations with different lags to understand the patterns of their interaction in Kyrgyzstan and adjoining regions. Based on these results a coefficient of determination was calculated to understand the extent to which NDVI is conditioned by precipitation and temperature variations. The images with the lags of time series correlation extrema for each pixel and coefficients of NDVI determination by temperature and precipitation were subjected to cluster analysis to identify interaction patterns over the study area. The research resulted in 5 spatial clusters with different patterns of NDVI interaction with temperature and precipitation on intra- and interannual scales. The highest correlation scores between NDVI and temperature at the seasonal scale were found at 0 – 4 month lag and between NDVI and precipitation at 1 – 5 months lag. At high elevations of 3000-4000 m above sea level, both precipitation and temperature occurred to be facilitating factors for vegetation development, whereas temperature was rather a limiting factor at lower elevations of 200 – 1300 m a.s.l. We developed maps of the NDVI coefficient of determination by both temperature and precipitation. Only deserts and glaciers had low coefficients of determination (adjusted R2) on the seasonal scale (0.1 – 0.3), whereas areas with vegetation were greatly conditioned by temperature and precipitation (0.7 – 0.95). On the trend scale, dense vegetation and bare areas had low coefficient of determination (0.1 – 0.3), whereas areas with average vegetation cover were greatly controlled by the climatic factors (0.7 – 0.9).

Assessing the impact of climate change on plant-herbivore interaction in central Asian mountain through lessons from western Himalaya

Sabuj Bhattacharyya, Deborah Dawson, Helen Hipperson, Farah Ishtiaq

Plant-herbivore interactions provide critical insights into the mechanisms that govern the spatiotemporal distributions of organisms. These interactions are crucial to understand the impacts of climate change, which are likely to have an effect on the population dynamics of alpine herbivores. Alpine herbivores that live in isolated mountain habitats, such as the pikas (*Ochotonidae*), a relative of rabbits and hares, are thought to be particularly vulnerable to climate change because many of the plant species upon which they feed are climate sensitive. In spite of their wide distribution (e.g. central Asian mountains, Himalaya) and important

ecological role as prey species, detailed information about their interactions with native plants is scarce. Similar to central Asian mountains, high altitude Himalaya also has high seasonality and a short growing period for plants. Therefore, we examined topographical features, plant species presence, and seasonal dynamics as drivers of the species richness of the Roylei pika's diet across an elevation gradient (2600m – 4450m) in western Himalaya. We identified 79 plant genera in the faecal pellets of pika using DNA metabarcoding, of which 89% were forbs species, >60% were endemic to the Himalaya and 97.5% of the diet species identified followed the C_3 photosynthetic pathway. GLM model results demonstrate that a large area of talus supports greater plant diversity and, not surprisingly, results in higher species richness in the pika's diet. The continued increase in global temperature is expected to have a significant effect on the distribution dynamics of C_3 plants, as they prefer moist, cold environment and consequently influence pika diet and distribution, resulting in a significant negative cascading effect on the Himalayan ecosystem. Furthermore, the talks will also shed light on possible implication of our findings to assess the vulnerability of endemic pika species and their interaction with native plants in central Asian mountains to climate change.

Herders' perceptions of climatic change in South Gobi, Mongolia

Nadia Mijiddorj

Supervisors: Boldgiv Bazartseren, Charudutt Mishra

Increasing intensity of precipitations accompanied with less frequency pattern of rain altering semi-arid rangeland in Mongolia which is directly influenced to livestock local herders' livelihood. The study assesses how shifts in climate are affecting rangeland and herder livelihoods in the South Gobi, Mongolia. Specifically, I assess

1. herder perceptions of major changes over the last 20 years and the perceived impacts on rangeland and livelihoods
2. whether long-term climatic data confirm reported trends.

The key findings include:

- Traditional knowledge and long term climatic data suggest that the South Gobi rangelands have becoming less productive over the last 20 years.
- Future shifts in climatic factors is expected to negatively influence local livelihoods. By for example, milder winters is likely to reduce livestock wool and cashmere yield.
- Some gap appears between local knowledge and scientific data which may due to mismatching the term, scales and time duration they use as well as climatic variation human exposures sensitive and does not often capture by general statistic trend and mean values.

Through traditional knowledge it's essential to compare past climate variability and provide baseline climate history and empirical test of such overlaps become available and gap between scientific and local knowledge of climatic changes observation gradually become bridged.

Future climatic this research will benefit by comparison study and complementary engagement with this combination knowledge rather competing with global knowledge system.

Vulnerability and Adaptation to Climate Change of Mountain Societies in Central Asia

Marc Foggin, Steganos Xenarios, Sujata Manandhar, Dietrich Schmidt-vogt, Christian Hergarten

Mountain societies in developing and low income countries are particularly vulnerable to external pressures such as changes in global markets and value chains, economic unrest, and climate change with consequent impacts on fundamental environmental parameters. Local livelihoods

largely dependent on natural resources are threatened by such changes, albeit partially mediated by social and economic factors. The situation of mountain communities of the Pamir and Tien Shan mountains in Central Asia (CA) is further exacerbated by often extremely remote location and a generally dry climate.

Various climate change models based on the most likely greenhouse gas concentrations have projected future temperature and precipitation changes in CA. The countries of Kyrgyzstan and Tajikistan, where the largest parts of Pamirs and Tien Shan mountain are situated, have developed strategies and policies to reduce vulnerability and enhance adaptation initiatives at national level. Assessing the vulnerability of mountain societies and assisting them in developing their own adaptation strategies at local level is, however, a challenging endeavor that demands thorough understanding of both technical and socioeconomic parameters. Moreover, institutional and socioeconomic changes in CA over the last few decades may also determine their capacity to adapt to climate change and weather extremes.

The current study reviews the state of research on climate change, vulnerabilities, impacts, and adaptation measures, and attempts to identify knowledge gaps as well as opportunities for the improvement of overall adaptive capacity of mountain societies in Central Asia. The study also proposes new research and the development of initiatives in areas of climate monitoring and assessment, climate-related hazards, vulnerability and adaptive capacities, and governance, which could improve the livelihoods of mountain societies in Central Asia.

Beyond the 6% Solution: Envisioning a Future for Asia's Tigers

Sources Sites and Landscapes: Envisioning a future for tigers in a rapidly changing Asia

Dale Miquelle, Eric Sanderson

Both "source sites" and "tiger conservation landscapes" have been proposed as the vital building blocks of tiger conservation. Some have perceived a dichotomy in tiger conservation strategies: either you focus conservation actions on source sites or on tiger conservation landscapes. We argue that there is no major dichotomy in the approaches and in fact that source sites and landscapes represent important components of a single comprehensive approach to tiger conservation. The differences that appear as a dichotomy are in reality largely a question of money and timing: with limited funding, when should conservation efforts on these building blocks be initiated? We argue that planning the spatial and temporal patterns of conservation interventions for tigers requires an understanding of potential social, economic, and political futures; that is, for a comprehensive tiger conservation plan to be successful, it will require an understanding and incorporation of human socio-economic development scenarios in Asia - something that has been completely ignored in existing plans.

Tiger conservation in two UNESCO World Heritage Site protected areas

William Marthy

Gunung Leuser National Park (GLNP) and Bukit Barisan Selatan National Park (BBSNP) are two of the three of large protected areas that form the Tropical Rainforest Heritage of Sumatra, a UNESCO World Heritage Site cluster. The 870,161 ha GLNP, which is part of the 2.5 million ha Leuser Ecosystem, and 313,572 ha BBSNP contain approximately 40% of the entire Sumatran tiger population. However similar to other Sumatran protected areas they face multiple threats, especially from poaching and forest habitat loss that together jeopardize the tiger's population viability. Here, we report on camera trap surveys that were conducted in GLNP (from the years 2010, 2013 and 2018) and BBSNP (2003, 2006 and 2015). For GLNP, the tiger population was found to be marginally increasing from 0.44 to 0.46 and to 0.59 tigers/100 km^2, but this is still considered a low-medium density and should be higher for the forest type surveyed. In BBSNP, there was a much more significant change with tigers increasing from 1.6 to 2.8 tigers/100 km^2, which is indicative of a healthy tiger population in evergreen rainforest. Whilst the results are encouraging, there are several important points to note. Firstly, the BBSNP study area received a much higher intensity of ranger patrolling than the GLNP study area, which may partly explain the differences in tiger densities and the need to strengthen enforcement efforts in GLNP to enable greater population recovery. Secondly, both study areas received disproportionately high levels of protection than the surrounding areas of the national parks but, despite this, still had poaching and other forms of human disturbance. So, the threats in these adjacent areas may be higher and the tiger population trends may be in decline. Thus greater effort is needed to boost the law enforcement more widely so that tigers can begin to recovery across.

Tiger conservation in the Western Forest Complex of Thailand: Recovering a tiger landscape

Anak Pattanavibool

The management of protected areas in Thailand has seen up and down in saving endangered species, especially the tiger. The extinction of tigers in the first national park in Thailand in early 2000s has stirred the awareness of resource managers that saving forests do not mean saving tigers and many other endangered wildlife. Therefore, the government of Thailand under the support from the Wildlife Conservation Society (WCS) has tried to strengthen protection of the remaining large forest landscapes using the landscape species approach as the indicator of management success. The Western Forest Complex (WEFCOM), one of the largest remaining protected area systems in Southeast Asia and the last stronghold for the Indochinese tigers (*Panthera tigris corbetti*), is the site

where the approach has been demonstrated. The key intervention is to strengthen the park ranger patrol system using the globally-approved law enforcement database currently known as "SMART patrol system". The SMART patrol system provides managers with various indicators such as patrol effectiveness, threat patterns, distribution of target species. It helps change the management style from top-down to adaptive management based on up-to-date information. However, it needs a long-term rigorous population monitoring system to show the results on target wildlife species, especially tigers. Over a decade of strong protection under SMART patrol system, the tigers have responded by showing 50% population recovery in the core area of WEFCOM. They have also shown clear dispersal patterns to recover the adjacent areas once extirpated. Following the successful model, the Thai government has significantly expanded the SMART patrol system to cover almost all protected areas. By understanding that conservation is long-term, WCS has also helped train next generations of resource managers to keep on the conservation quality and tiger and wildlife recovery.

Recovering tigers: how site-based conservation works for tigers

Abishek Harihar, John Goodrich

The persistence and recovery of tiger populations has centered on availability of inviolate habitats that provide secure breeding refuges, adequate wild prey, connectivity to other populations to facilitate colonization and maintain demographic and genetic viability, effective protection from poaching, low conflict with people in addition to local community participation in conservation. Therefore, inability to facilitate or restore these prerequisites is expected to impede recovery of tigers from areas where populations have declined. By highlighting case studies from several sites across the tiger range, we assess the demographic characteristics of a recovering tiger population and evaluate site conditions, which facilitate recovery. Our results show almost an immediate response in terms of breeding and increase in density when disturbances are removed in a protected habitat with adequate prey. Additionally, we highlight the importance of estimating vital parameters in characterizing a recovering population.

Microcosmic Methods for Snow Leopard Conservation: Innovations and Challenges

Challenge of conservative physiology in snow leopards with collaboration of noninvasive methods

Kodzue Kinoshita, Dale Kikuchi, Suraiya Luecke, Kubanychbek Jumabay, Koustubh Sharma

Genetic studies and camera trapping have provided information on the ecology of many species. Although these techniques have provided monitoring approaches for overall populations and individuals' dietary changes, few studies have been conducted focusing on the internal changes of animals. Hormones, for example, can elucidate the invisible physiological state of animals and the effect of their surrounding environment. Stress response is one of the many physiological responses. Recently, stress has become the focus of several studies in conservation biology.

For over five years, we have monitored stress level (cortisol) and reproductive state (estrogen, progesterone, and testosterone) by fecal hormonal analysis in captive snow leopards. We compared fecal estrogen and cortisol concentrations between the two different types of housing: AY, with a male all year; and WS, with a male only in winter. Estrogen concentrations in AY (0.13 – 4.51 mg/g) were significantly lower than those in WS (0.20 – 15.63 mg/g) ($P<0.05$). In contrast to estrogen, cortisol concentrations in AY (0.25 – 7.62 mg/g) were significantly higher than those in WS (0.18 – 3.96 mg/g) ($P<0.05$). This study suggests that the environmental conditions of captive snow leopards (in this case, housing conditions) can effect their stress levels, and that stress levels can in turn suppress female estrus levels.

From these results we find that the measurement of fecal hormone concentration is a useful tool to estimate an animal's physiological state. We have improved both the hormone extraction and hormone measurement methods for wildlife. We hope to use these methods to monitor the physiological state of wild animals as a response to external environmental changes (e.g. impact of hunting, etc.). In this presentation, we will introduce studies on the endocrinology of the snow leopard in captivity and discuss the possibility of the application of hormonal analysis to wild animal populations.

What do the feces say: non-invasive genetic methods application in snow leopard conservation in Sanjiangyuan, China

Cheng Chen, Xueyang Li, Byron Weckworth, Peiyun Li, Qi Lu, Mingyu Liu, Zhi Lu

With the development of genetic techniques, more and more important information of wild animals can be discovered from their feces. To conserve snow leopard in Sanjiangyuan, we need knowledge of its population dynamics, biology and threats. An integrated research based on non-invasive sampling and both classic and new generation genetic techniques are being carried on. Since 2009 we have collected more than a total of 1800 feces from the field.

POPULATION DYNAMIC: Two long-term monitoring sites – a village and a township – have been built up in the biggest snow leopard habitat. On the sites, systematic sampling and individual identifications are done to calculate the current population size and planning for long-term genetic monitoring. Individual database is also built up for future deeper studies, like social behavior.

BIOLOGY: In a known snow leopard signing hotspot according to camera trap data and field surveys, our sampling covered all ridges to discover individual range borders and their signing system. Diet analyses based on metabarcoding is used to find out snow leopard's main prey species.

THREATS: The top threats to snow leopard in Sanjiangyuan are habitat fragmentation and human-wildlife conflict due to livestock predation. Sampling are being done in all snow leopard habitats, population genetic analyses are done to reveal the genetic structure and geneflows among the divided habitats for conservation landscape planning. Metabarcoding diet analyses and gastrointestinal microbiome analysis are used to find out snow leopard's predation on livestocks, and to reveal the inter-species relationship between snow leopard and candidate competitive sympatric carnivores, i.e. common leopard and feral dogs. Through the multi-scale research, we expect to monitor snow leopard's population dynamics in the changing world, know more

about the species biology, identify threats and establish monitoring and threat measurement methods for conservation of snow leopard.

Developing a portable DNA testing device for conservation using Snow Leopards as a model

Natalie Schmitt, Yingfu Li, Dingran Chang, Dibesh Karmacharya, Tom McCarthy

We are in the process of developing a portable, affordable, paper-based DNA testing device that will revolutionize the real-time tracking of elusive animals in the wild using snow leopards as the model species. Finding effective ways to track species that are difficult to see is of paramount importance to national and global conservation efforts, allowing managers to analyze population dynamics, identify threats of local extinction, and assess the effectiveness of Environmental Impacts Assessments (EIA) and mitigation. A reliable tracking approach that is gaining traction is to identify DNA from retrievable materials such as fecal matter in the lab after collecting them in the field. Unfortunately, this approach often leads to misidentification at the field site, thereby wasting limited conservation resources. Other challenges that limit the widespread adoption of genetic species detection include:

1) it is time-consuming and requires specialized expertise;
2) the samples' age can impact the accuracy of the analysis; and
3) laboratory costs are too high for large-scale studies or for regions that do not have access to the latest but costly equipment.

Our project goal is to develop a simple, paper-based hand-held device, much like a pregnancy test, which can perform three functions in one: capturing the DNA, producing copies of the DNA, and detecting the DNA through a colour change. The unparalleled advantage of this technology is its simplicity, high detection sensitivity and ultra-low cost; a game-changer for in-field DNA testing. The application for such a device is vast as it can be used by both experts and non-specialists for tracking animals and plants across terrestrial and aquatic environments.

We present preliminary results on each component of the technology which illustrate great potential in stable DNA immobilization, sensitivity in detection and the ability to link detection to a colour change.

Conservation genetics of snow leopards: where we are and where we need to go

Byron Weckworth

Conservation geneticists apply genetic theory and techniques to preserve endangered species as dynamic entities, capable of coping with environmental change and thus minimizing their risk of extinction. Snow leopards are an umbrella species of High Asia, and a keystone for maintaining biodiversity within this fragile ecosystem. A clear understanding of patterns of snow leopard genetic diversity is critical for guiding conservation initiatives that will ensure their long-term persistence. Yet, a comprehensive analysis of snow leopard genetic variation is lacking. The number of published snow leopard genetic studies is far fewer than for other imperiled big cats. Here, I outline the limited genetic work to date on snow leopards and highlight a hierarchical logic flow for filling in knowledge gaps. First, phylogeographic analyses will elucidate subspecific diversity and allow for an improved understanding of evolutionary history, including climate refugia, patterns of population expansion, and continental scale source/sink dynamics. These results can help define evolutionary significant units and contribute towards modeling the impact of ongoing and future climate scenarios. Next, a range-wide examination of contemporary patterns of genetic variability will allow for measurements of gene flow and identifying meta-population structure important for delineating objective conservation units and defining key areas of connectivity. Finally, landscape genetic

methods within and among meta-populations provides information about the interaction between landscape features (including anthropogenic) and the micro-evolutionary processes of gene flow and genetic drift. These results can be used to evaluate levels of habitat connectivity. A lack of connectivity, particularly in low-density, small populations can lead to multiple demographic and genetic consequences, including inbreeding depression, loss of adaptive potential and heightened susceptibility to demographic and environmental stochasticity. New efforts in conservation research on snow leopards should focus on the areas above and will require considerable trans-boundary partnerships and collaborations to be successful.

Empowering conservation practice with efficient and economical genotyping from poor quality samples using mPCRseq

Uma Ramakrishnan

No abstract available.

Return of an apex predator triggers an abrupt trophic cascade

Uma Ramakrishnan

No abstract available.

Finding Common Ground Across the Rangelands of Central Asia and Tibet

Eurasian grasslands: extent, status, threats

Karsten Wesche

Temperate Grasslands are the world's most threatened biome with respect to rates of conversion and limited levels of formal protection. Eurasian steppes and related rangelands represent the largest share of these grasslands, occurring from the Mediterranean basin towards China. Here, we provide a new review of key topics in steppe ecology and conservation, building on the vast yet scattered literature.

Revisiting the terrestrial ecoregions of the world, we estimate that the Palearctic steppe biome (including the Mediterranean basin as well as the Tibetan highlands) extends over ca. 10.5 million km^2, of which ca. 9 Mio. km^2 may once have been grasslands. Reserves cover a total of 1.4 Mio km^2, yet levels of formal protection are unevenly distributed with a single complex in Tibet covering 0.8 Mio. km^2. Steppes have a specialized flora and fauna, with Middle Asia, Tibet, and especially Mongolia hosting the largest ungulate migrations outside of Africa. Steppe soils store large amounts of carbon, yet the sequestration potential is debated.

Conversion to arable fields represents a key threat for most steppe ecosystems, and the share of grasslands remaining ranges from <10% in Hungary, to 55% in Russia and >95% in Mongolia. Many extant rangelands are degraded and severe overgrazing has been demonstrated for the Mediterranean and for the Chinese province Inner Mongolia. Global change effects are, in contrast, not as apparent, largely owing to the generally variable conditions in steppes making detection of trends difficult. Summer heat became more pronounced in Mediterranean rangelands, and changes in precipitation patterns have altered productivity of many Tibetan rangelands.

Eurasia thus still holds some of the world's largest and most intact grasslands, yet effects of changing land use and – to a lesser extent – climate continue to threaten steppes on a large-scale, calling for continued regional-scale and enhanced international-level conservation efforts.

What is ecosystem condition, and how can we measure it? Using stakeholder evaluations to quantify the condition of Mongolian desert and steppe.

Matt White

Measuring and auditing the condition of ecosystems has become an important aspect of environmental accounting, impact assessment and off-setting. Condition concepts and metrics are innately subjective but few evaluation methods address the subjectivity that is inherent in their design. We created algorithms for measuring ecosystem condition for five biomes of the southern Gobi Desert region of Mongolia, using quantitative stakeholder evaluation data as inputs. Ninety-two experts contributed quantitative data that were used to derive the metrics. The stakeholders represented four groups: nomadic pastoralists, specialists in botany, specialists in wildlife, and conservation practitioners and policymakers. The experts evaluated a set of hypothetical rangeland sites, providing each with a score between 100 (a desired state) and 0 (no values of the desired state retained). We used these evaluation data to train a model (an ensemble of 30 regression trees) capable of predicting the score based on the site variables. The models were converted directly into metrics for each system, and are available for use as decision trees that can be implemented in a spreadsheet. We devised ways of evaluating the performance of these metrics that are consistent with their inherently subjective nature. We demonstrated that they are capable of producing scores for real field sites (not used in training) which are close to the consensus view of experts.

Spatiotemporal variability in space use of Mongolian gazelle: Conservation implications of nomadic animal movements

Nandintsetseg Dejid

Unlike residency and migration, long distance nomadic movements of terrestrial mammals are little understood and conservation strategies for these animals are largely missing. Here, we studied spatiotemporal variability of space use and conservation implications of nomadic Mongolian gazelle (*Procapra gutturosa*) using GPS data of 22 individuals tracked from 6 months to over three years.

We found a high degree of variability in space use among individuals within a year and also significant variability within individuals between years, where the same individuals often showed entirely different wintering areas between years. On average, single gazelle covered an area of ~19,000 km^2 in a single year. The average lifetime range of a single gazelle was ~100,000 km^2. Moreover, simulation experiments showed that gazelles avoided areas with high disturbances (e.g. oil fields, population centers). They also demonstrated that there was no particular preference for protected areas - although individuals moved through a total of six protected areas. In addition, border fences were an impermeable barrier for the gazelles' movements and the median distance moved along these fences before giving up crossing them was 11 km.

Our findings highlighted that gazelles roam over large ranges that are highly variable in space and time indicating that landscape permeability is essential to sustain their movements. In addition, border fences obstructed the long-distance movements of gazelles and overall, linear barriers that are currently planned or under construction could pose the most significant risk to the integrity of the gazelles' movement. Therefore, our findings recommend that new linear structures need to have frequent crossing options to mitigate disturbances to gazelle movements and to maintain landscape permeability.

An introduction to the Central Asian Mammals Migration and Linear Infrastructure Atlas

Kirk Olson

As the world prepares for the upcoming 'Infrastructure Tsunami' to ring in the Anthropocene era, tools will be required for strategic planning which enable conservation practitioners and development institutions committed to support sustainable development approaches. The broader impacts of linear infrastructure are habitat fragmentation by dissecting habitats, direct loss or conversion, leading to compression, sedentarization and a reduction of migratory populations. Central Asia is a vast region that harbours the largest intact and interconnected grasslands worldwide that support some of the last remaining long distance terrestrial migrations.

With guidance from the CMS Central Asian Mammals Initiative and support from the Governments of Germany and Switzerland, the Wildlife Conservation Society led an expert-driven mapping exercise for 10 of 15 CAMI species to define their population ranges and prioritize threats associated with 5 identified types of linear infrastructure (roads, railroads, pipelines, canals, and fences). The atlas was created as a guide for individuals and groups responsible for the planning of infrastructure in the region. It is intended to provide a visual representation of current and future conflicts and to quantify the scale of such conflicts.

The project's area of interest was outlined and species' ranges and linear infrastructure, obtained from a range of sources, were mapped. Threats and species range were next mapped out in more detail over a 3-day period by 25 species experts, at which point in time each respective linear infrastructure was prioritized based on its perceived threat to mobility by the species under assessment. Mitigation strategies were provided.

Used effectively, the information within will guide efforts to mitigate the negative effects of infrastructure development on the natural movements of Central Asia's migratory mammals. Next

steps are to broaden to all countries with CAMI species, create an interactive online version, develop an update mechanism and assess at finer scale.

Strategy and successes and challenges of the Altyn Dala Conservation Initiative, a multi-organization collaboration involving protected area establishment and population level conservation efforts

Vicky Wilkins, Albert Salemgarayev, Steffen Zuther

The Altyn Dala Conservation Initiative (ADCI) was founded in 2006 for the protection and restoration of grassland ecosystems of Central Kazakhstan, which are likely to be the biggest pieces of native grassland in Eurasia. The ADCI is financially and technically supported by international NGOs, but implemented by a national NGO, the Association for the Conservation of Biodiversity of Kazakhstan, supported by the government. The strategy of the ADCI is to plan for the long term and strictly follow an ecosystem approach, looking at all the ecological components of the steppe, semi-desert, and desert. This includes the creation of an ecologically representative network of well-managed protected areas, which are embedded in a landscape with nature-friendly use patterns, protection of endangered and reintroduction of extinct species with an outstanding ecological role, involvement of the local population and research work to create the needed knowledge base for an effective implementation of the ADCI. The partnership is characterised by mutual trust between the partners, open-minded discussions and substantial commitment. This has resulted in an increase of protected areas coverage of almost 4 million ha, a significant increase in saiga numbers, numbers of caught poachers and revealed cases of smuggling of wildlife products, and the return of kulan to the steppe.

But the approach had also to be refined to a certain extent, when unexpected saiga mass die-offs eradicated parts of the achieved success. This highlights the importance of a general view on the object of conservation and the numerous aspects, which need to be taken into consideration for successful conservation. A critical evaluation of the ADCI led to an even broader approach, not only technically, but also geographically, supported by a broader partnership. The now even stronger approach to landscape-level conservation can serve as example for effective conservation work.

Reintroduction of kulan to the Central Steppe of Kazakhstan to promote population and ecosystem level conservation

Petra Kaczensky, Albert Salemgareyev, Steffen Zuther, John Linnell

Asiatic wild ass, or kulan (*Equus hemionous*), were once a key species in the assemblage of large herbivores that ranged the Eurasian steppes. Overhunting and habitat conversion has since decimated their populations so that nowadays they are found on less than 3% of their historic range. The situation is particularly critical for the Central Asian subspecies accordingly listed as "Endangered".

In Kazakhstan kulan became extinct in the 1930s, but reintroduction initiatives already started in the early 1950s. Today, kulan are again found in 2-3 isolated locations but have only reclaimed a small fraction of their former range and remain absent from the central steppe where large tracts of land have become almost devoid of people and livestock due to socio-political and economic changes.

This has created the rare opportunity for land-scape-level biodiversity conservation and species recovery in a steppe ecosystem. In 2005, the Altyn Dala Conservation Initiative (ADCI) was initiated which aims to conserve and recover nationally and internationally important flagship species and their habitats in the steppe and semi desert zones of Kazakhstan.

In 2017 a kulan reintroduction project was initiated which aims to

1) Re-establish kulan as part of the historic large herbivore assemblage on the Torgai steppe,
2) Double the range of kulan in Central Asia,
3) Significantly increase the global population, and
4) Provide a catalyst for kulan and Przewalski's horse conservation actions across the region.

In October 2017 the first 9 kulan were transported from Altyn Emel National Park in SE Kazakhstan and to the release site on the Torgai steppe, strategically located in a network of protected areas and ecological corridors covering 40,000 km^2. The adult kulan are equipped with GPS-Iridium collars to allow post-release monitoring, which is integrated into ongoing monitoring and patrolling routines by protected area and state rangers.

Inclusive approaches to conservation and resource management on the Tibetan Plateau, with lessons learned from the Sanjiangyuan region for achieving Sustainability

Marc Foggin

Approaches to environmental conservation have developed significantly in China over the past two decades, including somewhat more collaborative and inclusive approaches than were previously practiced. China also is in the process of developing a new national parks system, with the first national parks expected to be formally launched in 2020. This paper aims to provide a broad overview of the development of 'protected areas' in the Tibetan Plateau region, broadly defined, and particularly to highlight several lessons learned from experiences in community co-management in the vast Sanjiangyuan region (i.e. headwaters of the Yangtze, Yellow and Mekong rivers). Both within and outside formal protected areas, community engagement and participation in the development of locally adapted plans for sustainable use and conservation of natural resources have been critical features of most successful ventures. A range of government development policies and programs including the creation of new national parks, as well as initiatives undertaken by civil society and the development of herders' cooperatives and associations, are introduced and tracked – each pointing towards the significant value of inclusive biodiversity conservation for achieving the broadly agreed Sustainable Development Goals (SDGs) by 2030, including the protection of terrestrial ecosystems. Keeping local people and communities at the heart of conservation is deemed fundamentally important, and indeed essential to ensure fuller achievement of the Sustainable Mountain Development agenda in the Tibetan plateau region and beyond.

Ecosystem response of alpine grasslands to climate change and human disturbance on the northern Tibetan Plateau

Jianshuang Wu

Alpine grasslands on the Tibetan Plateau are sensitive and vulnerable to climate change and human disturbance. Warming and overgrazing have been two of the most important drivers for grassland degradation during past decades. To recover seriously degraded rangelands, approximately 4.75 million hectares of fences were built in North Tibet from 2006 to 2012 to exclude livestock. Thus, examining the effectiveness of grazing exclusion by fencing and understanding the mechanisms behind ecosystem self-restoration is a great challenge for grassland conservation and sustainable management in the future. Here, we used moderate resolution imaging spectroradiometer (MODIS) normalized difference vegetation index (NDVI) as a proxy for ecosystem productivity during a ten-year restoration by fencing. A generalized additive model, with growing season precipitation (GSP) and temperature (GST) and grazing exclusion duration (GED) as predicting smoothers, was used to detect the potential restoration trajectory for alpine meadows, steppes, and deserts, respectively. The difference of annual NDVI after fencing (2006 – 2015) compared to the average NDVI before fencing (from 2001 to 2005) was used as an indicator of ecosystem resilience. Degraded alpine

grasslands exhibited three restoration pathways: an equilibrium in meadows, a non-linear increase across steppes, and an abrupt pulse in deserts following a slight increase in productivity. Combined with weather conditions, ten-year grazing exclusion successfully enhanced NDVI on the most degraded steppes but did not do so efficiently on either meadows or deserts. Warming favored NDVI enhancement of degraded meadows, but higher temperatures limited the restoration of degraded steppes and desert-steppes. Precipitation is necessary to restore degraded alpine grasslands, but more precipitation might be insufficient for self-restoration of meadows due to the counteracting effect of lower temperature and for desert-steppes due to the small species pool. Detailed field observations of community compositional changes are necessary to better understand mechanisms behind such non-linear ecological restorations.

The Conservation of North Eurasia's Bustards: Assessment and Action

Surveys reveal decreases in the population size of Great Bustard and Asian Houbara Bustard in Xinjiang, Western China

Muyang Wang, Weikang Yang

Xinjiang Province of China is an important breeding site for Great Bustard (*Otis tarda tarda*) and holds a large breeding population of Asian Houbara Bustard (*Chlamydotis macqueenii*). As these populations have been poorly understood, we carried out field surveys to assess population size and threats. From 2013 – 2016, we conducted surveys of Great bustards during the breeding and pre-migratory staging periods. We registered a probable strong decline in the breeding population (decrease of 92% compared with the last survey in 1990), with a minimum of 19 birds found in Tacheng and none in Qapqal. During the pre-migratory season, we found a minimum population size of 444 in Tacheng over three years of survey. Population monitoring of Asian Houbara Bustard has been carried out in Mori, Xinjiang since 1998, mostly in three time periods, i.e. 1998 – 2004, 2008 – 2012, and 2017 – 2021. We observe a general decline in the population of Asian Houbara Bustard in the past years. We found a maximum of 150 individuals during the breeding season in 2010, but less than 100 Asian Houbara were found during the breeding season in 2012. We observe a stronger fluctuation in migratory surveys: around 280 Houbara Bustards were found in 2010, however, only 4 were found in 2012. For both species, habitat loss and degradation from livestock overgrazing, rapid agricultural intensification and infrastructure constructionare the main factors which could affect their populations within Xinjiang. We suggest reducing the number of herdsman and farmers in their distribution area, then restoring the habitat, as the key actions for the conservation of Great Bustard and Asian Houbara Bustard in Xinjiang.

Evidence-based evaluation of in situ and ex situ management for the sustainable management of hunted Asian Houbara

Robert Burnside, Paul Dolman

The migratory Asian Houbara *Chlamydotis macqueenii* is threatened (IUCN Vulnerable) and declining primarily due to over-exploitation by Arab falconers. Maintaining these populations is vital not only to the conservation of the species, but also to the continuation of the cultural practice of falconry, which has significant geo-political and economic importance in many range states. To date, the primary intervention has been to release captive-bred birds, and hunting appears to have continued in an unregulated manner under the assumption that such releases compensate for the losses to the wild breeding stock. We have taken an evidence-based approach to sustainable hunting to understand how captive breeding and release can could contribute to population stabilisation under scenarios of regulated hunting. Using a powerful combination of fieldwork and satellite tracking we quantify the demography (productivity and survival rates) and migration strategies of both wild and captive-bred birds to develop individually-based stochastic population models. We examine if the wild study population in Uzbekistan has a surplus that can be hunted sustainably, and then model different scenarios of hunt offtake, release sizes and the consequences for the population growth rate. Results suggest that mortality rates of wild juvenile and adult birds are currently too high on the wintering grounds, due to hunting and poaching, to allow for sustainable hunting. Moreover, low recruitment rates of captive-released birds mean that high-volume releases are needed to offset these mortalities, while further releases would be needed to create a surplus for sustainable hunting. Relying solely on captive-breeding requires releases of a scale that risk overwhelming wild populations with potentially domesticated stock. To avoid the genetic erosion of the current wild stock requires hunters to accept scientifically determined quotas, and also requires coordinated transboundary conservation efforts across flyway states, that would limit the winter mortalities to a sustainable level.

Collision of Houbara and Great Bustard with power lines in Southern Mongolia

Dashnyam Batsuuri, Aimee Kessler, Nyambayar Batbayar, James Hamilton

We studied the collision of great bustard (*Otis tarda*) and houbara bustard (*Chlamydotis undulata)* in Southern Mongolia for six consecutive years. We initiated animal incident monthly monitoring along project infrastructures (e.g., power lines inside mine-lease area, 35 kV and 6 kV power lines along Oyu Tolgoi - Gunii Khooloi (OT-GH), and the 220 kV Oyu Tolgoi - Gashuun Sukhait (OT-GS) power line) in 2012. Every month two researchers (one driver and one inspector) drive along the Oyu Tolgoi infrastructure at a speed of 20-40 km/h to look for wildlife. For this study we use Geographic Positioning System (GPS), binocular, compass, distance measurer, and a record sheet are used to document sightings and locations.

Since 2010, we recorded 63 Houbara Bustard at 31 points and 9 Great Bustard at 4 points in the Southern Mongolia. There were a total of 20 incidents recorded along OT – GS 220 kV power lines as of April 2018. There were, 15 incidents of Houbara Bustard and 5 incidents of Great Bustard involved in these incidents, despite the installation of Bird flight diverters. Highest number of incidents was registered in 2014, when migratory birds were moving through the area. Collision with power line was the main cause among all incidents.

The assessments mine related infrastructure are intended to assess performance of mitigation measures and confirm impact assessment predictions. The assessments conducted by Oyu Tolgoi have had the added benefit of contributing data that is expanding the understanding of seasonal movements and relative abundance of bustard species in the Gobi Region of Mongolia.

Habitat use patterns of Little Bustard in Kazakhstan suggest low-intensity land use is key to species' conservation

Maxim Koshkin

Little Bustard *Tetrax tetrax* populations in Europe are well studied, however little is known about migratory Asian populations, particularly those occurring in the species' stronghold – Kazakhstan. In the early 20th century the species was found in Central Asia in huge numbers, however, large declines were documented after the 1930s. Yet, recent wintering bird estimates in Azerbaijan and Iran suggest high numbers still breeding in Russia and Kazakhstan.

To clarify the species' status, habitat use, and barriers to its recovery in Kazakhstan, we carried out field surveys and a comprehensive review of published literature and unpublished sources. We find that Little Bustard populations in Kazakhstan have likely been recovering substantially during the last three decades, with populations returning to some parts of its original range and mean density in Central Kazakhstan reaching 0.30 (95% CI; 0.20 – 0.45) individuals per km^2. Density of breeding birds surveyed in spring 2011 along 3,185 km of driven transects in central Kazakhstan was five and two times higher in old perennial hay fields and in abandoned arable fields respectively than in pristine steppe, with very low densities in farmed arable fields.

These findings suggest that recent increases in population we detected, which should be verified, can be attributed to increased availability of breeding habitat following large scale arable land abandonment across steppes of Kazakhstan and Russia after the collapse of the Soviet Union. Unfortunately, a return to intensive agriculture on the breeding grounds is now underway, posing a serious threat to the species. Additionally, poaching on wintering grounds remains a serious threat. Setting aside large areas of low-productivity land, to be managed with low-intensity grazing and/or mowing, will help to retain currently favourable conditions across the breeding range. In addition, key wintering sites for Little Bustard must be protected.

Population Status and Trends of Little Bustard and Great Bustard in Uzbekistan

Elena Kreuzberg

In the past, the little bustard and the great bustard were regarded as migratory and wintering in Uzbekistan. However, the Great Bustard nested irregularly in the pristine foothill steppes until the end of 1950s. A pair of breeding Little Bustard with chicks was found in the mountain grasslands of Zaamin Valley in 1982. Populations of both species significantly declined from 1960s to 1990s mostly due to development of pristine steppes in Kazakhstan for cereal fields.

With break-up of Soviet Union and transition of new Central Asian states to independent economic systems with reduced agricultural production, the populations of both species recovered in the main breeding grounds in Kazakhstan. This resulted in increased numbers of migratory and wintering bustards on the plain areas of neighboring countries.

In Uzbekistan, the Great Bustard was observed by local people, staff of hunting organizations and conservation authorities in early 2000s during winter in the Navoi and Djizak regions bordering with Kazakhstan. The birds stayed at the agricultural fields, mostly with vegetables, where they were persecuted and poached by local people. According to inquest, up to several hundreds of great bustards were observed during the winter in this area.

The Little Bustard was "rediscovered" in 1999 – 2000 on wintering in southern regions of Uzbekistan, closely to boundary with Tajikistan and Afghanistan. The birds stayed mostly on agricultural fields and their limited number was found in the desert area with greening fields of wild cereal grasses. Flocks from several dozens to several hundred birds were recorded on the agricultural fields with green shoots of cereals.

However, both species are under pressure of illegal hunting and poaching by local people due to lack of conservation and low reinforcement. They are heavily persecuted by local people, using nets for trapping on the fields.

Asian little bustards: what can be learned from western trends?

Manuel B. Morales

The little bustard is distributed over the Palearctic from north-western Africa an Iberia to central Asia, inhabiting natural grass steppes, pastured grasslands and cereal farmland. Nowadays, two disjoint distribution sub-ranges persist: a western one comprising Iberia, France, Italy and Morocco, and an eastern one encompassing mainly southern Russia and Kazakhstan, but reaching north-western China and other limiting countries. Little bustards have severely declined over the last forty years in their western range, including Iberia, so far considered the species' world stronghold. Here I review the main processes behind the western decline and preliminarily foresee their importance for central Asian populations, proposing general conservation guidelines that might prevent similar trends in the east.

Little bustard regression in its western range is associated to breeding habitat transformation and degradation following agricultural intensification, although other threats such as collision with powerlines and poaching can also be blamed. However, there are signs of recent population recovery in the eastern range, which may in fact be the species' current stronghold with more than half the world's population. Agriculture intensification of fallow areas abandoned after the fall of the Soviet Union is a main challenge for little bustard conservation in central Asia potentially affecting habitat quality and amount, but other landscape changes associated to increasing human development (e.g. power lines, roads) cannot be ignored. Hunting pressure is another potentially relevant threat, both in breeding and wintering ranges. Assuring little bustard conservation in Asia should thus require the maintenance of large expanses of good quality habitat, including extensively cultivated and or grazed areas. In these areas intensive land-use practices should be minimized. International cooperation to guarantee conservation of wintering populations and their habitats is a must for these migratory little bustard populations.

The eastern subspecies of Great Bustard is genetically isolated, ecologically distinct, and requires urgent conservation action

Aimee Kessler, Malia Anne Santos, Ramona Flatz, Nyambayar Batbayar, Tseveenmyadag Natsagdorj, Dashnyam Batsuuri, Fyodor G Bidashko, Natsag Galbadrakh, Oleg Goroshko, Tuvshin Unenbat, Ivan I Vagner, Muyang Wang, Christopher Irwin Smith

Eastern and western populations of the Great Bustard (*Otis tarda*) have been characterized as separate subspecies, but this distinction has not been well evaluated with population genetic approaches. To describe the degree of genetic differentiation and rate of female gene flow between the subspecies, we sequenced and compared two mitochondrial genes (cytochrome b and control region). We collected the first genetic samples from Great Bustards in Central Asia and Mongolia, near the geographic division between the two subspecies, and used gene sequences stored in GenBank from Great Bustards in Europe. Our findings indicate that the two subspecies are highly differentiated in the mitochondrion and have been isolated for over 1 million years. The rate of female gene flow from the western subspecies into the eastern subspecies is not statistically different from zero. This raises concern for the eastern subspecies (O. t. dybowskii), which is declining and now consists of fewer than 2000 individuals. Alongside genetic differentiation, morphological and ecological differences are observed between the subspecies. The eastern subspecies carries out prolonged migrations and uses larger wintering ranges, which increase its exposure to threats including poaching, poisoning, and collisions with power lines. To prevent the loss of Great Bustards from Asian steppes, governmental and NGO action is urgently required to establish comprehensive agri-environmental schemes to ensure suitable breeding habitat, regulate construction of new overhead cabling to reduce collisions, reduce wildfires, spread awareness about the plight of these birds, and enforce existing anti-poaching laws. Recent enactment of a Concerted Action for Asian populations of this species via the Convention on Migratory Species should facilitate international coordination of their conservation.

Impacts of Snow on Wintering Asian Great Bustard in China and Relevant Conservation Actions

Gang Liu, Aimee Kessler, Mighao Gong, Morigen Han, Derong Meng

China is the most important wintering site for the eastern subspecies of Great Bustard (*Otis tarda dybowskii*), which is listed as “endangered” in China. China hosts breeding populations in the northeast of the country, and also serves as the major wintering site for birds breeding in eastern Russia and Mongolia. Recently, some previously migratory populations in northeastern China have begun to overwinter at their breeding sites, where they encounter extreme snowfall events. To assess the physiological impact of severe winter weather on Asian Great Bustards, we measured corticosterone and Immunoglobulin A levels in fecal samples collected before and after snowfall in both low and high snow cover years. While we observed that corticosterone levels increased after snowfall in both years, Immunoglobulin A levels increased after snowfall in a low snow cover year but decreased after snowfall in the high snow cover year. This suggests that snowfall and snow cover represent sources of physiological stress and that immune function may fall in severe winter conditions. To improve winter survival, we suggest that supplemental feeding and snow removal be carried out during periods of heavy snow cover at sites hosting Great Bustards.

What measures are needed to save Asia's bustards from extinction?

Nigel Collar

Asia's six species of Otididae – Great Bustard *Otis tarda*, Little Bustard *Tetrax tetrax*, Asian Houbara *Chlamydotis undulata*, Great Indian Bustard *Ardeotis nigriceps*, Bengal Florican *Houbaropsis bengalensis* and Lesser Florican *Sypheotides indica* – are all threatened in varying (but mostly very serious) degrees by anthropogenic factors that need addressing. A detailed review of these threats, drawing on published and unpublished evidence from all range states, and their effects upon the species reveals some important commonalities and points to some equally important and also challenging conservation responses. The strongest common threats are habitat conversion in the form of agricultural intensification, which greatly reduces reproductive output, and mortality and injury on powerlines, which greatly reduces overall population survival rates; both these factors affect five of the six species. Hunting is a powerful threat to three species (Great and Little Bustards and Asian Houbara) while predation of nests and young by elevated numbers of carnivores (notably dogs) is known also to affect at least three species (Great and Great Indian Bustards and Bengal Florican). These threats are major challenges because bustards commonly range widely and unpredictably outside protected areas, although a first task must be to ensure that nature reserves where the species occur are managed optimally for their security and productivity. Moreover, special measures are needed in agricultural areas where males display and females breed, along with: the preservation of continuous unfragmented landscapes with low-impact farming; strict and strong regulation of both powerlines and fencing within those landscapes; equally strict and strong control of hunting, poaching, dog predation and inappropriate grass-fires; and sustained campaigns of public awareness and engagement. This requires partnerships between governments and NGOs, since the initiatives are too complex and extensive for NGOs alone.

Assimilated Knowledges: An Integrated Approach to Conservation in Snow Leopard Landscapes

Assimilated Knowledges: an integrated approach to conservation in snow leopard landscapes

Abhishek Ghoshal, Ranjini Murali, Saloni Bhatia, Dipti Humraskar, Ajay Bijoor

Understanding factors affecting distribution change can form the basis for assessing conservation status of elusive, hard to sample species. Snow leopard (*Panthera uncia*) is the top-predator of the Central and South Asian mountains. Knowledge on distribution and status of this elusive wild cat and its wild-prey is limited. In this symposium I will talk about how using recall-based key-informant interviews, we estimated changes in distribution of of snow leopards and their primary wild-prey, blue sheep (*Pseudois nayaur*) and Asiatic ibex (*Capra sibirica*), across two time periods (past: 1985 – 1992; recent: 2008 – 2012) and c. 15,000 km^2 area, in the state of Himachal Pradesh, India. At this wide spatial scale, snow leopard distribution seemed to overlap prey distribution. Blue sheep was restricted to eastern and south-eastern parts of the study area where migratory livestock grazing was absent, while ibex distribution was widespread in the western, central and south-western parts where migratory livestock grazing was prevalent. Again, competition over forage removal by livestock is often a challenge for coexistence and conservation of wild-ungulates in rangelands. Seasonally restricted livestock grazing in rangelands could potentially allow coexistence of wild-ungulates if consumption by livestock is offset by forage production, though this can be challenging in low productivity systems. At a finer spatial scale, impacts of migratory livestock grazing on forage availability and ibex population and demography was examined. Ibex seemed to be outcompeted by migratory livestock grazing through reduced forage availability and displacement of young individuals.

Beyond conflict: understanding the spectrum of human responses to wildlife

Saloni Bhatia

Humans have lived alongside and interacted with wild animals throughout their evolutionary history. At an extreme, wildlife can result in damage to property, injury or even loss of life, but not all interactions between humans and wild animals are negative. Yet, research has tended to focus disproportionately on negative interactions. We used ISI Web of Knowledge database to assess how human-wildlife interactions are framed in scientific literature. We found that the predominant focus of research was on human-wildlife conflict (69%) with little coverage of coexistence (2%) or neutral interactions (11%). We suggest that such a framing is problematic as it has the potential to overrepresent certain kinds of interactions. It can also lead to a bias in conservation planning by failing to consider the multidimensionality of peoples' relationship with wildlife and the underlying human-human conflicts. We propose a typology of potential human responses to wildlife to address the bias. Standardizing terminology and examining the intensity of both negative and positive human-wildlife interactions could lead to a more nuanced understanding of human attitudes and behaviours, and to better management for promoting coexistence. Based on a review of literature, we also propose a set of proximate (correlates) and ultimate (mechanisms) factors that influence peoples' relationship with wild animals. This approach can potentially help provide greater clarity in human dimensions' research and enable us to develop a predictive framework to assess human-wildlife relationships.

Socio-ecological boundaries: valuation and management of ecosystem services

Ranjini Murali

Most ecosystem service valuation studies focus on valuation from high productivity ecosystems such as forests or mangroves. This abundance of valuation studies from certain type of systems can inflate their value and further reinforce the stereotype that low-productivity systems such as deserts are wastelands. Here, I present the economic value of provisioning services from the cold desert systems of Central Asia and the High Himalayas. I present results from two local production systems found in these landscapes – agropastoral and pastoral; across five sites – Sarychat, Kyrgyzstan, Tost, Mongolia, Gurez valley, Pakistan, Spiti valley and Changtang, India. The results reveal substantially high levels of dependence of local communities on ecosystem services provided by these landscapes. The estimated economic value of provisioning ecosystem services used by households ranged from 0.6 to up to 40 times the local annual household incomes. This economic support that nature provides people is critical for humanity but remains hidden and unaccounted for. Land use change decisions, especially those that are damaging for nature and biodiversity, must start accounting for the value of ecosystem services in their cost-benefit analyses even in low productivity landscapes.

Living with snow leopards: Creating a constituency for conservation of the snow leopard in the Indian high altitude

Dipti Humraskar

Deep rooted connect with nature has been shown to foster positive attitudes and behavior towards nature and wildlife among children. They form a significant part of the society that can be strongly influenced and have the potential to bring about a positive change. The fragile trans – Himalayan ecosystem across Spiti and Ladakh constitutes a significant snow leopard habitat. Promoting stewardship among local children who are future stakeholders of this landscape could help ensure long term sustenance of research and conservation initiatives not only for the snow leopard, but also the other rare high altitude wildlife sharing the space.

Sensitization and engagement at a young age has been our strength complementing our research and conservation initiatives. I shall talk about our experiences of engaging with schools across Spiti and Ladakh over the last decade, conducting experiential outdoor activities to strengthen their bond with the surrounding environment, our learnings through the way and building upon them to create a community that is better informed and equipped to support conservation of the snow leopard and its ecosystem in the future.

Community-based conservation efforts through landscape level management planning

Ajay Bijoor

Effective conservation requires a number of dimensions to be understood: an understanding of the threats to a particular species/landscape, cultural dimensions and beliefs of the communities residing in these landscapes, and the dependence of these communities on their local ecosystem. With an understanding of these aspects, one can dabble in conservation.

In this talk, I share an experience of how knowledge gathered through research carried out along multiple axes was used to test community-based conservation models in a cluster of villages in a remote snow leopard landscape of India. Based on their successful implementation, these models were extended to cover a wider landscape. In doing so we also highlight how multiple government agencies and mechanisms were leveraged to scale conservation efforts.

Free Flying Wings, Migratory Birds Protection in the Context of One Belt and One Road

Migratory Birds Protection in the Context of One Belt and One Road: the importance of the Nanpu Saltpans for migratory waterbirds in East Asian-Australasian Flyway

Zhengwang Zhang

The natural coastal wetlands of the East Asian-Australasian Flyway (EAAF) are disappearing at alarming rates, leading to rapid declines of many populations of waterbirds in this most species – rich flyway in the world. Coastal saltpans are functional wetlands that support large numbers of waterbirds worldwide. The Nanpu Saltpans in the northern Bohai Bay in China is one of the largest (290 km^2) saltpan complexes in the world. In this paper, we document the value of the Nanpu Saltpans for supporting waterbirds. The surveys carried out from 2013 to 2016, included waterbird counts in the saltpans (93 km^2) at high and low tide and on the adjacent natural tidal flats (57 km^2) at low tide. Of the 89 waterbird species recorded, 27 had maximum counts exceeding the 1% threshold value of estimated flyway populations. The maximum counts of waterbirds in northward migration and southward migration in the Nanpu Saltpans were 96,000 and 93,500 respectively, and the total number of birds using the site is likely to be higher. The maximum counts on the adjacent tidal flats at low tide amounted to 73,000 and 20,000 waterbirds in northward and southward migration, respectively. Waterbirds used the inland ponds mainly for feeding both during low tide and high tide and used the nearshore ponds mainly for high-tide roosting. Some species, such as Black-tailed *Godwits Limosa limosa*, Marsh Sandpipers *Tringa stagnatilis*, Pied Avocets *Recurvirostra avosetta*, and Black-winged Stilts *Himantopus himantopus*, occurred mainly in the saltpans; other species preferred tidal flats, such as Red Knots Calidris canutus, Great Knots *Calidris tenuirostris*, Bar-tailed Godwits *Limosa lapponica*, Relict Gulls *Larus relictus*, and Grey Plovers *Pluvialis squatarola*. This study clearly demonstrates the joint ecological function of the Nanpu Saltpan complex and adjacent tidal flats as a key staging area for waterbirds in the EAAF.

Coastal Wetland Evaluation and Wetland Health Index (WHI) in China

Xiubo Yu

Coastal zone is the key interconnection of terrestrial and marine ecosystems. Regarding the degradation and fragmentation of coastal wetlands, urgent need appears in applicable assessment methodology to compare the health of wetland ecosystems at different spatial scales, and assess their ecosystem health with easy-to-access data so as to efficient protection. This study is made to understand the comprehensive distribution on the health of coastal and inland wetlands of China's coastal regions. A Wetland Health Index is built up to provide basis for policy and decision making according to the key ecosystem services provided by China's coastal wetlands. Four utilization models: Open model, Long-term model, Nature reserve model and Protected and economic model, are defined in context of China's coastal regions to specifically examine the health of wetlands. In general, the health conditions of wetlands in south provinces are relatively higher than the ones in north. With the increasing intervention of economic activities, the differences between health conditions (WHI scores) became bigger. The health conditions of regional wetlands are not certainly derived by regional economic conditions alone or economic intensiveness either. The policy interventions could be determining factor of health conditions of regional wetlands and their conservation. Appropriate management of intervention degree and timing could contribute to the health condition of diverse conservation and utilization.

Migration timing influences the responses of birds to food decline at a refueling site during migration

Mianjuan Ke, Shoudong Zhang, Peng He, Hebo Peng, Chi-yeung Choi, David S. Melville, Zhijun Ma

Migratory species are able to change their stopover decisions when facing food shortage at refueling sites en route. The responses to food shortage at refueling sites at individual level, however, has not been well studied. Because migration is time-constrained and migration timing varies among individuals, we predicted that intraspecific migration timing affects the stopover

decision for individual birds facing a food shortage. We compared the stopover decision, in terms of occurrence and length of stay (LOS) at the refueling site, of radio-tagged great knots (*Calidris tenuirostris*) at a critical spring refueling site in the northern Yellow Sea before and after dramatic food decline. The results indicated that the probability of occurrence at the refueling site was consistent between the two seasons. The average LOS, however, significantly shortened in the year of food decline because late arrivals were more likely to move to other sites. This suggests that, relative to early arrivals, late arrivals are more sensitive to and thus more vulnerable to food decline at refueling sites.

Building Monitoring Network for Endangered Bird Species through Citizen Science: The Wintering Census of Scaly-sided Merganser Project

Qian Wei

Scaly-sided Merganser (*Mergus squamatus*), also called Chinese Merganser named by the location of type specimen. It is an endangered species in IUCN red list. As the data showed from Waterbirds Population Estimation all over the world by Wetland International, all the individuals of scaly-sided merganser are less than 10,000, and this number continues to decline.

The Wintering Census of Scaly-sided Merganser is a citizen science project launched by China Birdwatching Association with the extensive participation of birdwatching societies, reserves, wetland parks, universities and scientific institutes all over China.

The project was held on September, 2014 by China Birdwatching Association (Rosefinch Center) as the first time. During the period between 2014 and 2018, the field research covered more than 400 observation sites in 25 provinces, autonomous states and municipality cities. The research areas involving the southern, middle and eastern parts of China that cover the ten main basins of Yellow River, Yangtze River, Huaihe River, Pearl River, Yalu River, Lancang River, Liaohe River, Haihe River and the rivers at the southeast coastal part.

The wintering population or individuals of Scaly-sided Mergansers were found in 19 provinces. Be the result of this census, as which include in the official report, 1138 Scaly-sided Mergansers totally, with 452 males and 683 females or juveniles.

The type and quality of data collected on the birds and their habitats has also never been achieved in the past, which can be considered as a survey precedent that was launched, financed and implemented by non-governmental organizations on single species of waterfowls. This has promoted the establishment of local protection policies and communities, which have been recognized by domestic and foreign ornithological scholars and organizations. This survey activity is the most scaled of the wintering situation to a certain species of waterfowls to this day.

Free Flying Wings, Migratory Birds Protection in the Context of One Belt and One Road

Chunsheng Yao

The proposed symposium aims to explore the innovative models to conserve wetland and protect water birds with well-known scholars, experts and practioners at home and abroad. Free Flying Wings, a comprehensive conservation program of SEE, will be taken as an example, which aims to preserve China's most endangered water birds and their critical habitats. Between year 2016 and 2026, Free Flying Wings will protect over 100 wetlands and 24 species of endangered water birds, and will actively implement prioritized tasks through civil society, as well as the participation of the general public, the government and corporations. This comprehensive conservation model can be referred to by other countries of One Belt and One Road in terms of wetland conservation and bird protection.

Central Asian Ungulates and Health

Saiga mass-mortality in Kazakhstan: Outcomes of a multidisciplinary research approach

Richard Kock, Mukhit Orynbayev, Sarah Robinson, Steffen Zuther, Navinder Singh, Wendy Beauvais, Eric Morgan, Aslan Kerimbayev, Sergey Khomenko, Henny Martineau, Rashida Rystaeva, Zarina Omarova, Sara Wolfs, Albert Salemgareyev, Florent Hawotte, Julien Radoux, EJ Milner-Gulland

In May 2015, more than 200,000 saiga antelopes died in about 3 weeks in Central Kazakhstan. Numerous theories were developed about why and how this had happened. We applied a multi-disciplinary "One Health" research approach to investigate this extraordinary mass mortality event.

Field necropsies and laboratory tests allowed to establish hemorrhagic septicemia as the proximate cause of death, caused by the bacterium *Pasteurella multocida* serotype B. Other potential explanations like potential pathogens or toxicosis were not supported by the specific character of the incident, observations in the field during and after the die-off (clinical and post-mortem examinations) and additional laboratory analyses, including next-generation sequencing, electron-microscopy, PCR, histopathology, virology.

We focused therefore on identifying the causal factors for the bacterium to become such a virulent pathogen. Potential co-factors were investigated by using statistical methods for contemporaneous and historical data and information from literature. The results suggest that unusually high relative humidity and comparably high average minimum daily temperature during the 10 days before the event have triggered the mass mortality in 2015, but also other previous events, which show a lot of similarities to the most recent one. This means that no efficient interventions are possible in the case of such mass mortalities.

But the scale and nature of the event calls for a continuation of research activities and an on-going health monitoring of saiga. Responses to such outbreaks must be interdisciplinary and should happen rapidly as soon as they are observed. Climate change might influence the frequency of such events. For the conservation of the species, which can easily by wiped out by such catastrophes, if the number of animals is lower, it is crucial to decrease other threats like illegal hunting and aim for big population sizes, which allow to recover quickly after such significant losses.

Peste de petits ruminants (PPR) outbreak in Mongolian saiga (*Saiga tatarica mongolica*)

Enkhtuvshin Shiilegdamba, Buuveibaatar Bayarbaatar, Chimeddorj Buyanaa, Shatar Munkhduuren, Richard Kock, Amanda Fine

The Mongolian saiga population comprises all survivors of an isolated subspecies and only exists in the Khovd and Gobi-Altai provinces of Mongolia. The population survey in January 2017 estimated about 10,000 individuals across its entire range. A PPR outbreak in Mongolian saiga was first reported on 24 December 2016, following an outbreak in domestic sheep and goats in August, 2016 and after vaccination had been completed on the domestic population. The PPR in saiga was confirmed on 03 January 2017 by the State Central Veterinary Laboratory of Mongolia. A team including wildlife veterinarians, epidemiologists, biologists and experts from the FAO/OIE CMC-AH mission carried out an emergency investigation late January 2017 and confirmed the extent and severity of the PPR outbreak in saiga. During the field investigation, a full set of pathological and virology samples from affected saiga population was obtained. The field team also confirmed PPR in goitered gazelle (*Gazella subgutturosa*) and Siberian ibex (*Capra sibirica*) using a field based rapid diagnostic test (BDSL UK). This PPR outbreak in saiga by the end of March had resulted in loss of > 50% of the population. Last saiga case confirmed was in June 2017. The SCVL confirmed PPR in argali sheep (*Ovis ammon*) on 29 March 2017. To prevent future outbreaks of the disease elimination of the virus from Mongolia is essential and the goal Nationally and regionally is for total eradication of the virus. Also, a long-term research program is required in collaboration with the authorities to better understand the disease epidemiology, combining ecological monitoring, disease surveillance, spatial ecological modelling and participatory epidemiology.

Understanding disease transmission in a spatio-temporally dynamic system: the Saiga edition.

Munib Khanyari

Transmission of disease at the interface of livestock and wild ungulates is important as it can impact agricultural economics, especially of resource-poor farmers (White & Bergis 2007) and wildlife conservation (Smith, Acevedo-Whitehouse & Pedersen 2009). Gastro-intestinal nematodes (GINs) are determinants of fitness in wild and domestic ungulates (Gulland 1992; Perry & Randolph 1999). Often GINs get overlooked as their impact can be subtle and their clinical signs hard to detect. Additionally, models that are sufficiently flexible to be easily adapted to different infectious diseases using the same basic architecture, and also structured to incorporate heterogeneous mixing patterns between hosts moving over a landscape that varies in environmental determinants of disease risk, are needed in order to address the particular dynamics of rangeland grazing systems. It is critical that these incorporate the ecological and social aspects governing disease transmission. Considering this, I aim to understand the effects of environmental change on the transmission dynamics of GINs in mobile wild-domestic ungulate systems and explore the effectiveness of targeted disease management systems in addressing the economic, social and conservation consequences of GINs. I hope to do so by using Saigas, Saiga tatarica in Kazakhstan as a case study system.

Mongolian Gazelle: Victims not Villains of Foot and Mouth Disease in Mongolia

Lkhagvasuren Badamjav, Enkhtuvshin Shiilegdamba, Bolortsetseg Sanjaa, Amanda Fine

Foot-and-mouth disease (FMD) is a highly contagious, viral disease that affects most ruminant and porcine species, and periodic outbreaks on Mongolia's Eastern Steppe affect Mongolian gazelles (*Procapra gutturosa*) and livestock. During 2005–08, we collected sera from 36 adult gazelles, and from adult domestic animals sympatric with the gazelles, including 138 sheep (*Ovis aries*), 140 goats (*Capra aegagrus hircus*), 139 Bactrian camels (*Camelus bactrianus*), and 138 cattle (*Bos taurus*). Our goal was to determine whether the prevalence of the antibody to foot-and-mouth disease virus (FMDV) in gazelles declined relative to previous estimates in the absence of FMD outbreaks. Overall, 2.0% (95% CI 0.7 – 3.3%, n=555) of the four livestock species were antibody-positive for nonstructural proteins of FMDV (FMDVNS), whereas 30.3% had antibodies for structural proteins (i.e., vaccination-derived antibodies). None of 36 adult gazelles sampled in 2008 were antibody-positive for exposure to FMDV, indicating a significant decline in antibody prevalence among gazelles from the same area during a livestock outbreak in 2001. The episodic nature of FMD outbreaks on the Eastern Steppe, Mongolia, with evidence of FMDV exposure in gazelles only during or following concurrent outbreaks in livestock, suggests that FMDV may spill over into the gazelle population during livestock outbreaks and that successful control of FMD on the Eastern Steppe requires a focus on control in livestock populations through vaccination.

Controlling the risk of spill over of peste des petits ruminants virus from livestock to threatened wild ungulates in Wakhan National Park, Afghanistan

Stephane Ostrowski, Ali Madad Rajabi, Hafizullah Noori

Peste des petits ruminants (PPR), is a highly contagious and devastating viral disease of small ruminants. It has been endemic in Afghanistan for more than 20 years. PPR has emerged as a serious animal health concern in Central Asia as it threatens the small-scale sheep and goat farming of millions of low-income families. There is also increasing evidence of spill over of PPR virus (PPRV) from domestic to wild animals with devastating effects on populations of susceptible wild ungulates. The Wakhan National Park (WNP) in Afghanistan was created in 2014 to protect a unique and vulnerable high mountain landscape. It is home to ca. 17,000 people and ca. 60,000 livestock sharing to various extents pastures with vulnerable populations of Marco Polo sheep (*Ovis ammon polii*), Siberian ibex (*Capra sibirica*) and urial (*Ovis orientalis*). Because of this cohabitation, the weak sanitary surveillance,

limited access to vaccination, and the reported cross border movements of livestock and wildlife, the populations of wild ungulates in Wakhan are at significant risk of PPR infection. Serosurveillance in sheep and goats carried out in 2006 – 2011 documented an annual prevalence ranging 1.2% – 7.5%. However, in winter 2012 a disease outbreak that claimed the life of ca. 4,500 sheep and goats with suggestive clinical symptoms supported that PPR could occur as episodic outbreaks followed by periods of clinical 'silence'. In support of the management of WNP, the Wildlife Conservation Society in partnership with the government and local communities has identified possible areas of PPR spill-over to wild ungulates and most-at-risk species, it has also supported the creation of a surveillance network of local para veterinarians, it has piloted a transboundary animal health detection effort, and in 2017, vaccinated 8,117 sheep and goats in areas of the park of higher risk of PPR spill over to urial sheep.

Conservation Biology in Central Asia

Conservation Biology in Central Asia

Elena Kreuzberg

Historically, the conservation science in the region of Central Asia of former Soviet Union started with establishment of first protected areas and laws, regulating using of wildlife species and their territorial protection in 1920s. The first protected areas, strict wildlife nature reserves or "zapovedniks" were established in Central Asia in 1926 – 1927 in Kazakhstan, Turkmenistan and Uzbekistan, namely, Aksu-Jabagly, Zaamin and Repetek. The first wildlife reserve in Tajikistan was established in 1938. After, the second World War more protected areas were created in all 5 Soviet Republics of Central Asia, but all of them belonged to the central ministry of forestry and managed from Moscow.

All new established protected areas had also the scientific departments, responsible for conducting wildlife study and inventories of flora and fauna in the reserves. However, due to limited financing, such departments usually had only two experts responsible for all zoological studies and for all botanical studies, respectively. This is paradoxical, but conservation science started in Central Asia in the protected areas with their limited financing, lack of equipment, lack of expertise and guidance from scientific institutions. All those "attributes" were compensated by enthusiasm of young scientists, recent graduates of the universities who arrived to the region that to form a task force for nature conservation. Many conservation initiatives were raised since that time facilitating the processes of nature conservation in new established independent countries of Central Asia after break up of Soviet Union.

However, due to lack of cooperation and communication between local universities and international institutions such as IUCN, WWF and other conservation organizations, the process of conservation biology integration into the education systems is still delayed, creating the problems of capacity building in conservation authorities and preparation and training the new generation of conservation biologists and protected area managers.

Conservation of the Asian Houbara *Chlamydotis macqueenii*: issues and solutions

Maxim Koshkin

The Asian Houbara *Chlamydotis macqueenii* is a large cryptic ground-nesting bird of semi-arid environments stretching from Egypt to Mongolia, listed as Vulnerable by the IUCN, following declines due to unsustainable hunting and illegal trapping on both migration routes and wintering grounds. In addition, habitat degradation and overgrazing are attributed to species declines in parts of its range, however with little published evidence.

Recent published and unpublished sources were reviewed in order to assess species' status and identify key threats and possible solutions for conservation. Effects of grazing on houbara numbers and nesting success were investigated in Kyzylkum desert of Uzbekistan.

Some sources suggest that unregulated hunting and trapping at wintering grounds are, by far, the most serious threats. Hunting along migratory routes is likely having a deteriorating effect on populations breeding elsewhere, however data is lacking to accurately quantify the damage. More recently, annual releases of large numbers of captive bred birds may be considered an emerging threat, likely affecting wild houbara through diseases and genetic pollution, with poorly surviving released birds not being able to replace harvested wild individuals. Habitat degradation has likely a low impact on the houbara populations and the species may co-exist with low to medium grazing pressures.

With unregulated hunting being the major threat for the species and with complete hunting bans currently unlikely in countries hosting hunters, this is foremost important to establish (based on scientific evidence) and enforce limits of sustainable off take. At the same time, a system of no-hunting reserves should be established along the migration routes to allow birds to safely breed, stop or winter. Finally, a number of national and international research programs should be supported

to identify key areas for protection, to determine hunting quotas and to advice on management interventions.

Conservation Biology in Central Asia

Elena Kreuzberg, Sergey Kulagin, Rustam Muratov, Kuban Matraimov, Chinara Sadykova, Zhanel Karina, Aleksandr Vereshagin, Maxim Koshkin, Natalya Marmazinskaya

The symposium "Conservation Biology" in Central Asia" is aimed to analyse the current processes and development of the conservation science in the region. The symposium will gather experts from Central Asia that to assess current achievement and challenges in the conservation science, which region is faced. The basic theme of the symposium is an assessment of current stage and role of conservation science in the region, participation in the conservation biology various players such as academic institutions, biodiversity conservation societies, community groups and individuals and their role in the further development of conservation science, public awareness and education. The symposium in some degree covers 7 thematic areas of the conference.

Presenters from four countries of the region will discuss their experience of capacity building and development of conservation programs in the region. Subjects of presentations will include community-based conservation, valuation and payment for ecosystem services, wetlands and mountain conservation, application of citizen science approach in the region, conservation of flagship species and general analysis of the current problems, which conservation biology is facing in the region.

Existing problems of conservation science in the region also will be clarified and the ways to resolve them will be discussed.

The symposium chair is its moderator, Dr. Elena Kreuzberg, conservation biologist and ecologist, expert in biodiversity of Central Asia, former Vice-Chair of the SSC/IUCN for Central Asia, initiator of INTAS project in the region "Correlation of extinction risk for Central Asian biodiversity" (conducted in 1999 – 2001 with participation of SSC/IUCN, London Imperial College, Swiss Institute of Biology and 5 academic institutions from 5 countries of Central Asia). Elena upgraded her education in Canada (Carleton University, Ottawa) in Landscape Ecology field. Currently Elena is an independent consultant, working in the area of biodiversity conservation and environmental management in the development projects.

Зимовки водоплавающих птиц на оз. Иссык-Куль

Sergei Kulagin

Озеро Иссык-Куль в 1976 году было включено в список Рамсарской конвенции о водно-болотных угодий имеющих международное значение. В 2002 году Правительством Кыргызстана был ратифицирован договор Рамсарской Конвенции в котором учитывалось глобальное значение природных комплексов Иссык-Кульской котловины и международное значение озера Иссык-Куль, как места зимовки водоплавающих птиц.

Первые учеты водоплавающих птиц на Иссык-Куле провел Ф.Ф. Пятков в 1944-1946гг. Систематические учетные работы на Иссык-Куле начались только с созданием Иссык-Кульского заповедника (1948 г) и организацией в его структуре научного отдела (1964).

Данные многолетних учетов показывают, что основными местами концентрации зимующих водоплавающих птиц, по прежнему остаются мелководья западной части и заливы восточной части оз. Иссык-Куль. Так в среднем по годам, в западной части зимует от 40 до 50 % всех птиц, в восточной от 25 до 30 %, в северной от 10 до 15 %, в южной зимует около 5 % всех водоплавающих птиц. Общая численность зимующих птиц подвержена сильным колебаниям например в 40-е годы на Иссык-Куле зимовало около 100 тыс. птиц, в 60-е годы около 60 тыс., в 70-е годы 50 тыс.,

в 80-е годы 35-45 тыс., в 90-е около 65 тыс. в 2000-е годы 46-60 тыс. Такие колебания численности водоплавающих птиц на оз. Иссык-Куль зависит в основном от кормности угодий и степени обмерзания мелководий, так в теплые зимы, обмерзание мелководий незначительное и на зимовку остается больше птиц.

Многочисленными в период зимовки являются такие виды как: лысуха (Fulica atra) от 25 до 30 тыс., красноносый нырок (Netta rufina) от 15 до 20 тыс., поганки (Podictps) (5 видов) около 6–10 тыс., лебеди (Cygnus) около 2,5 тыс., 1,2–3,2 тыс. речных уток. Редкими на зимовке являются: тундровый лебедь (Cygnus columbianus), морянка (Clangula hyemalis), пеганка (Tadorna tadorna), черноголовый хохотун (Larus ichthyaetus). В период зимовки на Иссык-Куле ежегодно встречается более 40 видов водоплавающих и околоводных птиц.

Conservation and sustainable use of wetlands in Central Asia: challenges and opportunities

Zhanel Karina

Central Asia is a vast region with a diversity of wetland types such as lakes, rivers, reservoirs and marshes that are unique in their nature and provide important ecosystem services for both humans and the environment, in particular, in the arid zones. Many of these ecosystems are under increasing pressure due to the anthropogenic impacts, poor nature management and climate change. As there is no comprehensive research on the current status of the wetlands in Central Asia, application of the monitoring mechanisms is not always ensured and the countries lack effective management system for wetlands conservation and wise use, it is crucial to raise awareness about wetlands in the region.

Enhancing awareness about wetland values at all levels as well as conducting a regional inventory of wetlands and improving the management effectiveness are among priority activity areas of the Ramsar Regional Initiative for Central Asia (RRI-CA). The new Ramsar regional initiative started its activity in 2016 and currently has Kazakhstan, Kyrgyzstan and Turkmenistan as members. The Initiative aims to promote stronger cooperation and synergies within the Central Asian region to effectively implement the Ramsar Convention and its Strategic Plan at the national and regional levels.

The first RRI-CA project was focused on the update on the status of wetlands in Kazakhstan, Kyrgyzstan, and Turkmenistan by collection and dissemination of good practices for the conservation and sustainable use of wetlands by local communities. The work with local communities is important in order to understand the benefits that the local communities receive from the wetlands. Using this bottom-up approach by working with local communities who utilize wetlands services, is crucial for raising awareness about the value of wetlands and for ensuring involvement of local communities into the decision-making process and dissemination of knowledge.

Biodiversity conservation with use of Kyrgyz Traditional knowledge.

Chinara Sadykova

This abstract presents the experience and traditions of Kyrgyz people on use of natural resources, how it was utilized in the past and how it is being used nowadays in daily life of the Kyrgyz people. The Kyrgyz Republic is reach with unique mountain ecosystems; the average concentration of biodiversity is higher than average. Currently Kyrgyzstan is facing with shrinkage and degradation of natural ecosystems, habitat lost and reduction of forest range. Elimination of plant and animal species, pollution and disfigurement of landscapes, soil depletion and degradation, contamination of water bodies, all this leads to destruction of environment that influences human life and wellbeing. Kyrgyz traditions are based on principles of harmonious and careful behavior with environment and rational use of natural resources. Nowadays, traditional knowledge of Kyrgyz people is being used and restored in the field of rational use of natural resources, economic self-management and

establishment of small nomadic farms, as well as for long-term use of renewable and non-renewable natural resources. Traditional knowledge is also utilized to preserve cultural heritage, promote high quality of individual and population health and development of the ethnos.

Kyrgyz traditional knowledge was passed down through the generations' verbally through stories, songs, legends and contain knowledge about their history, traditions, culture, and set of rules for restoration of natural resources. Return to restoration of traditional knowledge presents a unique approach and could be used as tools for the sustainable development.

Poster Sessions

Participatory Conservation of Latifi's Mountain Viper in Lar National Park, Iran

Hanyeh Ghaffari, Barbod Safaei-Mahroo, Jan Dohnal, Hadi Fahimi

Human-wildlife conflict is considered as a serious threat to the survival of species worldwide. Species conservation programs become more challenging when the target wild animals frighten humans to death like snakes do, therefore human-snake conflict mitigation is among the most difficult ones. Global distribution of Latifi's Mountain Viper (*Montivipera latifii*), an iconic endangered species, is restricted to a confined area in the central Alborz Mountains in Iran and mainly overlaps with the Lar protected complex boundaries (National park and No Hunting Area). The major threats to this viper are habitat destruction, overgrazing, illegal collecting and intentional killing by nomads and shepherds. In 2015, Pars Herpetologists Institute and zoological and botanical garden Plzeň together started a conservation project in Lar National Park in order to protect Latifi's Mountain Viper remaining population. The key aims of this participatory conservation project included reducing locals-snake conflicts in the area, changing attitudes towards the species through education and raising public awareness and improving awareness of tourists, as well as nomads and shepherds on the importance of *M. latifii* in its habitat and the ecosystem. The most important activities included face to face education of more than 12000 visitors, nomads and tourists in Lar National Park on the importance of Latifi's Mountain Viper, awareness raising via popular national TV programs and organizing the first Latifi's Mountain Viper festival.

Community-based conservation (including human-wildlife conflicts, community engagements in conservation/community initiatives, and sustainable livelihoods)

Kedar Gore, Harendra Singh Bargali, Naveen Pandey, Sharad Kumar, Devesh Gadhavi

The Corbett Foundation (TCF) was established in 1994 in India to primarily mitigate human-wildlife conflict in and around some of the important tiger conservation landscapes and other critical wilderness areas providing refuge to threatened wildlife species, and to provide an environment where humans and wildlife can co-exis. TCF believes in a holistic approach to wildlife conservation with active involvement and engagement of local communities that share the habitat with the wild denizens. TCF currently works in and around the tiger reserves and the connecting tiger corridors of Corbett, Kanha, Bandhavgarh, Kaziranga spreading over northern, central and eastern parts, and the semi-arid landscape of Kutch in the westernmost part of India. TCF's programmes reaches out to over 500 villages having a population outreach of over 100,000 people and 200,000 livestock. TCF recognises that the community must be provided the basic necessary facilities so that their existence does not have any negative impact on the ecosystem. With this philosophy, TCF provides interim cash compensation to villagers whose livestock is killed by tigers and leopards, provides alternative livelihood trainings to empower the community economically, provides regular medical and veterinary services to people and domestic animals, undertakes watershed programmes to facilitate sustainable and organic agriculture, restores degraded habitats and common community grazing lands for a long-term species conservation, provides solar powered fencing in preventing crop-raiding by wild elephants and other herbivores, and conducts ecological research that helps in monitoring the movement of threatened species such as Tiger and Great Indian Bustard. TCF is on the board of several governmental committees and corporate advisory bodies. TCF works closely with the forest department personnel and engages in capacity building of these foot soldiers. TCF's environmental awareness programme reaches out to the young minds through on-field activities and development of environment education resource material.

Abstracts

Resource partitioning and niche overlap among two sympatric civets; Asian palm civet and small Indian civet inhabiting north-eastern Himalayan region of Pakistan

Faraz Akrim, Tariq Mahmood, Sididqa Qasim

Diet composition of two sympatric carnivore species at Pir Lasura national park, Azad Jammu and Kashmir, Pakistan was investigated using scat analysis technique during 2014 – 2017. We used molecular identification technique to confirm for the carnivore species. Analysis of 108 scats samples of Asian palm civet showed that 27 species of mammals, birds, invertebrates and plants were consumed. Among all recorded species 9 were wild, 3 domestics, and 15 plant species. Consumption of wild prey was 33.68% compared to 10.88% domestic prey species and 53.37% plants. Analysis of 44 scats showed that 17 prey species occurred in diet of small Indian civet. Among them 8 were wild, 1 domestic, and 8 were plant species. Frequency of occurrence of wild prey in diet of small Indian civet was 30.65%, domestic prey 14.52%, and plants 51.61%. Niche breadth of small Indian civet was 0.52 whereas, of Asian palm civet was 0. 31. High niche overlap was recorded between Asian palm civet and small Indian civet 0.9.

Living with Tigers

Amy Fitzmaurice

Incidences of human-felid conflict (HFC), here defined as tiger and leopard attacks on both people and livestock, can adversely affect local communities, as it can result in physical and financial hardship, diminished psychosocial wellbeing, and lost opportunity costs (e.g. time spent guarding livestock). In turn, this jeopardizes conservation due to retaliatory killing of tigers/leopards and erodes community support for conservation efforts. Thus, it is imperative that effective preventive mitigation measures (hereafter interventions) are developed to reduce risk for both humans and felids, and foster co-existence in and around protected areas where large felids persist. My PhD project is assessing practical interventions for reducing HFC in Nepal, by evaluating the interventions implemented by the 'Living with Tigers' Darwin Initiative funded project led by Chester Zoo in collaboration with Oxford University-WildCRU, Green Governance Nepal and the Department of National Parks and Wildlife Conservation in Nepal. The ecological research covers camera trapping, genetic analysis, and footprint analysis during a two-year period. The social research consists of household surveys to investigate changes in attitudes and behaviours over a three-year period. This research assessment of interventions is vital for species conservation success, as tiger and human populations' increase, not only to protect wildlife but to benefit local people that are affected by endangered carnivores.

A study of people's perceptions of human-elephant conflict in villages around Kaziranga National Park in Northeast India

Naveen Pandey, Peter Lurz, Neil Anderson, Jadumoni Goswami, Tahir Ali

Human-elephant conflict (HEC) is a key issue today for conservationists in Asia and Africa due to increasing competition for space and resources between humans and elephants. This study explores people's perceptions of HEC in the villages along the southern boundary of the Kaziranga National Park (KNP), Assam in India. 140 villagers were interviewed in 29 villages using a semi-structured questionnaire between December 2016 and May 2017. Participatory risk mapping was conducted in three villages with 30 participants identifying perceived risks and their severity. The study found that HEC was a definite issue in villages around Kaziranga with HEC scoring a risk index of 0.986, greater than the combined risk index of wild buffalo and one-horned rhinoceros (0.881). HEC in Kaziranga is nocturnal and seasonal with peak activity in winter months of rice cultivation. Mitigation measures primarily consisted of traditional drive-away methods through shouting and burning used tyres to make light. Tobacco, chilli powder and honeybee were not used as mitigation tools in the study area. Villagers revealed intense respect for elephants as the embodiment of the elephant God, Ganesha and this sense of respect is of considerable value for conservation. Only 40% of the respondents were aware of the compensation policy of the Forest Department and 75% of them believed the compensation

process to be complex and the compensation amount inadequate. Farmers acknowledge support by the forest guards in patrolling conflict zones, but perceive it to be inadequate. Tolerance for HEC was obvious in the study area as most of the respondents (94%) expressed desire to stay in the same village adopting a combination of various mitigation measures. Affected farmers called for fencing their farm with solar power, efficient compensation scheme and all night patrolling by the forest guards. Further study is required to corroborate the perceived with actual risks.

Hunters in the hunting lands: the status of snow leopards in non-protected regions of Kyrgyzstan

Tamsin Rigold

Snow leopards (*Panthera uncia*) are an iconic, elusive cat found across the high-altitude mountains of Central Asia. The global population is considered to be at high risk of decline (1), with little of its range directly surveyed. Snow leopards face threats from prey reduction; illegal wildlife trade; habitat degradation; and retaliatory killings over livestock depredation. Within Kyrgyzstan multiple activities have land-use requirements across potential snow leopard habitat – more than 25% of the country (2).

This PhD research project is a collaboration between the University of St Andrews, Snow Leopard Trust, and Snow Leopard Foundation Kyrgyzstan. It will support the Global Snow Leopard and Ecosystem Protection Program (GSLEP) goal of '20 by 2020' (3), and the recently-launched Population Assessment of the World's Snow Leopards (PAWS) initiative (4); focussing on the question:

"How best to share land-usage to maintain the viability and connectedness of Kyrgyzstan's snow leopard population, and provide for snow leopard communities' well-being, now and in the future?"

Research locations will be non-protected, un-surveyed sites within the GSLEP Greater Sarychat landscape. Much of the landscape consists of multiple-use hunting concessions; for long-term snow leopard survival such sites must be able to provide additional, supporting habitat (5) beyond protected area borders.

Camera trapping and other methods will produce baseline surveys of snow leopard populations, and spatio-temporal data on land-use patterns; increasing the global population dataset. Participatory methods will investigate current local community land-use patterns, and potential future changes. From this, statistical and geo-spatial data analyses will identify the key biotic and abiotic drivers behind snow leopard and community land-use patterns, their interactions, and how to maximise opportunities for co-existence. Long-term sustainable shared-land management actions will be identified that can contribute to policy documents; aiming to scale-up increases in human and wildlife co-existence from individual sites across the wider landscape.

Antimicrobial Activity of Honeys from Kazakhstan, Central Asia

Sofiya Yunussova, Ludmila Yevstafeva, Lorna Fyfe, Ainur Zhulamanova, Azliyati Azizan, Pauline McLoone

Antimicrobial drug resistance is a global crisis requiring the urgent discovery of new antimicrobial agents. Wound infections, for example, are becoming progressively more difficult to treat because of infection with antibiotic resistant strains of bacteria such as *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Honey has been shown to have antimicrobial activity against a broad range of microbes and medical grade Manuka honey has been approved in some countries for clinical use in the management of wound infections. A multitude of honeys are produced around the world and some may have superior antimicrobial activity that are yet to be discovered. The development of local honeys into medical grade honeys suitable for use in clinical practice may be economically advantageous. Central Asia possesses a unique biodiversity with open steppe, desert and high mountains. Honey production is abundant in the region, but despite this, the regions honeys have

not been fully explored for potential biomedical uses. In this study, we investigated the antimicrobial activity of Kazakhstan honeys from a variety of floral origins against antibiotic resistant and non-resistant strains of wound infecting bacteria. More specifically, well diffusion assay was used to determine the anti-microbial activity of Kazakhstan honeys against bacteria, including; *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa* and *Acinetobacter baumannii*. Some of the Kazakhstan honeys demonstrated considerable antimicrobial activity that was comparable with Manuka honey (non-peroxide activity (NPA) 10+) and Activon medical grade Manuka honey. The findings suggest that honeys from Kazakhstan may potentially be used in the future as anti-microbial agents in the treatment of wound infections and emphasize the importance of conservation of the flora and honey bee populations in Kazakhstan.

Screening of Strepomycetes as Potential Antagonists Against Erwinia Amylovora for Control of Fire Blight

Olga Shemshura, Elvira Ismailova, Amankeldi Sadanov, Kulyash Iskandarova, Ainyur Seitbattalova, Raushan Kaptagay, Assel Molzhigitova, Alma Khasenova

Fire blight is a very harmful quarantine bacterial disease of apple, pear and other orchard crops. The appearance and spread of its causal agent *Erwinia amilovora* in Kazakhstan potentially threaten wild-growing *Malus sieversii* forests located in the foothills of the Zailiysky and Dzhungar Alatau, which are known as one of the centers of origin of *Malus* species.

Because of chemical control in protection forests and areas is strictly prohibited, the search for new methods and products for fire blight biological control and their application in the integrated plant protection system has an actual interest for Kazakhstan. In the recent year's biological control methods based on the use of antagonistic microorganisms isolated from various natural environments, including plants and soils, have been developed.

Streptomycetes from the collections of the Institute of Microbiology and Virology (Almaty) and the Republican Collection of Microorganisms (Astana) isolated from sandy, solonchak, takyr-like and meadow soils of Almaty and Kostanay provinces of Kazakhstan were screened for their antagonistic activity against *E. amilovora*.

The agar diffusion test was used to select potential antagonists. From 35 strains tested, six (9/2, K_{bm} , $22T_{I}$, $N10_{bm}$, 17T6, N1) were selected in accordance with the presence and diameter of the inhibition zones. The maximum inhibition of *E. amilovora* growth was demonstrated by only one of them (9/2). Strepomycetes manifesting inhibitory activity were mainly isolated from sandy soils of the Almaty region.

Selected strains of *Streptomyces sp.* are perspective for further study to develop preparations for fire blight biological control.

Effects of fire on lizards in forest habitats

Arman Kamangar, Hanyeh Ghaffari, Shahram Kaboodvandpour, Hedyeh Badakhshan

Fire has major impacts on ecosystems and burns are common in Zagros forest, each year vast areas of forest ecosystems are burned in Iran. The fire influences species by altering habitat, available resources, predation rate, reproductive success, species richness and abundance. We investigated the responses of lizards to fire in North Zagros Oak Forests. Field studies were conducted from late March to late October 2016, from 8 am to 5 pm. Surveys were carried out based on observation and using pitfall trap both in the recently burned forest and the unburned site. In each site which was 22 ha, 24 pitfall traps (20 cm width and 40 cm height in size) were installed randomly into the ground. Captured reptiles were identified, marked, photographed, measured and released on site. The higher number of species and specimens were observed in those microhabitats which were covered by tree and shrubs due to the availabilities of food and refuge. Our results indicated that

fire caused a significant negative impact on the lizard populations in Barghoro forest. Lizards were more abundant (67 %) in unburned site. Also, comparison of species diversity and richness indices between burned and control sites showed that the species diversity and richness in the control site was significantly higher than the burned site. Furthermore, we found fire could negatively impact large reptile populations as the abundances of some large species such as; *Timon kurdistanica* had declined considerably since 2015 fire in Barghoro Forest.

Occupancy Estimation and Habitat Selection of Red fox Vulpus vulpus, Stone marten Martes foina and Altai Mountain weasel *Mustela altecia* in Basha Valley, CKNP, Gilgit-Baltistan

Tahir Mehmood, Muhammad Ali Nawaz, Shoaib Hameed, Ejaz Rehman, Muhammad Shakil, Muhammad Younus, Hussain Ali, Sadam Husain, Fathul Bari

To estimate the occupancy of red fox (*Vulpus vulpus*), stone marten (*Martes foina*) and Altai mountain weasel (*Mustela altecia*) in Basha valley, Central Karakorum National Park, Gilgit-Baltistan, Pakistan, camera trapping survey was conducted from May to July 2017. Thirty motion-triggered (ReconyxTM) cameras were installed in seventeen grids of 5x5 km size across the study area. Cameras remained active for 1347 trap nights. Red fox was photographed 1529 times at 22 sites in fifteen grids, stone marten 742 times at 18 sites in eleven grids and Altai mountain weasel 20 times at 3 sites in three grids.

The detection probability of these three species varies from each other and is affected by the variable number of cameras per grid. Detection probability of red fox was highest (0.8824) amongst them followed by stone marten (0.7059) and lowest of Altai mountain weasel (0.1765).

The average estimate of occupancy for red fox was 0.8924 (±0.095 SE), stone marten 0.7079 (±0.10 SE) Altai mountain weasel 0.1970 (±0.128 SE). The variables have affected their occupancy; 'Slope' was most impacting covariate for red fox, 'distance from roads' effected the occupancy estimates of stone marten and four site covariates i.e. 'density of settlements', 'altitude', 'glacier cover' and 'distance from settlements' had effect on occupancy of Altai mountain weasel.

The preferred habitat for red fox is the area with good vegetations, higher altitude and away from human settlements. Stone marten preferred the area closer to human settlements, along the rivers and less vegetated areas. The preferred habitat for weasel is vegetated area.

The mean temperature in wettest quarter contributes maximum for habitat suitability of red fox and stone marten as 38.4% and 35.7% respectively, while Isothermality contributed most for weasel as 56.5%.

Innovative use of ICTs and 'citizen science' can inform management of mountain ecosystems through community involvement in monitoring

Matthew Emslie-Smith

Emerging Information & Communication Technologies (ICTs) and citizen science approaches have enabled innovative approaches in conservation to develop at the interface of science and society over the past few years. In particular, the general public and academic researchers alike have benefitted from widespread availability of new technologies such as the smartphone along with increasing connectivity. Citizen science is now a powerful approach not only for research purposes, introducing the possibility of 'big data' as never before, but also for every person engaged in the broadened scientific endeavor, particularly through the empowerment this can bring to local citizens and communities. These recent developments also help to bridge gaps between different sectors in society and between formal and informal governance and management of ecosystems.

Regular monitoring of ecosystems and wildlife is essential for their effective management, yet the vast areas of significant importance to biodiversity in Asia present challenges in terms of scale, especially in areas where there is limited conservation activity or funding. The emergence of citizen science technology presents novel opportunities to empower local communities as partners in conservation. Lapis Guides is a smartphone application, which allows users to easily document geo-tagged observations of wildlife, habitats, or indeed any feature of the environment and can enable local communities to participate more effectively in biodiversity monitoring, partially mitigating the challenge of scale. Meanwhile, empowering communities to actively participate in conservation monitoring and management of ecosystems and their services presents a clear win-win scenario at multiple levels.

The value and potential of emerging ICT tools in the context of biodiversity conservation in Asia, including China's national parks system, will be explored. This poster presentation identifies the functions of Lapis Guides as one of these new approaches and platforms for conservation, and its potential to serve as catalyst for community-based monitoring and co-management.

Snow leopard genetics across High Asia

Imogene Cancellare, Byron Weckworth, Tom McCarthy, Kyle Mccarthy

For multi-scale efforts across the twelve range countries, a key gap in snow leopard conservation pertains to their molecular ecology. There is present need for collaborative efforts seeking to generate more information on range-wide genetic structure of snow leopards, as these processes can elucidate transboundary conservation issues, population responses to climate change, explain spatial distribution, describe cryptic population structure, and generate information on the evolutionary history of species. Our range-wide snow leopard genetic study incorporates robust samples sizes with multiple genetic markers to evaluate snow leopard genetic diversity across a hierarchy of geographic space and time. Our objectives include describing range-wide phylogeography and contemporary population structure, and investigating which biotic, abiotic, and anthropogenic landscape features are most important in impacting snow leopard gene flow. We will also use this genetic data to model snow leopard distribution in order to address regional variation in connectivity. To date, we have identified 90 unique individuals from over 250 scat samples across five range countries. We are currently processing scat samples using newly-designed SNPs (single nucleotide polymorphisms) markers for snow leopards; this cutting-edge technology will allow us to delineate variation not detected with microsatellite markers. We continue to collect new samples via our generous collaborators, including previously unsampled areas, in addition to our own field efforts in summer 2018.

Our objectives will combine to identify key demographic units of snow leopards, geographic regions of high genetic diversity, and important corridors for gene flow within and between snow leopard populations. This poster details our progress on these efforts. This poster details our progress on these efforts. The results of our study will generate novel and critical information on snow leopard ecology, facilitate collaboration among international graduate students, researchers, and conservation practitioners, and provide defensible conservation units upon which snow leopard conservation efforts can refocus.

Actual data for the state of the summer bat colonies in South-western Kyrgyzstan

Heliana Dundarova, Alexey Dudashvili, Zheenbek Kulenbekov, Abdurashit Nizamiev, Dmitry Milko, Asel Zholdoshova, Aksana Chyrmasheva, Kursantbek Altybaev, Pirim Mamatkalykov, Begai Sultanbek kyzy

The south-western part of Kyrgyzstan is characterized by mountainous terrain and encloses the southern wall of Fergana Valley. These features suggest a variety of underground habitats which play an important role for the vulnerable bat communities. In addition, the life cycle of the cave-dwelling bat species is closely related to the underground sites. They form nursery colonies in the summer, which have high conservation priority. Unauthorized entry into the caves during this period

has a negative impact on the new-born bats. Due to this fact, extensive studies on the summer bat underground roosts were carried out from June to July in the south-western part of the country.

The obtained results for the summer monitoring will serve as a prerequisite to form the basis for a bat conservation framework in the region. Moreover, the study is a pilot for the transboundary territories of central Asia and is essential for future, more thorough, research on bats.

Distribution, morphological and genetic patterns of two soil mite species (*Acari: Oribatida*) from Southeast Asia

Badamdorj Bayartogtokh, Satoshi Shimano

We studied two species of soil mites, which found in Southeast Asia. The first species, *Eremaeozetes octomaculatus* is an Oriental and Oceanian species, currently known from the Western Samoa Island of Polynesia, Luzon and Mindanao Islands of the Philippines, Okinawa Island in the Ryukyu Archipelago of Japan, and recently we found it in the Java Island of Indonesia. This species appears to be primarily an inhabitant of tropical forests, and it prefers mosses and fungi growing on stones, tree trunks, as well as forest floors and decomposed plant debris. The other species is *Scapheremaeus nakanoshimensis*, which is the inhabitant of a subtropical forest in Nakanoshima Island in the Tokara archipelago, Southern Japan. The immatures of the *Eremaeozetes* and *Scapheremaeus* species are morphologically similar, which suggested a close relationship of the families Eremaeozetidae and Cymbaeremaeidae, in which these two genera are ascribed. We present the maximum-likelihood tree, which shows that the phylogenetic relationships have the maximum-likelihood and maximum-parsimony boot-strap support value and Bayesian analysis posterior probability. Data of analysis on 28S D3 gene sequence of these species is provided. Comparison of the gene sequences of both these species with other oribatid mites 28S D3 sequences identifies that these genera are closest relatives with regard to the species included in this analysis. Considering the limitation of single molecular marker and the wide geographic distribution of species in these genera, additional studies with more genetic data and extended sampling on a large scale will be helpful for further exploration of the genetic diversity of these genera.

Genetic Analysis of Snow Leopard Employing Next Generation Sequencing for Its Improved Conservation and Management

Safia Janjua, Jeffrey Peters, Byron Weckworth, Thomas Rooney, Fakhar Abbas, Orjan Johansson

Despite having the high profile of a charismatic carnivore, information on snow leopard biology, population structure, and genetics is scarce. This lack of information is largely a result of the snow leopard's cryptic nature and remote habitat. As a result, we lack sufficient data to identify population numbers, locations of peripheral and core populations, and areas where they are in decline. Such information is needed for the conservation of this apex predator. Genomic analysis of DNA extracted from non-invasively collected snow leopard samples can benefit conservation efforts by providing information about population densities, individual movements and habitat use, and the number and distribution of distinct conservation units. Previously, genotyping errors were common due to the low DNA yield and quality obtained from such non-invasive sources. These errors lead to incorrect inferences, such as misidentification of individuals. Next generation technologies have revolutionized the depth of information we can get from a species' genome. Here we used ddRAD-seq, a well-established technique for studying non-model organisms, to develop a reference sequence library for snow leopards using blood samples from five Mongolian snow leopards. Our final data set has 4504 loci with median size range of 221 bp. We identified 697 SNPs and low nucleotide diversity (i.e. 0.00032) within these data. However, the probability that two random individuals will share identical genotypes is about 10-175. We developed probes for DNA capture method using this sequence library which can be used for genotyping individuals from samples of scat. Genetic data from ddRAD-seq is proving useful for fine-scale resolution in identifying snow leopard population conservation strategies.

Abstracts

Patterns of livestock losses and people perceptions on snow leopards and Himalayan wolves in Central Himalayas, Nepal.

Madhu Chetri, Morten Odden, Per Wegge, Olivier Devineau

The existence of large carnivores in human-livestock dominated landscapes is a challenge for conservation management owing to livestock depredation and retaliatory persecution. An understanding of losses and local people's attitudes is vital in order to formulate long-term mitigation strategies. In a large landscape in Nepal trans-Himalaya (c 5000 km^2), we used structured interview surveys to assess losses from predation by snow leopards and wolves and to gain an understanding of people's perceptions about the problem. We used linear mixed effects models to examine the survey data. Our results showed that livestock depredation is site-specific, varying greatly across the landscape. Snow leopards were responsible for half of the kills (52%), and small stock (goats and sheep) were more vulnerable to depredation than large stock (yak, horse and cow). Losses occurred in all seasons and mainly when the herders were absent or far from the herd. Among farmers owning large proportions of large stock, the probability of loss increased with herd size, whereas no such trend was evident among farmers owning mainly small stock. Lowest probability of loss occurred in areas of low densities of livestock and high densities of wild prey. Local people were more tolerant towards snow leopards than of wolves, and those with multiple livelihood options were more positive than those with strictly agro-pastoral livelihoods. Furthermore, perceptions varied with livestock ownership and herd composition, sex, age and literacy. Overall, annual livestock losses to carnivores was low (ca 2%), but a marked spatial variation indicates that site-specific measures and improved monitoring systems are required. There is a need for clear incentive policies and mitigations measures both within and outside protected areas.

Extremophiles from unique ecosystems of Kazakhstan as potential producers of novel antibiotics

Lyudmila Trenozhnikova, Ainur Zhulamanova, Meruyert Alibekova, Zhanat Koshenov, Dinara Iskhakova, Yelena Marchenko, Ludmila Yevstafeva, Pauline McLoone, Azliyati Azizan

Introduction:

ESKAPE bacteria (*Enterococcus faecium, Staphylococcus aureus, Klebsiella pneumonia, Acinetobacter baumanii, Pseudomonas aeruginosa, and Enterobacter* spp.) are drug resistant Healthcare-Associated Infection (HAI) pathogens that pose the greatest threat globally. Actinomycetes strains are the main producers of currently used antibiotics, including streptomycin, tetracycline and lincomycin. Microorganisms that exist in extreme environment known as extremophiles include Actinomycetes species. The goal of this study is to discover novel antibiotics from Kazakhstan against ESKAPE pathogens from actinomycetes grown in extreme conditions for antibacterial activity.

Methods:

Soil from extreme environments of Kazakhstan was collected and cultured for isolation of pure cultures of Actinomycetes species. Pure strains of Actinomycetes were then cultured in modified Bennett's broth containing either high salt or high pH to mimic extreme environment in the soil. Antimicrobial compound was extracted with butanol and tested for activity against *S. aureus* and *E. coli*. After this screening, wells assays were performed to assess the inhibitory activity of the extracts against hospital strains of ESKAPE pathogens.

Results:

A total number of 5936 strains were isolated from variants of modified Bennett's agar; from these, 2019 strains of extremophile actinomycetes were further isolated into pure culture (756 strains from Northern Kazakhstan and 1263 strains from Southern Kazakhstan). Of these, 415 actinomycetes

strains were chosen and analyzed based on their ability to show antibacterial inhibitory activities. Zones of inhibition for *A. baumanii, S. aureus,* and *E. faecium* were detected when these organisms were grown in the presence of some of these extracts.

Conclusion:

From screening a few hundred extremophile strains, we identified some interesting candidate extracts with putatative antibacterial activities against several Kazakhstan hospital strains of ESKAPE pathogens. Initial chemical characterization of the extracts was performed using HPLC and showed promising results. These extracts are being further investigated for their specific therapeutic potential as novel antimicrobial.

Assessing vulnerability of China's ungulates to droughts

Lyubing Zhang, Luke Gibson

Increasing threats of anthropogenic climate change on biodiversity have boosted the development of climate change vulnerability assessments (CCVAs) for species and ecosystems. As an important component of climate change, changing frequency or magnitude of extreme climatic events has received attention in CCVAs, due to their dramatic impacts on populations and habitats. Extreme climatic events usually take a variety forms such as droughts, cyclones, and floods. Among these phenomena, droughts are considered to have a major impact on ungulate species through reducing adult survival rate, reproductive rate, and raising intra- and inter-specific competition. Due to global warming, increases in drought frequency or intensity have already exacerbated drought impacts on both human and natural systems in East Asia since the 1970s. China covers over 80% of the area of East Asia, where many regions have repeatedly suffered massive damage due to catastrophic flooding or prolonged droughts. Aiming at assessing drought vulnerability of ungulate species and subspecies distributed in China, we identify ungulate species most vulnerable to drought impacts, based on species intrinsic sensitivity and adaptability to droughts, conservation status, and exposure to recent drought events. We also highlight areas where ungulates are most likely to face high risks posed by droughts, to facilitate national and regional conservation planning and climate change risk management. As China recently started to take strong actions towards the initiative of improving conservation efficiency, assessing vulnerability of ungulate species to drought impacts is expected to provide insights for biodiversity conservation plans responding to climate change.

Towards greener Chennai – sustainable urban greening strategy for a water deficit, cyclone prone expanding city

Muthu Karthick Nagarajan, Avantika Bhaskar

Urban green spaces are a significant contributor to sustainable development. Chennai presently is one of the densely populated cities in India. Over the years, the city has been rapidly losing its tree cover because of ad-hoc growth and poorly planned expansion, and more recently to cyclone Vardah in 2016. The present study reviewed green cover status and has proposed a plantation strategy for Chennai. Land cover analysis of the city revealed high built up area at 71%, followed by vegetation (15%), open area (8%) and waterbodies (6%). In most of the areas, the green cover has degraded to different degrees or variously modified due to continuous human interference like lopping, grazing and introduction of exotic and invasive species. Across the city, vegetation canopy cover was estimated at 15%, which means 85% of city is without natural shade. Nearly 120 tree species were recorded in Chennai. The study revealed that at least four of the most dominant species recorded in Chennai including *Albizia saman, Delonix regia, Peltophorum pterocarpum* and *Tamarindus indica* are non-native species, which were introduced by colonial rulers. Over the years, these species have been preferred for planting for their ability to grow fast and provide shade. However, these trees do not have the deep-rooted stability as native

species, and cannot withstand cyclonic storms. Additionally, documentation of the street trees revealed lack of maintenance of plants on pedestrian pathway, medians and traffic islands. With increasing population and steep increase in built up area, there is need to preserve and enhance the existing green spaces besides taking concerted efforts to augment and maintain new tree cover. A list of 90 native species which are resilient have been prioritized for Chennai. The greening plan also includes strategies for sustainable water management for irrigation and implementation of a program for community engagement.

'Management' as anathema to conservation: the case of two new water related Acts in India

Neha Sinha

India is a signatory to environmental multilateral agreements such as Convention on Migratory Species (CMS), Convention on Biodiversity (CBD) and Ramsar treaty. India is also a fast-growing economy and the Indian government has announced several national schemes, ostensibly to boost India's economy. Simultaneously, the government has also changed environmental legislation. Two recent new Acts are on water- the National Waterways Act, 2016, and the Wetland Rules, 2017. An analysis of both Acts was carried out. Both emphasise the sovereignty of the country by extending control of natural resources, ie water. The National Waterways Act envisages creating highways or waterways in rivers; it states that it is in "public interest" to "develop and regulate waterways". The 2017 Wetland Rules accord power to states to decide what to do with wetlands, while withdrawing description of wetland ecological criteria for wetland identification, or prescribing punitive measures for contravention of Wetland Rules, which the prior Wetland Rules 2010 had. Firstly, it is noted that both Acts envisage engineering or managing ecosystems as a positive step towards stated national goals of development. Secondly, though both legislation involve freshwater, and several wetlands are connected to rivers, no connections or references were made to each other in the Acts. The analysis reveals that while goals of 'development' have been mainstreamed – namely by trying to change natural infrastructure, there is a long way to go in mainstreaming biodiversity conservation and ecological sustainability in the development discourse, and new legislation can be a step down from previous safeguards or laws for biodiversity conservation. The paper will contrast new and old legislation, placing in perspective changes made, and where they fit in to CBD and Sustainable Development Goals. The paper will also discuss how words such as 'development', 'regulation' and 'management' can mask decisions which disregard biodiversity conservation.

Tigers conservation through a genetic lens

Uma Ramakrishnan, Meghana Natesh, Prachi Thatte, Anubhab Khan

Like other endangered species, tigers face several conservation challenges including the impacts of fragmentation. We used genome-wide SNP data to identify 'genetic landscapes' for Indian tigers. This research points to a genetically impoverished, isolated tiger population in Western India. Whole genome analyses based on identified individuals reveals high inbreeding within this population, and helps reconstruct a putative pedigree. Conversely, our results suggest that the Central Indian landscape has high genetic variation. Microsatellite-based landscape genetic analyses reveal that high traffic roads and high density human settlements negatively impact tiger movement. Future simulations of this landscape allows assessment of the impacts of further fragmentation on population extinction, genetic variation and connectivity. Together, our results substantiate a need to monitor individuals, relatedness and connectivity between populations across tiger range. This requires a cheap, fast, reliable and easy methods to genotype several thousands of individuals across tiger range. I will end by exploring this possibility.

Building Monitoring Network for Endangered Bird Species through Citizen Science: The Wintering Census of Scaly-sided Merganser Project

Qian Wei

Scaly-sided Merganser (*Mergus squamatus*), also called Chinese Merganser named by the location of type specimen. It is an endangered species in IUCN red list. As the data showed from Waterbirds Population Estimation all over the world by Wetland International, all the individuals of scaly-sided merganser are less than 10,000, and this number continues to decline.

The Wintering Census of Scaly-sided Merganser is a citizen science project launched by China Birdwatching Association with the extensive participation of birdwatching societies, reserves, wetland parks, universities and scientific institutes all over China.

The project was held on September, 2014 by China Birdwatching Association (Rosefinch Center) as the first time. During the period between 2014 and 2018, the field research covered more than 400 observation sites in 25 provinces, autonomous states and municipality cities. The research areas involving the southern, middle and eastern parts of China that cover the ten main basins of Yellow River, Yangtze River, Huaihe River, Pearl River, Yalu River, Lancang River, Liaohe River, Haihe River and the rivers at the southeast coastal part.

The wintering population or individuals of Scaly-sided Mergansers were found in 19 provinces. Be the result of this census, as which include in the official report, 1138 Scaly-sided Mergansers totally, with 452 males and 683 females or juveniles.

The type and quality of data collected on the birds and their habitats has also never been achieved in the past, which can be considered as a survey precedent that was launched, financed and implemented by non-governmental organizations on single species of waterfowls. This has promoted the establishment of local protection policies and communities, which have been recognized by domestic and foreign ornithological scholars and organizations. This survey activity is the most scaled of the wintering situation to a certain species of waterfowls to this day.


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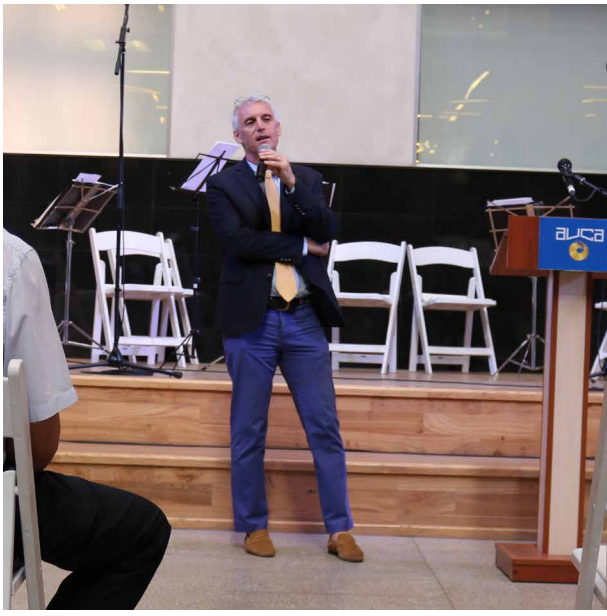


Taalai Mambetov


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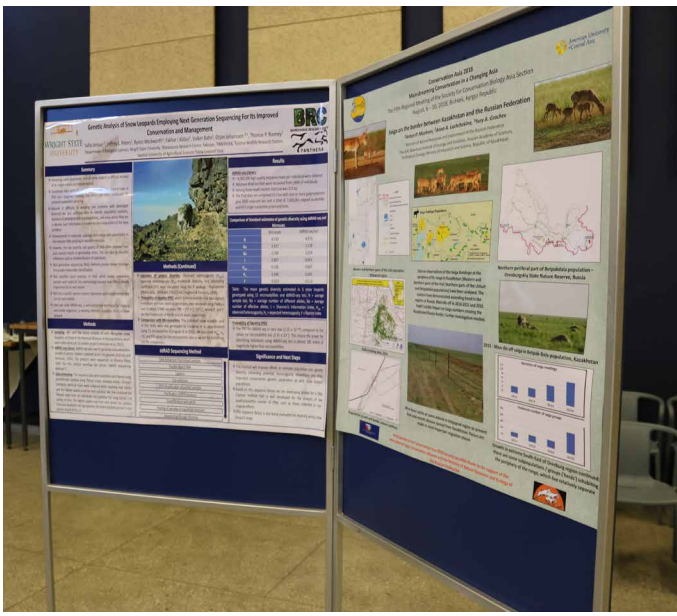
Genetic Analysis of Snow Leopards Employing Next Generation Sequencing For its Improved Conservation and Management
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