AMERICAN MUSEUM ᴏꜰ NATURAL HISTORY

CENTER FOR BIODIVERSITY AND CONSERVATION

Student Conference on Conservation Science – New York

Talk and Speed Talk Abstracts

October 20–22, 2016

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Land use and ant–mediated pest control services in coffee–dominated landscapes

The interaction between ecosystem services (ES), biodiversity, and land cover change has been of great interest in recent years. Pest control is an important example of an ES provided by biodiversity that can be regulated by landscape structure. To investigate the relationships between landscape structure and pest control, we manipulated ants through exclusion experiments and compared coffee berries inside and outside exclusion experiments in coffee–dominated landscapes in Southeastern Brazil. We measured efficiency of pest control of the coffee borer beetle (CBB), coffee's most economically influential pest, in exclusion of ants and among ten landscapes that differ in land cover and gradually differ in forest cover from 10–55%. We tested whether the interaction of exclusion of ants with distance to the nearest forest fragment, forest cover at two levels (2km and 300m), and coffee cover (300m–level) influence percentage of CBB infestation and coffee bean damage. Results show that CBB percentage and bean damage increase as coffee cover intensifies at the 300m–level and decreases as forest cover augments at the 2km–level. In addition, the farther away from a forest fragment, the more CBB infestation and bean damage is found. In conclusion, coffee producers benefit from the presence of ants and the inclusion of forest fragments in their properties. This study provides firsthand, valuable data useful when planning multifunctional landscapes that could contribute in the reconciliation of agricultural production and biodiversity conservation.

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What fosters ranchers' pledge to participate in wolf conflict mitigation strategies?

Fostering ranchers' commitment to participate in carnivore conflict mitigation strategies is an important goal of achieving human–carnivore coexistence and conservation, especially in rural settings where humans live in proximity with carnivores. However, little empirical evidence exists to describe factors that influence such commitments. We interviewed 46 ranchers to investigate their commitment towards participating in wolf conflict mitigation strategies designed to reduce conflict and increase human–wolf coexistence in Washington State. This data collection was part of a larger project to assess the social and economic feasibility of wolf recovery in Washington State. We analyzed ranchers' responses to three questions: (1) how do they feel or what do they think about the return of wolves to Washington State? (2) What mitigation strategies are they currently implementing to prevent depredation of their livestock? And (3) what other mitigation strategies would they participate in and what would increase their participation? We analyzed the data using qualitative methods specifically structural and in vivo initial coding in order to gain a deeper understanding of the data patterns, followed by second phase coding and grounded theory to recognize and develop nuanced but salient theories from the data. Preliminary results show that ranchers' perspectives towards the return of wolves are related to their commitment to participate (or not) in wolf conflict mitigation measures. There are wide variations of what types of mitigation strategies ranchers can commit to, and the reasons for their commitment (or lack of) also varied widely depending on their attitudes and value orientations towards wolves.

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Land change around protected forests of the New Jersey Highlands: 1986–2012

Although the establishment of protected areas (PAs) has been an important forest conservation tool within the U. S. since the turn of the 20th century, protected lands are not decoupled from the surrounding landscape. The land cover types bordering protected forest (PFs) can influence forest processes and communities, aggregating across time and space within the larger network. I examined the 26 year stability of land cover within a 250m buffer of PF fragments in a region of active conservation acquisition and urbanization, the New Jersey Highlands. One–third of the Highlands now has protected status; forests occur on roughly 60% of those lands. Using land cover data from 1986 and 2012, I classified PF fragments greater than five hectares (n = 1287) according to size and the percent urban, agricultural, and natural lands in the buffer around each. Fewer than 50% of any size class had buffers dominated by agricultural or developed land but smaller forest fragments had the most heterogeneous buffers. About 20% of the fragments had a shift in the buffer land cover classification from 1986–2012. Agricultural loss and/or an increase in developed land were the most common shifts. Such changes in the buffers can directly impact the species, pollutants, and habitat heterogeneity in protected forests, but may be moderated by the size, area to perimeter ratio, and management practices of each fragment. Fragments with buffer shifts should be a focal point of study to understand the lag time between external landscape change and PF community response.

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Close encounters of the parasite kind: alien invasions and their parasites in Panama

The spread of non–native, invasive species is a significant threat to biodiversity conservation worldwide, in part because of their ability to introduce diseases to new environments. For this reason, it is important to consider the ecological drivers of parasite transmission in recently expanded ranges of parasites and their invasive species hosts. Here, we evaluate how a unique assemblage of non–native trematode parasites are establishing in the Isthmus of Panama, a crossroads of oceans and continents. Using natural field surveys and experiments in 26 lake and stream sites, we assess the relationship between native bird host abundance and diversity on the abundance and diversity of introduced parasites. We find that higher abundance and diversity of native birds is strongly associated with higher abundance and diversity of non–native parasites. We also evaluate how these trematodes interact with a community of native and non–native fish hosts. In nature and in laboratory experiments, we find that an introduced parasite can successfully infect all available fish hosts, but has more success at infecting an ecologically dominant invasive fish than native fish. This suggests that an introduced parasite has rapidly adapted to a locally invasive fish host with which the parasite does not share a common evolutionary history. Finally, we discuss how testing basic processes of disease transmission in an introduced range of parasites and hosts provides important theoretical insights to parasite ecology and evolution, but also provides valuable practical applications for addressing the spread of diseases to new environments.

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Museum and citizen science records change distributional estimates for the olinguito

In the context of global change, a necessary first step for conservation of species is gaining a good understanding of their distributional limits. This is especially important for biodiversity hotspots with high endemism such as the Northern Andes. The olinguito (Procyonidae: *Bassaricyon neblina*) is a newly described, medium–sized carnivoran found in Northern Andean cloud forests, with distributional estimates recently published (2013). As most occurrence records and previous studies stem from formerly misidentified museum specimens, occurrence records are scarce and therefore extremely valuable. In this study, we build ecological niche models in Maxent, calibrated using two types of occurrence data—carefully georeferenced museum and citizen science records—along with 19 bioclimatic variables. Exhaustive georeferencing of museum records was achieved by integrating information from verbatim localities, topographic maps, gazetteers, and field notes. Citizen science records (photo–vouchers) were obtained through bird watchers, locals, and researchers. Optimal Maxent models were selected via two different approaches, AIC and performance on withheld data. The AIC–optimal model was chosen because visual inspection indicated that it aligned more closely with our current knowledge of the species in terms of elevation. The occurrence data used here have a different climatic signal than data used in the original description of the species, with the current model showing more extensive suitable area in Northern Colombia. This model also highlights areas for future sampling. Based on the model, we will perform a formal conservation assessment using IUCN criteria, taking into account climate change and deforestation.

James Herrera

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Response diversity in lemurs of Madagascar promotes ecosystem resilience

Habitat loss and climate change are affecting the environments in which species function. Response diversity—the diversity of responses to environmental change among species that contribute to ecosystem functioning—promotes ecosystem resilience because the composition of communities change as the environment changes but overall function is preserved. Response diversity is evidenced statistically by an interaction between the species identity and the environmental gradient on abundance. I surveyed 31 transects in five localities in southeast Madagascar to measure lemur abundance, elevation, tree species richness, tree diversity, lemur food tree abundance, forest structure, and human disturbance history. I tested for an interaction between species identity and each environmental factor, while controlling for the phylogenetic relatedness of species and spatial effects. I found that 13 species co–occur in the region, but only 5–10 species co–occur on each transect. Variation in lemur abundances was explained by interactions between species identity and each of the environmental variables, suggesting different species react individualistically as the environment varies. The greatest response diversity was

observed in relation to elevation and tree diversity. The abundance of six species increased with increasing elevation, while five species decreased. The abundance of seven species increased with increasing tree diversity, while four species decreased. These results illustrate that communities composed of species with different responses to environmental gradients increase the resilience of ecosystems in the face of environmental change, and future conservation policies should also focus on response diversity in addition to species diversity.

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Examining the effect of billboards on local engagement with human–wolf conflict

Large carnivore reintroductions, motivated by ecosystem restoration, ecosystem health, and ecotourism, have become commonplace in modern conservation. Despite the benefits of such programs, real or perceived human conflict with carnivores can jeopardize efforts to restore carnivore species. Reintroductions of gray wolves in the American West are particularly polarizing, and opposing views are often popularized via a variety of media. I examined public billboards, both for and against wolf colonization, in Spokane, WA. These billboards presented an ideal medium for examination of human–wolf conflict due to the visibility and clarity of opposing viewpoints. I used social science concepts—framing, affect, affordance, and the psychology of advertising—to assess how billboards shape public perceptions of wolves. I analyzed visual imagery, traced frames in newspaper articles, and conducted interviews with a range of key informants in the surrounding area. My results show that billboards attracted attention to the issue and increased tension within the debate, but were limited in their ability to stimulate long–term engagement due to a discrepancy between their structure and intended impacts. The visual imagery on the billboards only aligned with extreme viewpoints, and the target audience—undecided and unbiased locals—did not have the necessary social and cultural contexts to respond positively to them. This disconnect limited the influence of the campaigns to a short–term inflammation of the debate. This case study serves to caution stakeholders into careful consideration about which techniques should be relied upon to motivate engagement, and the necessity for focused alignment of imagery and frames.

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Eurasian harvest mouse (*Micromys minutus*) movements across eroded ecological networks

Habitat fragmentation and degradation of ecological networks have been identified as an influencing factor of *M. minutus* population viability, although, this has yet to be fully quantified. Mortality rates over winter for this species can be as high as 95%, therefore well connected habitats are essential for maintaining genetically viable populations. The development of a novel ecological survey method for studying *M. minutus* has allowed this previously unmeasured ecological parameter to be recorded. Within a specially designed release enclosure located in semi–improved grassland, various sized gaps were created in cross sections of 'hard' (artificial road surface 4.8m) and 'soft' (mown, with low vegetative cover 1m, 2m and 4.8m). Movements of a reintroduced population of *M. minutus* (Soft ♂N=5, ♀N=9; Hard ♂N=8, ♀N=13) over these gaps were recorded. This method utilised a combination of an automated Radio Frequency Identification network and individually fitted Passive Integrated Transponders. Movements over smaller 'soft' gaps were frequent in both sexes ($\bar{x}$: 1m ♂=2.6 ♀=3 and 2m ♂= 0.8 ♀= 1.44) with no significant difference between the sexes (P = 0.945, 0.957 respectively). Whilst both genders crossed narrower fragments that have ground vegetation, as gap width increased willingness to cross decreased significantly (P < 0.001), with little or no crossings of the 4.8m gaps. The implications here suggest that gaps over just 2m will impede movement and dispersal of both sexes, with potential genetic implications on *M. minutus* populations.

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Nutrition ecology and conservation of the Tana River Mangabey, *Cercocebus galeritus*

The nutritional properties of the primate foods strongly influence their survival and reproductive success. Thus, knowledge of nutritional ecology is fundamental to successful conservation of endangered species, particularly efforts to enhance local habitat quality. The Tana River Mangabey (*Cercocebus galeritus*) is highly endangered, but little is known about the chemical properties of its foods and how those data might improve its conservation. I studied juveniles and adult females

in the lower Tana River, Kenya for 15 months to examine two questions: (1) how do plant foods eaten vary in nutritional content?; and (2) can such nutritional information be used to foster long–term conservation? I collected feeding data using focal animal sampling and conducted laboratory nutritional analysis of 81 plant foods. Preliminary results indicate *Phoenix reclinata* (36.43±3.40%) and *Ficus sycomorus* (14.43±1.65%) had the highest relative frequency in the diet. Foods with highest percentage of fats, digestible fiber, and protein were the; seeds of *Mormodica trifoliate*, leaves and seeds of *Brachiaria subquadripana* (42.12%), and young leaves of *Cordia goetzii* (28.86%), respectively. Protein was unlimited, but most foods were poor in lipids, which is typical of most frugivorous primate foods. Crude protein and digestible fiber in this foods were significantly higher compared to crude fat (F = 70.490, N=81, p<0.0001). Leaves, flowers, and seeds had significantly higher crude protein content than fruits, stems, pith, roots and gum (F=9.41, N= 81, p<0.0001). Thus, restoration efforts to conserve this species and its habitat should adopt the preferred species rich in caloric returns and lipids.

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Need for speed: does a slow life history lead to high extinction risk?

We are in the midst of the sixth mass extinction episode in earth's history. Approximately 690 species (13%) of mammals are Endangered or Critically Endangered, 176 of which are primates. Previous work has investigated which traits contribute to the extinction risk of mammals, finding that high body mass and slow life history were linked to extinction threat. There has not been a study focusing on primates, which have an especially high proportion of endangered species (39%). We compiled data on IUCN Red List status, body size, gestation length, home range size and human impacts (composite variable of human population density, road density, land conversion, and land use) on primates from the literature (n=259 species). To test which variables best predict conservation status, we performed multiple regression analyses, controlling for phylogeny. We found that threat status increased with increasing body mass (r=0.12, p=0.04), gestation length (r=0.11, p=0.05), and human impact (r=0.075, p<0.001), while home range size was not related to conservation status (r=−0.008, p=0.58). Species with longer gestation periods, higher body mass, and higher human impact have an increased risk of becoming extinct. Based on our results, species with long gestation length and high human impact that have low conservation status should be re–evaluated and their IUCN Red List status updated. By targeting these species, conservation funds can be allocated to protecting those with higher extinction risk. Similar research should be done for non–mammal species to determine if the same life history patterns present in mammals hold in other taxonomic groups.

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Participatory visioning of pathways and constraints for REDD+ in Indigenous lands

Recent estimates suggest that, globally, ~20% of tropical forest carbon is stored in Indigenous territories, both recognized and under claim. As such, Indigenous peoples have the potential to play a preponderant role in the climate change mitigation mechanism, Reducing Emissions from Deforestation and Forest Degradation (REDD+). To increase the benefits of REDD+ and attenuate its deleterious impacts on people, social safeguards have been set forth by the United Nations Framework Convention on Climate Change (UNFCCC) and other agencies. Putting these safeguards into practice, however, may prove challenging, particularly in "fragile states". Potential dissonance with broader development goals, incongruent policy and governance frameworks, and cultural and communication gulfs with forest stewards are some of the difficulties that may plague REDD+. We contend that facilitated land–use planning may prove useful in addressing these challenges, and determining if there is a place for REDD+ in Indigenous territories. Using the Upper Bayano Watershed in eastern Panama, and working with Embera and Kuna Indigenous peoples, we illustrate how this approach, including participatory mapping, scenario building and visioning, can effectively capture indigenous worldviews of nature, land and livelihoods. We also demonstrate how opportunities and constraints for REDD+, both within and outside its policy and implementation sphere, are elucidated. Our study reveals a growing disconnect between Indigenous visions for land use and the current state of their territories. This is symptomatic of a process of acculturation that could jeopardize REDD+. We explore pathways forward for REDD+ that embrace and align with Indigenous culture and means of living.

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Leaps and bounds: landscape connectivity through amphibian composition & genetics

Amphibians are globally imperiled, and often require intact, heterogeneous landscapes to complete their complex life cycles. Many amphibians use geographically isolated wetlands (GIWs) as breeding sites and for larval development and use surrounding upland for forage and cover during the non–breeding season. Hence, the composition, configuration, and connectivity of the landscape influence population dynamics of the organism(s), and in turn population genetics may inform the ecological patterns and processes of the landscape. In our study, we examined amphibian community composition and genetic distance among populations within GIWs to determine how land–use affects landscape connectivity. We surveyed amphibian species from 36 GIWs embedded in a range of upland land–uses on the Dougherty Plain of Southwest Georgia, USA. These GIWs were arranged in complexes of three wetlands within 350m of one another's borders. Specifically, we developed models to identify land–use variables that explained patterns of species richness, diversity, evenness, and similarity of amphibians as a clade, as well as variability in genetic distance of two focal amphibian species (*Lithobates sphenocephalus* and *Acris gryllus*) within and among wetland complexes. Potentially explanatory variables included land use (i. e., forest, agriculture, wetlands, and road density), isolation, and hydroperiod. We found that percent forest within a 500m buffer was an important predictor of amphibian species richness; correlations between landscape aspects and genetic relatedness data are pending. A deeper understanding of landscape connectivity could assist future land management, especially if stated goals include increased biodiversity or the protection of threatened amphibians.

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Do cultural taboos conserve wildlife?

Several contesting claims exist about the role of Indigenous communities in wildlife conservation. Although cases of local conservation behaviour have been documented, focus has shifted from labeling indigenous people as guardians or exploiters to identifying socio–political factors leading to local conservation within the broader context. We empirically tested the effectiveness of cultural norms, especially hunting 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. Monthly data were gathered on wild meat consumption, hunting and observance of taboos with a representative sample of 90 households from January to September 2014. These variables were modelled as a function of household wealth, education, ethnicity and seasonality using a mixed–effects framework. Results show that rich outsiders and wealthy Idus consumed considerably more game meat than other groups. Observance of taboos was stricter in Idus of lower wealth classes and with lower levels of education. Though taboos apply to anyone that consumes game meat, they are stricter and longer for the hunter. Wealthier Idus bought meat from the less wealthy thereby using wealth to transfer the burden of taboos over to the poor. Combined with long–term qualitative data we show that in this situation cultural restrictions do impact game hunting. However, taboos are less effective when the society is linked to wider market economy as is the case with wealthier Idus. Our research contributes to debates on making conservation more locally relevant by incorporating complex dimensions of human–nature relations.

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Fostering habitats: identifying drivers of the illegal slow loris trade in Vietnam

Vietnam is known for high levels of biodiversity as well as rapid rates of economic growth, agricultural activity, deforestation, and illegal trade in wildlife. Illegal trade is a particularly important threat for an endangered nocturnal primate present in the local, national, and international trade: the slow loris (genus *Nycticebus*). We present a study on the effects of socioeconomic factors on the decisions of people to engage in hunting or selling of slow loris in northern, central, and southern Vietnam, and how they relate to potential policy interventions. The data were collected from 112 individuals across the country in both urban centers and rural villages using semi–structured, open–ended interviews and a respondent–driven sampling strategy. Interview answers were coded and analyzed using descriptive statistics in STATA. Very few people (23 individuals) overall reported hunting or selling slow lorises. Male respondents with higher income levels, environmental knowledge, living in rural areas far away from a health clinic tend to hunt and sell pygmy slow loris in areas in which their population is low or

not expected, and Bengal slow loris in areas in which their population is high. However, none of these differences were found to be statistically significant. A higher sample size might be able to provide more support for these trends. In the long run to reduce illegal wildlife trade, the Government of Vietnam and other agencies should invest in a combination of enforcement to reduce supply and public education to decrease demand.

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Environmental DNA methods for conservation of rare freshwater species

Amidst a global extinction crisis, freshwater species are declining at five times the rate of terrestrial vertebrates. A first step to stem species loss is possession of a clear understanding of distributions. Unfortunately, conventional methods for sampling aquatic organisms are not well–suited to rare species. The amount of time, effort, and the invasiveness of methods required to detect presence/absence of rare species in large aquatic systems often makes such research infeasible. Here we demonstrate that shed DNA extracted from river water samples (environmental DNA or "eDNA") enables species–level assignment of small degraded fragments of DNA. This approach can help to overcome the limitations often presented by conventional methods when sampling for occupancy of rare aquatic organisms. We demonstrate the utility of this method through a case study on Australian lungfish (*Neoceratodus forsteri*) and several other rare species native to subtropical Australian rivers, where we found that eDNA techniques enabled accurate, sensitive, and non–invasive detection of presence. An analysis of variance in sequencing results from replicate samples that we amplified using universal fish primers and universal eukaryote primers showed that the velocity of the river at the sampling point has a significant influence on detection probabilities. The eDNA method is rapidly gaining popularity, but more work is needed to understand detection probabilities and design sampling strategies accordingly. Broader application of these methods has the potential to provide data that are essential for the conservation of rare and threatened organisms in a wide range of aquatic systems.

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Testing unmanned aerial systems for behavioral observations of marine mammals

Managing marine mammal populations and mitigating harmful impacts of human activity are often hindered by limitations of tools available for gathering behavioral observations of animals, those needed to identify critical habitats and threats of disturbance. Unmanned Aerial Systems (UAS) are rapidly being employed as non–invasive remote–sensing tools for wildlife monitoring, management, and conservation. Small multicopter UAS equipped with high–resolution cameras show great potential for remote observations of marine mammal behavior, yet their effectiveness at this task and potential to disturb marine mammals has not been thoroughly investigated. In this study, we evaluated the effectiveness of commercial multicopter UAS to: 1) track the movements of bottlenose dolphins (*Tursiops truncatus*) and Antillean manatees (*Trichechus manatus manatus*) from small, threatened populations at Turneffe Atoll Marine Reserve in Belize; 2) conduct fine–grained behavioral observations; 3) identify group sizes; and 4) test whether they cause behavioral disturbance in focal animals. During 53 boat trips in 2015, we piloted 88 flights of multicopters at varying altitudes above the animals (5–50 m) and distances from the boat (0–800 m), and gathered ~16 hrs of aerial video observations of focal animals. In most observations, animals did not visibly respond to the craft, resulting in only five brief potential attendance responses by dolphins. Our results illustrate UAS are powerful non–invasive tools for gathering low–cost aerial observations that radically improve our ability to track marine mammal surface movement, continuously observe behavior, and verify group sizes, and provides support for the use of UAS for marine mammal conservation.

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Estimating the persistence of seaside and saltmarsh sparrow populations in New Jersey

Globally limited to 45,000 km², salt marshes are threatened by a myriad of anthropogenic influences. Among the most prominent is sea–level rise, which is projected to continue at accelerated rates and reduce global salt marsh area 20–45% by 2100. Endemic salt marsh inhabitants are particularly vulnerable to salt marsh loss and degradation and may be unable to adapt to rapidly changing conditions. Along the Atlantic coast, seaside (*Ammodramus maritimus*) and saltmarsh (*A. caudacutus*) sparrows are year–round endemic species with declining breeding populations from Maine to Virginia. Because the vital rates and factors affecting population persistence vary regionally for both species, localized assessments are

required to best predict individual population persistence. We used a metapopulation model to estimate the population viability of the breeding Seaside and Saltmarsh sparrow populations in Forsythe National Wildlife Refuge, New Jersey over a 42–year period. In our models we incorporated empirical data on the vital rates and abundances of these populations and simulated the effect of low (0.35m) and high (0.75m) levels of sea–level rise through habitat loss. We found that the Seaside Sparrow population persists under both sea–level rise scenarios. The Saltmarsh Sparrow population reaches a quasi–extinction threshold within eight years under the 0.35m sea–level rise scenario. Using the same modeling framework we modeled potential management scenarios for the Saltmarsh Sparrow population and found that fecundity and survival rates will require dramatic increases for the population to persist beyond the next 10–30 years.

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Can camera traps provide accurate population density estimates for northern quolls?
Density estimates are frequently used to guide conservation management decisions, yet these estimates are often invasive, costly, and difficult to acquire. Remote sensor technologies such as camera traps are becoming popular research tools to overcome these issues, however, further validation is required. 'Photographic–recapture' and the 'random encounter model' are two methods that have been developed to estimate densities using camera traps. Photographic–recapture requires unique identification of individuals using natural markings such as spots while the random encounter model uses mathematical models based on the number of photographs with the animal of interest, regardless of individual identity. This study is the first of its kind to compare reference density estimates from a traditional, long–term 'mark–recapture' program to density estimates from photographic–recapture and the random encounter model. Density estimates were calculated for a wild population of northern quoll (*Dasyurus hallucatus*) on Groote Eylandt, Australia during pre–breeding, breeding, and post–breeding seasons in 2015. The density estimate from the photographic–recapture method during the breeding season was similar to the mark–recapture reference density. The random encounter model estimated similar densities for the pre–breeding and post–breeding seasons, however, this model overestimated the density for the breeding season. Our results suggest that photographic–recapture can provide a less invasive and more cost effective means to estimate densities for cryptic wildlife. It also highlights the potential of the random encounter model while suggesting further modification and validation before widespread use in wildlife monitoring programs.

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Understanding resiliency of Pacific walruses to climatic change using stable isotopes
Pacific walruses (*Odobenus rosmarus divergens*) are sentinels of Arctic climate change and an important subsistence species for many Inuit communities. These pinnipeds rely on sea ice for resting, reproduction, and migration. Due to habitat loss (i. e., reduced sea ice), walruses were listed as a candidate under the Endangered Species Act. For successful ecosystem–based management, scientists need to understand how walruses interact within their environment and respond to change. However, we do not fully comprehend key ecological relationships, such as diet variability by season, sea ice extent, life stage (e. g., weaning, sexual maturity), or sex. In this study, foraging history of individual walruses has been reconstructed over their lifetimes using stable isotopes of carbon ($\delta 13C$) and nitrogen ($\delta 15N$). Stable isotopes are useful to understanding food web roles; $\delta 13C$ reveals information regarding primary production supporting the base of food chains and $\delta 15N$ indicates the organism's trophic level. $\delta 13C$ and $\delta 15N$ were derived from collagen of individual annual growth layers in cementum of walrus teeth over the past century. Teeth were collected in partnership with museum collections, researchers investigating archaeological middens, and Alaska Native subsistence users. We present trends in diet variation of individual walruses and within the Pacific walrus population, encompassing previous and current climate anomalies as well as regime shifts (e.g., 1976–1978). These findings yield an improved understanding of how walruses have responded to change in the past, thus enabling us to better assess the species' resiliency to current Arctic warming and contribute to more meaningful conservation efforts.

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Demographic and traditional knowledge perspectives on the status of polar bears
Subpopulation growth rates and the probability of decline at current harvest levels were determined for 13 subpopulations of polar bears (*Ursus maritimus*) that are within or shared with Canada based on mark–recapture (M–R) estimates of

population numbers and vital rates, and harvest statistics using population viability analyses (PVA). Aboriginal traditional ecological knowledge (TEK) on subpopulation trend agreed with the seven stable/increasing results and one of the declining results, but disagreed with PVA status of five other declining subpopulations. The decline in one subpopulation appeared to be due to over–reporting of harvested numbers from outside Canada. The remaining four disputed subpopulations were all incompletely M–R sampled, which may have biased their survival and subpopulation estimates. Three of the four incompletely sampled subpopulations were PVA identified as nonviable (i. e., declining even with zero harvest mortality). TEK disagreement was non–random with respect to M–R sampling protocols. Cluster analysis also grouped subpopulations with ambiguous demographic and harvest rate estimates separately from those with apparently reliable demographic estimates based on PVA probability of decline and unharvested subpopulation growth rate criteria. We suggest that the correspondence between TEK and scientific results can be used to improve the reliability of information on natural systems and thus improve resource management. We do not find support for the perspective that polar bears within or shared with Canada are currently in any sort of climate crisis. We suggest that monitoring the impacts of climate change on polar bear subpopulations should be continued and that adaptive management practices are warranted.

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Highly disparate bird assemblages inside sugarcane and pastures crops

Each crop type in human–modified landscapes (HML) has particular environmental characteristics and management practices. Managers are interested about the impacts of each crop on biodiversity, and how each crop can harbor faunal species. Two abundant crops in southeastern Brazil—sugarcane and cattle pastures—have not been properly investigated in this regard. We used birds as a biodiversity indicator, to: (1) characterize bird assemblages of both crops and compare composition between them; (2) understand which landscapes features may exert influence on seven indicators groups (i. e., forest species, non–forest species, species that use both "forest and non–forest" habitats, insectivorous, omnivorous, granivorous, and frugivorous). To do so, we conducted bird survey monthly (Nov/2011–Nov/2012) in a HML of São Paulo state, using four independent bird survey plots located in each crop. Each plot had two point counts and one linear transect and was located at least 350m distant from any other soil type. Landscape diversity, effective size of natural forest and crop permeability provided by spotted tree were collected from each plot (1000m circular buffer radius). We observed 132 species in pastures while only 72 species in sugarcane, a low similarity between crops (48%). Species richness and relative abundance of frugivorous and omnivorous depends of crop permeability while abundance of "forest and non–forest" species depends of landscape diversity and natural forest amount. All indicators were mostly in pastures, which have more landscape diversity and spotted trees. Our findings corroborate that higher landscape heterogeneity favors more species with diverse ecological traits.

Lauren Collins

University of Glasgow, Glasgow, UK

Visitor perceptions of a Eurasian brown bear (*Ursus arctos*) sanctuary

This study aimed to determine perceptions of visitors watching the three Eurasian brown bears (*Ursus arctos*) in the sanctuary at the 5 Sisters Zoo, West Calder, Scotland. It determined how much visitors know about the animals they are seeing and suggests that the zoo should be a primary provider of information about the welfare and conservation of both these individual bears as well as the species. In order to determine perceptions, a survey was offered to visitors with nine multiple–choice questions regarding objectives of brown bear welfare, conservation and the bear enclosure. Visitors were also asked their age, sex and where they lived. As bears are now extinct in Scotland, the project also investigated whether people believe ex–situ conservation of the animals here is relevant to them and if they would support international conservation efforts in countries with bear populations. The study found that the majority of the surveyed population supported the sanctuary in Scotland and utilised the signage around the enclosure. Age, sex and gender affected their interest in travelling to continental Europe to see bears in sanctuaries or the wild. Visitors also over estimated the current range of the species in Europe. The study suggests that more informative signage can help to fill gaps in knowledge and increase visitor interest. The resulting information can help to evaluate how affective current zoo education programmes are at informing visitors about the brown bear, risks to its welfare and its conservation status in Europe.

Joseph Cutler[1], Pius Oben[2], Benedicta Oben[2], Don Croll[1]

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Conservation of Cameroon's crater lakes

Conservationists have limited funds, and prioritization of conservation projects is a valuable tool to bolster conservation efforts. These techniques have been successfully applied in island systems, but have rarely been applied to freshwater systems. Cameroon is home to a series of volcanic crater lakes noteworthy for their species richness and endemism, and while this ecoregion has been highlighted for conservation, no work has been done to assess and prioritize the conservation potential of the individual lakes. I will present a prioritization framework for freshwater lakes, and a prioritization of volcanic crater lakes in the South West region of Cameroon. From August–December 2015, I sampled fish and benthic macroinvertebrate community composition in nine volcanic crater lakes, and conducted interviews with local communities to assess local reliance and anthropogenic impact on each lake. These assessments have allowed me to prioritize and rank the nine volcanic crater lakes of the South West Region of Cameroon allowing for more efficient use of limited conservation funding. I will present these results at SCCS–NY 2016.

Sylvia De La Piedra[1], Carlos Portillo–Quintero[1], Blake Grisham[1], Clint Boal[1], David Haukos[2], Willard Heck[3]
[1]*Texas Tech University, Lubbock, TX, USA;* [2]*U.S. Geological Survey, Kansas State University, Manhattan, KS, USA;* [3]*Grasslans Charitable Foundation, Causey, NM, USA*

Remotely-sensed vegetation seasonality parameters for monitoring wildlife populations

Remote sensing technologies are currently being evaluated as tools for assessing landscape conditions in wildlife studies. Remote sensing is a more quantifiable, relatively inexpensive, and rapid method for acquiring information about the Earth's surface than most traditional field observations for surveying phenological changes. We used remote sensing methods as decision–making tools to support conservation management of the lesser prairie–chicken (*Tympanuchus pallidicinctus*) on the Southern High Plains of Texas and eastern New Mexico. We analyzed time series of Normalized Difference Vegetation Index (NDVI) data from NASA's Terra MODIS satellite from 2001 to 2012. We used the software TIMESAT for time series analyses of MODIS NDVI data—an index of photosynthetic activity—and extracted seasonality parameters such as start date and length of the vegetation growing season. NDVI–derived seasonality parameters were used because lesser prairie–chicken home range sizes and nesting behavior depend, in part, on the amount of green native vegetation present. Increased temperatures and decreased precipitation may lead to delayed and shortened vegetation growing seasons, resulting in an increase in home range sizes, a delay in the timing of nesting events, and an increase in failed nests. We present results evaluating the effect of variability of seasonality parameters on lesser prairie–chicken home range sizes, nest habitat selection, and timing of nesting events. We also discuss the use of time series analysis of NDVI data as an efficient methodology for researchers and land managers to quantify spatio–temporal patterns in green vegetation and better manage wildlife populations.

Alexandra DeCandia[1,2], Stephen Gaughran[1], Anthony Caragiulo[1], George Amato[1]
[1]*American Museum of Natural History, New York, NY, USA;* [2]*Columbia University, New York, NY, USA*

A novel molecular method for noninvasive sex identification of order Carnivora

Noninvasive sampling can provide an efficient means of genetically monitoring mammals. Due to the fragmented quality of DNA derived from such samples, few methods span taxonomic groups beyond the species level. In my talk, I will describe a more universal protocol. Through novel primer design and PCR optimization, I designed an effective and reliable method for the genetic sex identification of order Carnivora from noninvasive samples. Amplification of a 176 bp segment of the SRY gene indicates a male, whereas no amplification indicates a female. A 245 bp segment of the ZFX gene serves as a positive control. This method is internally consistent, and multiple trials confer confidence in results. It applies to at least three families (Canidae, Felidae, and Phocidae) in both carnivore suborders (Feliformia and Caniformia), rendering this protocol the first noninvasive sex identification method suitable for multiple families within the order. Its adoption can enable more time– and cost–effective monitoring, management, and conservation of carnivores with minimal organismal disturbance.

James Goetz
Cornell University, Ithaca, NY, USA

Household resource politics: PES implementation in La Visite National Park, Haiti

Payments for environmental services (PES) have gained attention for protecting biodiversity and alleviating local poverty. Environmental impacts of PES are well–studied, but little is known about the effect that payments and land use restrictions can have at a household level. A pilot PES project to protect and restore habitat for migratory birds in La Visite National Park, Haiti, provides a ready case study of implementation of this cutting–edge conservation tool amid the daily realities of traditional society in rural Haiti. Data from semi–structured interviews and focus groups conducted with PES program participants, along with direct observation, suggest that power asymmetries within the households and extended families cause cash payments to disproportionately benefit patriarchs, while land use restrictions disproportionately disadvantage female conjugal partners and young males, by reducing their access to crop and pasture land. Further, although this conservation project reduces forest loss on contracted land parcels, it also displaces degradation to neighboring sites outside the project area.

Flora Yifan He[1], Austin Martin[1], Eliot Jackson[1], Ivan Monagan, Jr.[1], Kevin Li[2], Shawn Colborn[1], Susanna Campbell[1], Theresa Wei Ying Ong[1], Ivette Perfecto[1]
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Spatial exclusion of a native ant by an invasive shrub within a short 50 year window

Invasive species are a significant threat to global biodiversity, but our understanding of how invasives impact native communities across space and time remains elusive (Vila et al. 2011). In this study, we investigated changes to the distribution of a native ant species, *Formica obscuripes*, before and after invasion by *Elaeagnus umbellata*, an invasive shrub. By comparing a historical dataset with present nest distributions, we found that the nests of the *F. obscuripes* population transitioned from a random distribution in 1980 to a clustered distribution in 2015. Results of a stage–structured model suggest that the population of *F. obscuripes* is declining and is projected to disappear completely within the next 15 years. Analysis of land cover change using aerial photos shows that *E. umbellata* has expanded aggressively, causing the transformation of 10–22% of original open field into dense shrubland. We argue that *E. umbellata* restricts the dispersal of *F. obscuripes* nests by limiting the amount of potential nesting sites. The population decline can likely be explained by reduction of resources and increased competition, indirect effects of *E. umbellata* invasion. Our study documents a significant impact ($p < 0.05$) of the invasive species, *E. umbellata*, on the spatial distribution and population projections of a native ant species. These findings demonstrate the importance of invasive control in conservation and land–use management.

Felipe Miguel Libran Embid, Greet de Coster, Jean Paul Metzger
University of São Paulo, São Paulo, SP, Brazil

Long term natural regeneration of holm oak woodlands after agriculture abandonment

Several studies have shown that the abundance and richness of predators increase with the amount of native forest, however, the underlying mechanisms relating forest cover at different spatial scales with the provision of biological control are still poorly understood. We experimentally excluded flying vertebrates (birds and bats) in eight coffee landscapes in the Brazilian Atlantic Forest and quantified the consequences for coffee leaf loss by herbivory and fruit set. Leaf loss showed a negative relation with forest cover at landscape level, indicating that herbivory is better controlled in landscapes with high forest cover, especially in the presence of flying vertebrates. However, at local level, leaf loss and fruit set responded to forest cover differently. In units with low local forest cover, flying vertebrates' exclusion was associated with increased leaf loss and reduced fruit set by 13%. However, under high local forest cover, flying vertebrates' exclusion had no significant effect on leaf loss or fruit set. We conclude that the effects of excluding flying vertebrates on leaf loss and fruit set are modulated by different processes occurring at landscape and local levels. We posit that when local forest cover is high flying vertebrates are not only controlling herbivores but may also be reducing mesopredators. In contrast, when local forest cover is low, mesopredators occur in lower abundance, and flying vertebrates provide biological control by feeding mainly on herbivores. We highlight the importance of employing a multi–scale analysis in systems where species with different dispersal abilities are providing an ecosystem service.

Jennifer Miller, Paul Funston, Guy Balme
Panthera, New York, NY, USA

Aging traits and sustainable trophy hunting of African lions

Trophy hunting plays an important role in wildlife conservation globally, yet excessive hunting is contributing to species declines, especially for large carnivores. Using African lions as a case study, we tested criteria for an age–based approach for sustainably regulating hunting. Simulation models suggest that sustainable hunting may be achieved by restricting offtakes to male lions old enough to have reared a cohort of offspring. Using photos of 228 known–age males from ten sites across Africa, we measured change in ten phenotypic traits with age and found four age classes with distinct characteristics: 1–2.9 years, 3–4.9 years, 5–6.9 years, and ≥7 years. We tested the aging accuracy of professional hunters and inexperienced observers before and after training on aging. Before training, hunters accurately aged more lion photos (63%) than inexperienced observers (48%); after training, both groups improved (67–69%). Hunters overestimated 22% of lions <5 years as 5–6.9 years (unsustainable offtake) but only 4% of lions <5 years as ≥7 years (sustainable offtake). Due to the lower aging error for males ≥7 years, we recommend 7 years as a practical minimum age threshold for trophy hunting male lions. Results indicate that age–based hunting is feasible for sustainably managing threatened and economically significant species such as the lion, but must be guided by rigorous training, strict monitoring of compliance and error, and be supported by conservative quotas. Our study furthermore demonstrates methods for identifying traits to age individuals, information that is critical for estimating demographic parameters underlying management and conservation of age–structured species.

Mbunya Francis Nkemnyi[1], Tom De Herdt[1], Tom Vanwing[2], Chuyoung George[3]

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Reconstituting the role of indigenous structures in protected forest management

This article illustrates how institutional transitional processes influence the intended sustainability outcomes in protected forest management in Cameroon, using the case of the Tofala Hill Wildlife Sanctuary. The study revealed that the major setback in attaining sustainable forest management does not necessarily lie in the conflicting interests of actors, but also in the social processes that guided the negotiation of these conflicting interests. Processes initiated by bureaucratic institutions did not adequately appreciate the efforts of the existing Indigenous structures. The differences in the modelling of social change by the agents of change had negative impacts on governance outcomes and disrupted collaborative actions. This study argues that Indigenous structures should not just be regarded as mediators in the processes of forest management. Their actions are influenced by powerful actors (elites). They are thus embedded in complex configurations that can retard sustainable forest management processes. There is a need to carefully explore and understand the various contexts in which these complex configurations influence forest management in order to foster sustainable collaborative management.

Teresa Rose Osborne[1], Jonathan Wright[2]

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Estivation physiology and habitat selection in southern California land snails

Helminthoglypta (Pulmonata: Helminthoglyptidae) is a genus of land snails endemic to California and threatened by habitat destruction. Coastal sage scrub–dwelling *H. tudiculata* avoids hot, desiccating southern California summer conditions by estivating. Since *H. tudiculata* spends most of its lifespan estivating, habitat needs during estivation are central to species' ecology. We surveyed habitat use during estivation and compared microclimates in representative habitats with snails' physiological limits. Lethal temperature for active snails was 41.3 ± 0.24 °C. All sites on the substrate surface (SS) exceeded this threshold during late summer or early fall of 2014, whereas only 25% of subsurface refugia (SR) exceeded 41.3 °C. Estivating snails and shells were found in SR significantly more often than on SS. Snails may preferentially estivate in SR to avoid lethal temperatures. Based on respirometric measurements, estivating snails lose about 55 mg water per week in SR. Active snails had a hydrated water content of 79.6% by mass, and average mass of four active snails was 1.703 ± 0.4486 g. Thus, many snails lethally desiccate before the 25–week mark. Since maximum summer dry spells from 2005 to 2014 ranged from 12 to 23.7 weeks, snails face lethal desiccation during the driest summers. *H. tudiculata* currently estivates in conditions near its physiological limits. Increases in SR temperature or drought length due to climate change are likely to reduce survivorship of this and other vulnerable Helminthoglypt snails. Additionally, our habitat use data can inform conservation efforts by identifying relevant habitat characteristics within an endangered ecosystem.

Diya Paul

Rutgers University, New Brunswick, NJ, USA

Unintended wildlife spaces in the Eastern Ghats: bears & antelopes in the Anthromes

Anthropogenic landscapes and their influence in the analysis of wildlife presence/habitat has gained scholarly attention in the past two decades globally. Yet, barring a few cases, research on wildlife presence outside protected areas (PAs) in India is still lacking. This is despite the fact that more than 80% of forested area in India lies outside PAs or in anthropogenic landscapes or "anthromes". My research analyzes the presence of the four–horned antelope (*Tetracerus quadricornis*) and sloth bear (*Melursus ursinus*) in one particular anthrome located in the Eastern Ghats in southern India. I use a mixed methods approach to understand the distribution of these two species in this landscape matrix that consists of fragmented forest patches, agricultural fields and wastelands. The data is based on fieldwork undertaken in 2015, during which I collected faunal evidence (tracks, scat and other signs) across four unprotected reserve forests. I also undertook household surveys in six villages located on the periphery of these forests to examine the land–use practices of local communities. More specifically I use species distribution modeling to understand the distribution of these vulnerable species in the matrix and show how both biophysical and anthropogenic variables contribute to their presence. I combine these results with a qualitative analysis of the agricultural practices to show how changes in agricultural practices and livelihood strategies facilitate the presence of wildlife. The results point towards an urgent need to acknowledge the value of wildlife conservation in anthromes, and shift the debate and praxis of conservation beyond protected areas.

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Novel hosts are critical when predicting spread of invasive avian brood parasite

Biological invasions of several actual and potential hosts have set the stage for 2nd order invasions by parasitic species. The pin–tailed whydah (*Vidua macroura*) is an interspecific obligate avian brood parasite, native to Africa, that has successfully established as an invasive species in two biodiversity hotspots in the Americas. Here, we utilize Ecological Niche Modeling (ENM) approaches to address whether (1) across large spatial extents climate covariates are always the most important predictors of habitat suitability, and (2) ENMs incorporating native and novel hosts allow better identification of high risk areas for future invasion. By using recent methodological advances and machine learning algorithms we found that the most accurate habitat use models of this brood parasite incorporate environmental covariates, historical hosts, and a potentially novel host as covariates. The two best predictive models indicated that southern California is highly suitable, confirming the ability to identify recent areas of novel invasion that do not contain the whydah's most common native host. Additionally, all models found Hawaii, a region where the whydah had been introduced but failed to establish, as an area of high habitat suitability—these islands have two of the whydah's historical and one potentially novel host, and should be closely monitored for introductions. Contrary to previous findings, which encourage the use of abiotic predictors over large spatial extents, we found that when targeting key areas of potential introduction, especially for brood parasites that exhibit host switching behavior, novel hosts improve the predictive power of risk maps.

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Dogs into the wild: assessing dog presence in a biodiversity hotspot

Urban sprawl and human activities are increasingly occupying and disturbing natural ecosystems, fragmenting natural landscapes, with remaining natural areas surrounded by an hostile anthropogenic matrix. This scenario increases interactions between humans, domestic animals, and wildlife, triggering conflicts. Additionally, domestic animals that accompany humans, such as domestic dogs, can act as an "extension" of human activities inside natural areas, with detrimental effects on wildlife. This study was developed in the interface area between a natural reserve (NR) and the surrounding anthropogenic matrix (MA). The main objective was to determine the factors influencing dogs' presence inside the NR and the effective protection of the NR, in terms of edge effects, and was based on dog's presence and movements. We developed a camera– trap survey and domestic dog fine–scale tracking through GPS data loggers. Models based on camera trap data detected that variables that best explained the presence of domestic dogs were the distance to houses and cattle presence, the latter a previously undescribed variable, that should be considered for dog management in rural areas. Results confirmed that under a conservative approach, dogs are reducing the NR effective protection area, between 4–26%. Our findings show that a great variety and quantity of dogs are present in the NR and its borders, increasing the edge effect over the NR. According to our results, the NR is not fulfilling its role of biodiversity protection. Exclusion of cattle herding, inside the NR, using a human dimension approach, will help to reduce the presence of dogs.

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Shedding light on the understudied McGregor's pit viper to change its IUCN status

Batanes Protected Landscape and Seascape (BPLS) is the Philippines' remotest province and is inhabited by several range–restricted species and sub–species. One particularly charismatic species is the McGregor's pit viper (*Trimeresurus mcgregori*). No study on its population status have been performed hence IUCN categorizes it as Data Deficient. However, the species is well known in international trade because of its variable color morphs, despite a lack of government export permits. It breeds well in captivity, making it hard to track down the origin of the animals. This study aimed to determine baseline information to help conservation assessment. We performed visual encounter surveys at night in dry riverbed and scrubland forest transects during a ten–day period (March 19–28, 2016), covering a total of 9.4 kilometers in four municipalities, with 10x100–meter transects, on Batan and Sabtang islands. We encountered 23 individuals, comprising five color morphs, in dry riverbeds or near tree roots, with most encounters near small pools. We posit that the pit viper encounter rate is largely affected by

weather conditions as we spotted the first 22 individuals during four days with hot and dry weather. We calculated a crude relative density of 244.68 ind/km² of suitable habitat. The species seems to be locally common upon comparison with other pit viper density estimates. However, the small range and scarcity of suitable habitat can be a population limiting factor. Also, potential threats include illegal trade and habitat modification for agricultural activities, causing the drying up of rivers and thus, degrading suitable habitat.

Andrea Reid[1], Mikayla Wujec[2], Alec Hughes[3], Douglas McCauley[4], Dan Brumbaugh[5]

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Paper parks and the bumphead parrotfish they do not protect

Marine Protected Areas (MPAs) are spatially delineated ocean areas that are managed, at least in part, for the conservation of biodiversity. However, MPAs are all too often insufficiently implemented and enforced, rendering them ineffective 'paper parks' that do little in the way of conserving biodiversity. In the Solomon Islands, a marine biodiversity hotspot, an extensive MPA network was established in part to protect the iconic and 'Vulnerable' bumphead parrotfish (*Bolbometopon muricatum*), but lack of MPA enforcement may be resulting in continued bumphead parrotfish declines due to overfishing. Reef dive–surveys in the Solomon Islands by our team in 2015 revealed that bumphead parrotfish population densities did not differ between MPAs and unprotected areas, but that the remoteness of these sites from human fishing pressure coincided with greater abundance of bumphead parrotfish. Our results suggest that MPAs in the Solomon Islands do little to protect this species that is both highly prized by local fisheries, and bears strong cultural significance. Continued declines of bumphead parrotfish do not only jeopardize the status of this species, but also threaten the economic and social systems that depend upon them. For these MPAs to be more than 'paper parks' for this target species, we recommend that their boundaries and enforcement policies be reassessed and based on emerging research that identifies critical bumphead parrotfish habitat.

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Identifying challenges to on–farm restoration of Brazil's Atlantic Forest

Centuries of deforestation in Brazil's Atlantic Forest have reduced forest cover to 11–16% of its original extent. Fragmentation threatens the biome's globally significant biodiversity, and degradation raises concerns regarding impacts on ecosystem services. Drinking water, in particular, appears vulnerable, as years of drought contributed to shortages in major cities (esp. São Paulo) and land management upstream negatively impacts water quality. Conservation and restoration is challenging, as roughly 90% of the ecoregion is held as private property. Federal legislation mandates native vegetation on private land, but enforcement is difficult and restoration is expensive, especially for small agricultural households. Government ministries and NGOs have turned to positive incentives, such as 'payments for ecosystem services' (PES) programs, to encourage restoration. The appeal of PES has resulted in a great effort to create enabling policies and support research identifying ecosystem service values for use in contracts. However, little data is available on non–pecuniary considerations that affect landowner participation. Here we present results of a study of cattle farmers in the Cantareira region of São Paulo state—the source of half of the drinking water capacity for the São Paulo metropolitan area. Focus groups with cattle farmers and interviews with agronomists identified risks in production, including short–term price changes affecting liquidity, constraints in the labor supply, and distrust in government contracts, not captured by opportunity cost considerations. Further, demographic factors, especially an aging population that is hesitant to commit to land use restrictions, may adversely affect efforts to increase participation in PES.

Christopher Satter, Marcella Kelly

Virginia Tech, Blacksburg, VA, United States

Long term study estimating ocelot density across varied habitat types in Belize

The ocelot *Leopardus pardalis* is a medium–sized wild cat with a distribution from southern Texas to northern Argentina, including the islands of Trinidad and Margarita. In Belize, Central America, ocelots occur over a wide range of habitat types, such as primary and secondary palm/broadleaf forest, marsh forest, pine forest and savanna grasslands, yet ocelot populations throughout these diverse habitats remain unstudied. We used camera–trapping methodology and spatial mark–recapture models (SECR) to estimate ocelot density in 7 study sites representative of the variable habitat communities across Belize. We used robust design models to estimate ocelot survival at 3 sites with 6–12 years of data. SECR models

produced lower density estimates than past research in similar sites using traditional approaches. We found ocelot density varied dramatically across habitat types from a low of 1–2/100km² in pine forest to 9–10/100km2 for rainforest. Sex was an important covariate in density estimation. Females occurred at higher proportions than males (0.6, 0.4 respectively), but with a lower (0.02) detectability than males (0.07). Females had smaller movement estimates (0.93km) compared to males (1.45 km), likely caused by larger territories for males that overlap several females. Robust design models indicated high constant survival of ocelots over time, but varied by habitat type. SECR models are less sensitive to trap configuration than traditional models, allowing ocelot density to be estimated from a long–term study targeting jaguars. Our results provide valuable information on ocelot status and trends, which are important due to increased anthropogenic disturbance adjacent to protected areas.

Samuel Sellers
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Exploring value–added in an integrated population, health, and environment project

Population, health, and environment (PHE) projects are an increasingly popular strategy for improving human and environmental outcomes in areas with high threats to biodiversity, unsustainable harvesting practices, and poor access to health services. PHE initiatives provide a range of integrated conservation, health, and livelihoods programming to rural communities. These projects are predicated on the idea that integration between conservation and other development sectors will result in better outcomes than a single–sector intervention. However, few studies have explored whether PHE projects result in such "value–added" outcomes as a result of integration. Using focus group and key informant interview data from a PHE project operating in fishing communities along Lake Victoria in Kenya and Uganda, I explore the mechanisms operating within the project that have the potential to improve fish populations and health outcomes. Participants are increasingly sensitized to the linkages between health–seeking behaviors, such as family planning or latrine use, and conservation behaviors, such as tree planting and sustainable fishing, suggesting pathways through which the project is working, as well as areas that need improvement. In addition, participants made linkages between conservation and other sectors that were unexpected, such as families planting additional trees, with the hope that such trees would be harvested later to pay for school fees. Despite improvements associated with the project, continued resource scarcity, lake ecosystem degradation, and high population growth are placing considerable pressure on project communities, resulting in uncertainty regarding the likelihood of further "win–win" human and conservation outcomes in the region.

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Using benthic macroinvertebrate communities as indicators of sustainable wetland use

Wetlands play an important role in regulation of both the quantity and quality of downstream water resources. However, most Rwandan wetlands are threatened by agriculture, with rice farming being the most dominant crop. A new model was developed for sustainable rice cropping meant to maintain wetland health and ecological function including water filtering and storage. This model consists of alternation of rice parcels with uncultivated parcels left in fallow. The main objective of the study was to evaluate the effectiveness of this innovative new model by assessing the richness of benthic macroinvertebrates as biological indicators. This was coupled with examining physicochemical variables as well as sediment retention, chemical recycling and filtering function capacity. Over a one year period, stratified methods for data collection were used across different treatment types. Soil and water chemical analyses were conducted in the laboratory to test nutrient and heavy metal concentrations in fallow and rice in old and young treatments. Results showed that the new habitats created with the new model of rice cropping contributed significantly to an increase richness of macroinvertebrates at the family level. This was an interesting result from an integrated wetland landscape created to provide much more habitat heterogeneity favorable to wetland species. This innovative rice system management model contributed to the maintenance of healthier ecological function while increasing the long-term ecological processes of Ndobogo wetland, hence the sustainability of this wetland agricultural system.

Charles van Rees[1], Sarah Sonsthagen[2], Robert Wilson[2], Aaron Nadig[3], Jared Underwood[3], J. Michael Reed[1]
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The Movement Ecology of an endangered rallid, the Hawaiian gallinule

Hawaiian gallinules (HAGA) on O`ahu depend almost entirely on a small number of managed wetland habitats that are spatially isolated and separated by a large, diverse, and highly dynamic landscape matrix. The small populations persisting in these protected areas are more sensitive to demographic and environmental stochasticity, and are at risk of inbreeding depression—factors that increase extinction risk, but that are ameliorated by immigration from nearby populations. Thus, determining the connectivity of these protected habitats and how this connectivity might be managed is of critical importance to the long–term conservation of this endangered subspecies. I present the findings of a three–year study on the movement ecology of HAGA on O`ahu using data from a citizen–science based mark–resight approach, radio telemetry, and two molecular markers. Over 150 birds from 13 wetland habitats were genotyped at 13 microsatellite loci and 150bp of the ND2 region of the mitochondrial genome to assess gene flow and genetic distance between wetland populations. At the time when this abstract was written, genetic structure is readily apparent between populations, even those >5km distant from one another. Statistical analyses (Mantel test) show that geographical distance does not adequately explain genetic distance. Inter–wetland movements by radio–tagged and banded–resighted birds have been rare and sporadic, corroborating genetic findings. I discuss possible behavioral drivers for population structure in HAGA and management implications for this and other wetland–specialist rallids in developing landscapes.

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Moving forward: lessons learned and strategies from assessing fisheries in California

Marine recreational and commercial fisheries in the state of California are valued in the billions of dollars, yet the state struggles to complete cutting edge stock assessments for many of these species, often relying on non–profits and outside scientific panels to fund and conduct the assessments. The first modern stock assessment of white seabass (Atractoscion nobilis), conducted by the Center for the Advancement of Population Assessment Methodology and funded by a non–profit, was recently completed. Here we present lessons learned during the assessment that are widely applicable to other assessments and studies of wildlife populations. For this fishery, and many fisheries in the state as well as nationally and internationally, there are no fishery–independent surveys of abundance. As a result, relative indices are calculated from the most complete data available. To make these indices, variations of the delta–glmm model, a two–part model that models presence/absence and then the positive data, were used. This type of model is extremely flexible and has applications in a wide variety of wildlife and ecosystem studies. Here, we discuss limitations and gaps in the fisheries data currently available, and make suggestions for future research. We present working solutions and techniques for making the best use of the data in hand, including: solutions for zero–inflated data, working with aggregate data, and methods for subsetting data using species co–occurrence. Additionally, we discuss conversations with fishery stakeholders in order to improve future data resources. These lessons extend to other fisheries in the state and to data–limited species elsewhere.

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Sacred nature sites and biodiversity conservation in Qinghai–Tibet Plateau grassland

Sacred nature sites based on traditional culture protect great biodiversity and have been considered of value for biodiversity conservation. However, most related studies focused on forest; our understanding of sacred nature sites in grassland is still poor. In our study, 2014–2016, we record 77 Tibetan sacred nature sites in grassland of Zadoi County, Qinghai Province in western China. Mean size of sacred sites is 22.0km² (range 0.9–789.4km²). Hunting, digging Caterpillar fungi, mining, and mowing are strictly forbidden in the sacred sites. Indigenous lamaseries and Tibetan communities monitor the sites together, and people who break the taboo will be punished. Sacred sites cover 1563.1km² of snow leopard habitats, 10.9% of all habitats in Zadoi county. 395.8km² of 1563.1km² habitats are not covered by the nature reserves now. Tibetan herders believe there are more wildlife in sacred sites, and our camera–traps put in sacred sites caught more snow leopard individuals than other sites indeed. In this case study, we find the sacred nature site (mountain deity) plays different roles in Tibetan culture. In recent years, its roles about environment, like the master of wildlife or the protector of minerals, are emphasized. Local herders believe following the taboo and protecting the surroundings of sacred sites will please the deity and bring good fortune. In summary, we believe sacred sites help wildlife get habitats within herders' rangeland in the Qinghai–Tibet Plateau. They are significant for landscape–level conservation, and can be the entry for indigenous herders participating in biodiversity conservation.