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## Poster Abstracts

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### Is coral juvenile abundance associated with reef quality?

Coral recruitment is a crucial process in reef community structure. Recruit abundance is an important indicator of a reef's potential for recovery and growth after a disturbance. Despite the importance of recruitment little is known about habitat characteristics that favor this process. Here we aim to determine whether reef attributes commonly used to describe reef health (e.g., coral cover, macroalgae cover and reef complexity), and attributes that favor larval settlement (e.g., crustose coralline algae (CCA) cover), are important predictors of juvenile coral abundance. Eleven shallow reef–sites (<5m) were surveyed in Puerto Morelos, Mexico, where sites were selected based on the ratio between the abundance of the major reef–building coral *Acropora palmata* and the abundance of macroalgae. Sites varied from architecturally complex–healthy reefs (high *A. palmata* abundance–low macroalgal abundance) to low complexity–unhealthy reefs (low *A. palmata* abundance–high macroalgal abundance). Measurements of coral cover, macroalgae, CCA, reef complexity and juvenile abundance were conducted using between 25–45 1m<sup>2</sup> quadrats per site. No relationship was found between juvenile abundance and coral cover, macroalgae cover or reef complexity. A strong positive relationship was found between CCA cover and juvenile abundance. These results suggest that healthy coral reefs may not provide the most suitable attributes necessary for coral recruitment and juvenile growth. This highlights the need to understand the attributes that better describe healthy reefs, specifically those that favor coral recruitment, and how these attributes can be implemented in the planning of Marine Protected Areas.

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### Studying the role of rivers as barriers in Amazonia using the genetic and morphological diversity of *Lepidothrix coronata*

The Amazonian Basin in South America has a high degree of biodiversity and endemic species, some of which have not been discovered. One species in particular, *Lepidothrix coronata*, is distributed across the entire Amazon basin and is described by the IUCN as having an extremely large range. Researchers have found that environmental barriers, such as rivers, appear to be isolating Amazonian species into small groups in endemic areas. We are looking to see whether or not there are environmental barriers that have affected the speciation of *L. coronata*, which is currently classified as having 8 subspecies. We sequenced ND2 and cyt b for 17 individuals of 4 subspecies, and analyzed the geographic and morphological properties of *L. coronata* using the AMNH collections and georeferenced records. We found 6 genetic groups and 4 subspecies groups that correlate with geography, and that individuals in the same region have similar morphology. *L. caelestipileata* is a genetic group, but there were no individuals in the collections that corresponded to previous morphological descriptions. The genetic geographic and morphological groups are separated by rivers that are acting as barriers. *L. coronata* does not have an extremely large range. Instead, there are multiple species that each occupy small ranges. We propose that the taxonomy of *L. coronata* should be revised to elevate the subspecies to species status. Conservation organizations should pay closer attention to the small ranges of each individual species in order to protect and conserve those that might be endangered.

Bernadette Arakwiye, Florencia Sangermano

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### Predictive distribution mapping and protection status of Albertine Rift endemic birds

The Albertine Rift region in East Africa is globally recognized for its high biodiversity richness and high species endemism. Landscape change following increased population density and conversion of natural habitats threatens the survival of these unique species. Furthermore, many species in the region lack information on their current distribution due to the region's remoteness and poor local monitoring capacity. Therefore it is challenging to assess the impacts of landscape change on biodiversity and to develop sound conservation and management plans. This study uses maximum entropy algorithm in Maxent software to relate seventeen Albertine Rift endemic bird species' location records from the Global Biodiversity Facility to bioclimatic environmental variables and vegetation quality data within the region. Results show that temperature seasonality, precipitation seasonality and precipitation of the driest quarter contributed the most to the models, thus suggesting that distribution of Albertine Rift endemic bird species is susceptible to seasonal climatic changes even under

lower warming scenarios. Spatial analyses also showed that current protected areas enclose lowly suitable habitats, fragment highly suitable habitats and fail to cover more than 60% of species rich areas. Habitat suitability maps developed in this study reveal priority areas for ground truth fieldwork for researchers and protected area managers and may serve as baseline information against which to assess future landscape changes. This study highlights the need to revise protected areas zoning in the Albertine Rift region in order to improve suitable habitat connectivity and focus conservation activities where they are relevant.

**Olivia Asher**, Rachel Lee, Sandra Lewocki, Rita Pozovskiy, Neil Dunca, Mark Weckel  
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### **The diet of New York City coyotes**

New York City (NYC) has the highest human population density of any coyote (*Canis latrans*) habitat in North America. The diet of the NYC coyote population may be influenced by NYC's dense human population. The goal of this study was to determine the baseline diet of NYC coyotes and to compare it to the diet of similar urban coyote populations. The prey remains from forty-nine scats collected in six NYC parks from 2010-2015 were identified using the reference collection at the American Museum of Natural History's Department of Mammalogy. Frequency of occurrence per prey item was calculated to analyze the diet of NYC coyotes. Small mammals (<6.0kg) had highest frequency of occurrence per prey item (19%) in the NYC coyote diet. *Odocoileus* species, small mammals, and fruit/seed were major coyote diet items in all localities analyzed, but Aves only made up a large percentage of the coyote diet in NYC. Anthropogenic items made up a low percentage of coyote diets across studies analyzed. As research on the diet of NYC coyotes continues, acquiring a larger sample size to obtain more accurate results a top priority.

**Justine Atkins**<sup>1</sup>, Corina Tarnita<sup>1</sup>, Ryan Long<sup>2</sup>, Robert Pringle<sup>1</sup>  
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### **Modelling the drivers of large herbivore movement in a spatially patterned landscape**

Given the fundamental nature of movement to animal life, a comprehensive understanding of the drivers of movement patterns is a primary concern in conservation biology. Improvements in tracking technology mean we can now investigate the relative influence of both internal (e.g. behavioral state) and external factors (e.g. landscape structure) on individual movement, and develop predictive models of animal space use that account for inter-individual variation in responses to these factors, alongside species-level characteristics. Such models are fundamental for conservation managers to understand how different species will respond to changing environments. Our research builds on and extends an emerging body of work in this area, in the context of ongoing restoration in Gorongosa National Park (GNP), Mozambique. GPS collars have been deployed on 10 females of each of three congeneric antelope species (bushbuck, nyala and kudu) for the last three years to examine their movements and association with termite mounds. The spatial pattern of GNP's mounds and their high vegetation concentration strongly influence resource distribution at broad spatial scales. Using GPS tracks, vegetation surveys and spatial mapping, we are developing a series of ecological models, including class-structured population models and spatially explicit integrated population- and individual-based simulations. Such a framework will allow us to account for how intra-specific behavioral plasticity and inter-specific differences interact in decision-making to determine space use and population dynamics, as a function of resource availability and distribution. This research will assist GNP recovery while also providing theoretical insights on large herbivore habitat use and management.

**Ashara Bell**<sup>1,2</sup>, Margaret Matthews<sup>1,3</sup>, Suzanne Macey<sup>1</sup>  
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### **Methods for conserving bog turtles (*Glyptemys muhlenbergii*): developing a non-invasive protocol for DNA extraction**

The bog turtle (*Glyptemys muhlenbergii*) is one of the smallest and most endangered turtle species in the world. Currently, the only established methods for obtaining bog turtle DNA are invasive and require the turtle in hand--a difficult task because of bog turtles rare and cryptic nature. However, successful efforts to extract DNA from avian eggshells (e.g., Bush et al. 2005) support the possibility of establishing a similar protocol with bog turtle eggshells, which may be more readily found than the turtles themselves. The goal of this study is to establish this non-invasive method for extracting DNA for genetic studies. We measured the amount of DNA extracted using five sample types, three extraction protocols, and two

approaches to quantify the DNA extracted. We successfully extracted DNA from each sample type. Generally, we recorded higher amounts of DNA from tissue as compared to blood preserved in buffer and egg matter--which yielded similar results. DNA yields from eggshells were low and inconsistently obtained. Interestingly, blood on paper (Whatman FTA cards) yielded even lower levels of DNA than eggshells. The two DNA quantification methods (Nanodrop and Qubit) produced correlated concentrations indicating that using either the Nanodrop or the Qubit would provide relative results in the amount of DNA yielded in the samples. DNA quantity did not readily translate to positive results of DNA visualization via genomic, microsatellite, or mitochondrial gels, and therefore we suggest future research focus on adaptations of these protocols. Our research provides next steps in developing a non-invasive DNA extraction protocol, and with this method, we hope to provide a greater understanding of the population genetics of bog turtles.

**Greer Bizzell-Hatcher<sup>1,2</sup>, Destiny Marie Lugo<sup>1,3</sup>, Georgina Cullman<sup>1</sup>**

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### **Analyzing dietary diversity through food group indicators and the effects of local and nonlocal food consumption**

The Solomon Islands is a country with high levels of increasingly threatened biodiversity and changing diets. Environmental and cultural changes are contributing to the increased consumption of processed foods, with severe health consequences including malnutrition, Type II diabetes, hypertension, and heart disease. Data was collected in three communities in the Western Province, Solomon Islands via 24-hour dietary recall surveys (n=97) and was analyzed for dietary diversity using an internationally recognized food group indicator, the Food and Agriculture Organization's Minimum Dietary Diversity for Women. The data was also coded for added salt or sugar, and if the food was locally sourced or store-bought. Our results indicated that the majority (72%) of the respondents were not consuming enough food groups to achieve minimum dietary diversity, with an average of 3.72 food groups consumed. Surprisingly, there was no relationship in the data between the amount of local foods consumed and the MDD-W score, which means consuming more locally sourced foods does not necessarily guarantee a higher dietary diversity. As expected, the vitamin A rich food consumption correlates with a dietary diversity score; consuming more food groups has a positive correlation with intake of vitamin-A-rich foods. A high percentage of respondents consumed 2 or more foods that contained added sugar (29.9%) and salt (52.6%), which can cause Type II diabetes and hypertension. We intend that our research will ameliorate these communities' resource management, increase the diversity of the foods consumed, and make maintaining a diverse and micronutrient sufficient diet easy.

**Sam Chew Chin, Nathan Morris, Roman Ivana, S. Elizabeth Alter**  
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### **Surveying without seeing: environmental DNA metabarcoding of fish**

The sensitivity of environmental DNA sampling methods for the detection and identification of fish species has recently been shown to match or exceed that of conventional techniques such as electrofishing or trawls. Environmental DNA methods are low-impact, requiring no direct interaction with the species of interest. This makes them particularly valuable to surveys of rare species or fragile habitats. We are conducting an environmental DNA metabarcoding study of two systems: the New York Aquarium, and the city of New York's only freshwater river, the Bronx River. DNA extracted from water samples collected from four tanks at the aquarium and at ten locations along the length of the river will be amplified with fish-specific primers and sequenced to determine the species present. The species composition of the aquarium tanks is known exactly, allowing for testing of the accuracy and completeness of our metabarcoding results. The detection results of the Bronx River samples will be compared to years of data collected from electrofishing and other direct methods. Environmental DNA sampling methods hold great promise, but as a relatively new set of techniques, verification studies such as this one are an important step toward their standalone use for answering ecological and conservation questions.

**Nicholas Dorian**

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### **Effect of bumble bee queen body size on overwinter survival and colony establishment**

Many bumble bee species are in decline despite efforts to provide abundant floral resources. It is possible, however, that other life stages are also important since diapause and colony establishment are poorly studied, relative to worker foraging. Queen body size varies across colonies and may be an important determinant of queen success during these life stages.

Larger queens may benefit during diapause because they can store more fat, and during colony establishment due to higher foraging efficiency, thermoregulation, and fecundity. Here, I analyze the relationship between body size (intertegular span) and overwinter survival and colony establishment for bumble bees (*Bombus impatiens*). To measure overwinter survival, I evaluated changes in the distribution of body size between fall and spring. Spring queens were significantly larger than fall queens and more narrowly distributed about the mean. I estimated minimum mortality at 0.28 and the body size that maximized this probability was 7.54mm. To measure colony establishment, I hand-reared queens in the lab under low- and high-food treatments and recorded success as whether or not a single worker enclosed. Under low food, smaller queens were significantly better at establishing colonies, but only 22% of queens were successful. Under high food, there was no relationship between body size and success, and 36% of queens established. The loss of a relationship under a high food regime suggests that smaller queens are better able to cope with low food. Future research is needed to investigate the importance of these early life stages for bumblebee population viability.

**John English<sup>1</sup>**, Felicia Keesing<sup>1</sup>, Alexandra Wright<sup>2</sup>

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### **The effect of global change factors on American grasslands**

Climate change can negatively affect ecosystem functioning and services that natural ecosystems provide. Higher biodiversity may help to buffer against such changes by providing a higher resistance to environmental perturbation. The global loss of biodiversity is compounding this problem, creating ecosystems that provide fewer services and are less resistant to environmental change. Here we assessed how drought, plant species diversity, and mycorrhizal fungi affected growth of two prairie grasses (*Panicum virgatum* and *Dactylis glomerata*). We found that increases in plant species diversity may have decreased biomass production of our plots. This was mostly driven by a type of reverse sampling effect: the most productive species in monoculture was the weakest competitor in mixture. Drought had universally negative effects on growth and mycorrhizal fungi had a mostly parasitic effect on growth of both grasses. Understanding the conditions that lead to stability (or instability) for diverse grasslands is of critical importance. Here we present unexpected trends for early establishment of these species. Similar trends should be explored for at the multi-year scale.

**Andrea Giardina**

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### **Ending the plight of the elephant: a human-animal interaction**

The Asian elephant, *Elephas maximus*, has evolved to have many unique physical features and special behaviors. It is revered by many, but its population has been rapidly declining due to human-led activities, including habitat loss and fragmentation, human-elephant conflict, poaching, and the illegal wildlife trade. Critical analysis of conservation models commonly used in the United States, such as the North American Wildlife Conservation Model, the Endangered Species Act, and the AZA Accredited Zoo Model, shows that while some models are more successful than others, there is something missing in all of them. Inclusion of Indigenous peoples in biodiversity conservation has proven to be successful in developing countries worldwide, however these groups of people are in need of economic resources. Ecotourism may be the critical link in conserving the elephant while also supporting the Indigenous groups which impact the species the most. In this thesis I argue that while conservation is a multifaceted effort, the conservation of the Asian elephant depends on the interaction between humans and elephants.

**Rachel Giles<sup>1</sup>**, Michelle Gros<sup>1</sup>, Josephine Iacarella<sup>1</sup>, Beatrix Beisner<sup>2</sup>, Alessandra Giani<sup>3</sup>, Jennifer Barrow<sup>1</sup>, Irene Gregory-Eaves<sup>1</sup>

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### **Zooplankton community responses to a regime change experiment**

The alternative stable states theory describes the tendency for shallow lakes to be found in one of two regimes: a clear macrophyte-dominated state or a turbid, phytoplankton-dominated one. Lake bioremediation emphasizes fish removal as a strategy to restore turbid lakes. However, the transition to turbid states depends on a variety of complex factors such as macrophytes and nutrients, which could also be regulated. Broadly, the goal of this study was to quantify changes in zooplankton communities (important grazers of algae) in experimental ponds to evaluate the influence of macrophytes and nutrients on the non-linear transition from clear to turbid-states. We found that the addition of nutrients increased

zooplankton abundance, whereas the treatments with higher macrophyte densities had lower zooplankton abundances. Looking more closely at the responses of individual taxa, large cladoceran populations crashed while copepods increased rapidly. In terms of zooplankton composition, we found that copepods, chydorids and bosminids dominated all tanks (regardless of nutrient and macrophyte treatment), and showed little variability over time. These observations suggest that fish predation had a large influence on zooplankton communities, but differing macrophyte and nutrient treatments were influential in determining total zooplankton biomass. Together, these results elucidate the important ecological interactions that exist in shallow lakes. In future experiments where we will add a greater amount of nutrients, we will aim to calculate a suite of early warning signs for critical transitions, which may then be used by conservationists and communities to help prevent further change in lakes and restore problematic ones.

**Francisco Gomes De Carvalho, Jean Paul Meztger**  
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### **Carbon stocks in fragmented forests are extensively modulated by edge effects**

Despite the importance of fragmentation for tropical forest carbon (C) balance, most of our knowledge comes from few sites in the Amazon and disregard processes that relates landscape configuration with C stocks. Accurate estimation of CO<sub>2</sub> emission from fragmentation must account for additive edge effects and edge age. We investigated those effects on carbon stock and forest structure in eight oldgrowth forest ( $\geq 70$  years) fragments (13 to 362ha), surrounded by pasture, in the Brazilian Atlantic Forest. We sampled 5,297 stems in four distinct treatments, distributed in each fragment: fragment interiors; old ( $> 50$  years) corner edge; old straight edge; and new ( $< 50$  years) straight edge. C stock was highly variable between treatments, scoring from 6.61 mg/ha up to 87.96 mg/ha (average of  $29.55 \pm 14.97$  mg/ha). Interior treatments had higher C stock, basal area, tree stem density and taller trees than edges. We found no significant effects of edge age or additive edge effects on C stocks. These results suggest that edge effects in the heavily disturbed Atlantic rainforest differ from those observed in more recently fragmented tropical forests, such as the Amazon. In human modified landscapes, edge effects on tree mortality and reduction on AGB may contribute to higher levels of degradation across entire fragments, reducing the observed difference between edge and interior habitats, and suggesting that existing Amazonian forest models may underestimate the true impacts of tropical forest fragmentation for C storage.

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### **Speciation and hybridization patterns of two endangered Neotropical crocodiles**

Understanding historical population demographics and the driving forces behind speciation can be critical in evaluating the conservation status and threats to endangered species. In particular, looking for signatures of historical introgression can assist in determining the threat level of hybridization between endangered species and evaluating how hybridization occurs between species, and if this affects the maintenance of species identities. Recent genetic studies have identified hybridization between endangered populations of the American crocodile (*Crocodylus acutus*) and the Morelet's crocodile (*Crocodylus moreletti*). In order to answer questions about the threat to conservation efforts and the role of hybridization in crocodylian speciation, I generated thousands of SNPs using double digest restriction-associated DNA sequencing (ddRAD-seq). I analyzed the SNP diversity within and between *C. acutus* and *C. moreletti*, as well as genetically identified hybrid individuals. The SNP data was used to infer population demographic history and test for historical hybridization, which can be used to inform management strategies. The results indicated high levels of SNP diversity within and moderate levels of introgression between species. Analysis also indicated reductions in effective population size during the Pleistocene glacial cycles. These results can be used to develop more effective conservation plans that are based on crocodylian evolutionary biology.

**Chris Hensley<sup>1</sup>, Jennie Phillips<sup>2</sup>, Madhusudan Katti<sup>1</sup>**

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### **Differential urban biotic filtering in three desert cities in the USA**

Urbanization is a major driver of biodiversity loss, with urban habitats often favoring only a few native species and excluding others. Mechanisms of this biotic filtering remain unclear. We ask if filtering occurs similarly in three cities of the arid American Southwest: Fresno, California, Tucson, Arizona, and Phoenix, Arizona. We obtained bird species checklists from long-term point counts from the Central Arizona Phoenix Long-Term Ecological Research (CAP-LTER) project, and the citizen



science based Tucson Bird Count and Fresno Bird Count. Here we present results from analyses comparing the avifaunas of these cities to determine the extent and nature of biotic filtering in these cities. Jaccard's indices are lower between urban communities (Fresno–Phoenix: 0.376, Fresno–Tucson: 0.293, Tucson–Phoenix: 0.581) than between species pools (F–P: 0.595, F–T: 0.532, T–P: 0.733) in every pairwise comparison. Fresno harbors the fewest native species, exhibiting the strongest trait-based filtering. The urban community differs in dietary traits from the pool in Fresno (Chi-square  $p=0.002$ ,  $df=8$ ), but not in Phoenix ( $p=0.65$ ,  $df=8$ ) or Tucson ( $p=0.98$ ,  $df=8$ ). Similarity between cities and their respective species pools follows a water use gradient; cities with less water use harbor bird communities more similar to their species pool. We propose that this is due to differences in urban habitat structure, i.e., more mesic vegetation in Fresno contrasting with arid native habitats. Results confirm findings that cities may not homogenize communities as suspected, and point to the potential for large, dense cities to conserve native species through ecologically mindful design of urban habitats.

**Natalie Howe<sup>1</sup>, John Dighton<sup>2</sup>**

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### **Lichens of Philadelphia**

As lichens are sensitive to air pollution, the absence of lichens from densely populated urban centers is well documented; my study will address how exactly lichen cover in and around Philadelphia responds to land cover and human land use. My guiding questions are: Are there thresholds of human population density below which there are obvious increases in lichen cover and diversity? At constant human population density, are there differences in lichen cover with different socioeconomic conditions (household income)? Do urban lichens respond most strongly to land use on a local (100m) scale, or on the landscape scale (1000m)? I will answer these questions using a lichen survey array established around Philadelphia, including 8 transects, each 45° apart, radiating from Philadelphia city center and extending for 14 miles. Every 2 miles along the transect, I will establish a monitoring point, at which I will quantify the epiphytic lichen cover on the N, E, S and W sides of the 8 closest trees that are at least 40cm in diameter. I will combine this data with geospatial data from the Census Bureau to answer the demographic questions and population density question, and data from the City of Philadelphia Licenses and Inspections Department to answer the land use questions. Lichen diversity in many cities in the northeastern US appears to be increasing, and understanding these trends would help us better understand the ecological contexts of those cities.

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### **Genetic analysis of *Boraria stricta*'s arrival in the Mianus River Gorge Preserve**

*Boraria stricta* is a species of black, cyanideproducing millipede indigenous to the southern Appalachian Mountain range (extending from southern Georgia up through the Virginias). Recently, *B. stricta* was discovered within the Mianus River Gorge Preserve (MRGP) in Bedford, NY, over 700 km north of the northern edge of its range. How did *B. stricta* travel 700 km northward, when was *B. stricta* introduced into MRGP, and how do the MRGP *B. stricta* compare genetically to *B. stricta* from the native range? Through comparative genomics we aimed to answer these questions and further research on this fresh topic of mystery. We extracted and sequenced DNA from individuals within the native and introduced MRGP range and found significant genetic differences between these groups. We also discovered low genetic diversity within the MRGP group, suggesting a recent introduction into MRGP with little time to diversify. The mode of introduction into the MRGP remains unclear, but we suspect rhododendrons were brought to homes surrounding the MRGP via landscaping projects, and *B. stricta* hitchhiked on the plants and spread within the MRGP via its extensive network of watersheds.

**Andrew Jacobson<sup>1,2</sup>, Peter Gerngross<sup>3</sup>, Joseph Lemeris Jr.<sup>4</sup>, Rebecca Schoonover<sup>4</sup>, Corey Anco<sup>5</sup>, Christine Breitenmoser–Würsten<sup>6</sup>, Sarah Durant<sup>2</sup>, Mohammad Farhadinia<sup>7</sup>, Philipp Henschel<sup>8</sup>, Jan Kamler<sup>8</sup>, Alice Laguardia<sup>9</sup>, Susana Rostro–García<sup>10</sup>, Andrew Stein<sup>11</sup>, Luke Dollar<sup>4</sup>**

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## **Leopard (*Panthera pardus*) status, distribution, and research efforts across its range**

The leopard's (*Panthera pardus*) broad geographic range, remarkable adaptability, and secretive nature have contributed to a misconception that this species might not be severely threatened across its range. We find that not only are several subspecies and regional populations critically endangered but also the overall range loss is greater than the average for terrestrial large carnivores. To assess the leopard's status, we compile 6,000 records at 2,500 locations from over 1,300 sources on its historic (post 1750) and current distribution. This effort represents the most detailed delineation of the leopard's historic and current range ever. We map the species across Africa and Asia, identifying areas where the species is confirmed present, is possibly present, is possibly extinct or is almost certainly extinct. The leopard now occupies 25–37% of its historic range, but this obscures important differences between subspecies. Of the nine recognized subspecies, three (*P. p. pardus*, *fusca*, and *saxicolor*) account for 97% of the leopard's extant range while another three (*P. p. orientalis*, *nimr*, and *japonensis*) have each lost as much as 98% of their historic range. Isolation, small patch sizes, and few remaining patches further threaten the six subspecies that each has less than 100,000km<sup>2</sup> of extant range. Approximately 15% of extant leopard range is protected, although some endangered subspecies have far less. We found that while leopard research was increasing, research effort was primarily on the subspecies with the most remaining range whereas subspecies that are most in need of urgent attention were neglected.

**Serge Alexis Kamgang<sup>1</sup>**, Brise Sinssin<sup>2</sup>, Mary Catherine Gonder<sup>3</sup>, Bobo Kadiri Serge<sup>4</sup>

<sup>1</sup>University of Oxford, Tubney, UK; <sup>2</sup>University of Abomey Calavi, Cotonou, Benin; <sup>3</sup>Drexel University, Philadelphia, PA, USA; <sup>4</sup>University of Dschang, Dschang, Cameroon

## **Influence habitat change on chimpanzee ecology in Mbam Djerem National Park, Cameroon**

The Mbam and Djerem National Park (MDNP) is located between 5°30' and 6°13' of the North latitudes and 12°13' and 13°10' of the East longitudes. It has an area of about 416,512 hectares and shelters the Nigeria–Cameroon chimpanzee (*Pan troglodytes ellioti*), the most endangered of all currently recognized chimpanzee subspecies, with a total remaining population of between 3,500 and 9,000 living in forested habitat to the north of the Sanaga River in Cameroon, the eastern edge of Nigeria, and in forest fragments in the Niger Delta and southwestern Nigeria. The forest savanna ecotone and human pressure (poaching and a dam project) influence the community dynamic of chimpanzees in MDNP. Despite the biological importance of MDNP and specificity of its ecosystems, there is lack of sufficient data to understand the socio–ecology of Nigeria–Cameroon chimpanzee, the single species of great apes found in MDNP. Close to 29,000 people live in the periphery of the MDNP and depend on the park natural resources for their subsistence. For good management of Chimpanzee in MDNP, a better knowledge of their ecology is necessary. To attain these objectives, interviews with human populations around MDNP and ecological surveys of chimpanzees base on line transects were used. Cybertraker has been used during field data gathering. Typology of human–chimpanzee interactions is known (conflicts and cultural interactions); Habitat suitability of chimpanzee (feeding, nesting and human activities pressure) is known and vegetation cover is being developed.

**Jamie Kass<sup>1</sup>**, Matthew Aiello–Lammens<sup>2</sup>, Bruno Vilela<sup>3</sup>, Robert Muscarella<sup>4</sup>, Robert Anderson<sup>1</sup>

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## **Wallace: a user–friendly web app for advanced modeling of niches and distributions**

Correlative niche/distribution models, which have numerous conservation applications, estimate the response of a species to the environment. Despite their popularity, they are often built without concern for best practices that can be challenging or tedious to implement, like addressing spatial sampling bias or optimizing model complexity. To address these issues, we developed Wallace, a web application that guides users through analyses modeling species niches and distributions. Wallace harnesses R code for ecological analyses from multiple sources, runs it in the background, and offers its functionality through a user–friendly interface. It assembles a variety of tools for building and evaluating models; features interactive maps, tables, and graphs to explore data and model predictions; allows user data input and multiple results for download; and provides guidance text that addresses conceptual and methodological issues. For each step of the analysis, Wallace offers different methodological options, or modules, and researchers can contribute new modules to advance functionality. Lastly, Wallace provides executable code for documenting and rerunning the entire analysis at the end of a session. We envision that future



versions will integrate a greater diversity of both niche/distribution modeling methods and other applied ecological analyses that use their predictions, such as invasive species spread or wildlife corridor analyses. We hope that through Wallace, these analyses will become more accessible to a broader community interested in species distributions, particularly land managers and conservation groups.

**Eric Katz<sup>1</sup>, Viraj Sikand<sup>2</sup>**

<sup>1</sup>*University of Michigan, Ann Arbor, MI, USA*; <sup>2</sup>*Brown University, Providence, RI, USA*

### **Kulisha: fueling the future of fish farming one insect at a time**

In Msambweni, Kenya, large scale commercial fishing vessels have started frequenting the shore. Many are catching forage fish, which are ground up into fishmeal used in animal feeds for aquaculture, poultry, and swine farms. This increase in fishing pressure is depleting fish stocks, and devastating the community economy. What is happening in Msambweni is a global phenomenon, with over 30% of all wild-caught fish used for fishmeal, contributing to overfishing, bycatch, and the destitution of rural fishing villages around the world. Our project aims to address the underlying socioeconomic drivers of this problem by providing an alternative to the current unsustainable practices in the feed industry. Named after the Swahili verb “to feed,” our venture, Kulisha, will grow and process insects to produce a sustainable alternative protein base for use in animal feeds. Specifically, we will be raising black soldier flies, an incredible endemic insect that is rich in protein, fats, and micronutrients, and has been shown to increase fish yields up to 34% more than conventional feed. We are designing a processing venture that is sustainable in all of its components, and have received backing to begin this work in 2016. By producing a sustainable, high protein alternative to conventional fish meal, we hope to reduce pressure on our coastal ecosystems whilst supporting economic development and growth in Kenya.

**Pradeep Koulgi, Anand Osuri, Jayashree Ratnam**

*National Center for Biological Sciences, Bangalore, Karnataka, India*

### **Fragmentation impacts on soil carbon storage in tropical rainforests of Western Ghats**

Globally, tropical rainforests account for roughly half of earth’s terrestrial carbon stocks—with almost half of this being stored in their soils—thus playing a crucial role in regulating the global climate. Across the tropics, pervasive human-induced disturbances have fragmented and altered the very nature of these forests, reducing their aboveground carbon stocks, but impacts of these changes on their belowground carbon is unclear. Our study addresses this gap and is being conducted since November 2015 in a fragmented forest landscape in the Western Ghats biodiversity hotspot of southern India, assessing soil organic carbon (SOC) stocks in forest fragments. In these fragments that already show tree community shifts and drastically reduced aboveground carbon following fragmentation, we hypothesize that these changes will impact their SOC stocks, mediated through altered belowground microbial properties. Aboveground vegetation characteristics being a strong influence on soil properties, we extensively sample a cluster of six forest fragments for tree distribution, ground litter and the underlying soil, and compare them with a nearby contiguous forest. To evaluate our hypothesis, we test the ability of the local tree influence potential, ground litter properties and soil microbial characteristics to explain observed trends in SOC stocks. Thus, this study attempts to further our as yet limited understanding of fragmentation impacts on belowground carbon storage in tropical rainforests. By highlighting ecological pathways linking aboveground forest degradation with belowground characteristics, it could provide valuable insights for better future management and conservation of vital ecosystem services provided by these remnant forests.

**Justine Therese Lamperty, Amy Dunam, John Poulsen**

*Rice University, Houston, TX, USA*

### **Investigating associations between defaunation and changes in macroinvertebrate communities and their role in driving key ecosystem processes in an afro-tropical forest**

Unsustainable hunting in tropical regions is rapidly depleting forests of their large and medium-sized vertebrates, a process known as defaunation. Defaunation causes widespread alterations to forest vertebrate communities and has been found to alter the abundances of insectivorous animals such as rodents and birds. However, the cascading impacts this may have on invertebrate communities has not been widely investigated. My work addresses this through a comparative study of terrestrial macroinvertebrate communities between defaunated and intact rain forests in Central Africa. Through a combination of observational and experimental techniques, my study evaluates how defaunation is associated with changes in three key ecosystem processes that operate across three different trophic levels: litter decomposition, seed predation, and invertebrate predation. Specifically, the objectives of this study are to (1) examine how defaunation is associated with changes in terrestrial macroinvertebrate communities, (2) quantify the robustness to defaunation of three critical ecosystem processes, and (3) determine if the dominant taxa driving these processes changes between defaunated and intact forests.



Invertebrates play central roles in tropical forests, where they drive many crucial processes important for the maintenance of ecosystem health and functioning. Understanding how defaunation may trigger changes in invertebrate communities and potentially interrupt their contributions to ecosystem processes is an important step toward understanding and addressing the impacts of defaunation on tropical forests.

**Valerie Magan**<sup>1,2</sup>, Angela Tsao<sup>1,3</sup>, Claudia Wultsch<sup>1,4</sup>

<sup>1</sup>Science Research Mentoring Program, American Museum of Natural History, New York, NY, USA; <sup>2</sup>Brooklyn Friends School, Brooklyn, NY, USA; <sup>3</sup>Stuyvesant High School, New York, NY, USA; <sup>4</sup>Panthera, New York, NY, USA

### **Landscape Genetics of Central Asian Snow Leopards (*Panthera uncia*)**

Maintaining connectivity (i.e., degree to which landscapes facilitate or impede movement among habitat patches) is a primary objective in conservation planning for species of conservation concern such as the endangered snow leopard (*Panthera uncia*). We applied an individual-based landscape genetics approach to examine relationships between different landscape features and pairwise genetic distances in Central Asian snow leopards ( $n = 58$ ) studied across several sites in Mongolia, Afghanistan, Tajikistan, and Kyrgyzstan. Multiple landscape resistance hypotheses, including various natural and anthropogenic landscape attributes were tested to increase our understanding of how landscapes affect regional genetic connectivity patterns in snow leopards. Our results suggested that gene flow in Central Asian snow leopards is related to a combination of geographic distance ( $r = 0.357$ ,  $P < 0.000$ ) and the occurrence of several natural landscape features, including bare ( $r = 0.137$ ,  $P = 0.001$ ) and sparse ( $r = 0.096$ ,  $P = 0.012$ ) lands, closed forest habitat ( $r = 0.112$ ,  $P = 0.002$ ), and topography (elevation  $< 1500\text{m}$ ;  $r = 0.257$ ,  $P < 0.000$ ). Alternative landscape resistance hypotheses involving various anthropogenic landscape attributes (e.g., agricultural areas, human population density, proximity to roads and human settlements) were not supported. At last, we identified movement corridors facilitating potential dispersal routes for Central Asian snow leopards among several study areas by applying a circuit theory approach, which helped to identify the most likely movement routes among snow leopard subpopulations, but also revealed areas of conservation concern (e.g., low levels of landscape permeability). We conclude that examining the role that landscapes play in gene flow is crucial information to ultimately improve regional conservation and management efforts for endangered species such as snow leopards.

**Alison Molnar**, Ryan Utz

Chatham University, Pittsburgh, PA, USA

### **Quantifying impacts of invasive vascular plant species on carabid beetle assemblages**

Non-native plant species are expanding in range and abundance at unprecedented rates, exerting strong impacts on ecosystems. Plant species that entirely replace a fundamental ecosystem attribute, such as becoming the dominant ground cover, likely pose a serious threat to native flora and fauna. Japanese barberry (*Berberis thunbergii*) and Japanese knotweed (*Fallopia japonica*) represent two particularly noxious invaders currently spreading in range throughout the eastern United States. Such plants may be particularly acute invaders in urban and suburban systems, where ecosystems are stressed in myriad manners. Arthropods, specifically ground beetles (Coleoptera: Carabidae) are especially sensitive to the conditions of their microhabitat, and are frequently used to gauge the impacts of habitat alteration. Consequently, measuring the community composition of such forest-dwelling arthropods serves as a useful proxy for overall ecosystem health. We compared the Carabid biodiversity (species richness) and abundance (catch rates) between relatively intact forest floor habitat and parcels heavily invaded by *F. japonica* and *B. thunbergii*. Additionally, we sampled in urban systems that had been actively restored to suppress the nonnative plants. Pitfall trapping was utilized to catch and preserve specimens. Sampling occurred throughout the growing season, with collections retrieved twice monthly. Our findings demonstrate how the invasion of these non-native plants affect the structure of Carabid assemblages in both urban and rural environments. Considering the importance of these burrowing organisms to the structure of soil matrices, our findings carry implications for ecological function beyond the organisms directly quantified in our study.

**Asia Murphy**<sup>1</sup>, Zach Farris<sup>1</sup>, Sarah Karpanty<sup>1</sup>, Felix Ratelolahy<sup>2</sup>, Vonjy Andrianjakarivelo<sup>2</sup>, Marcella Kelly<sup>1</sup>

<sup>1</sup>Virginia Tech, Blacksburg, VA, USA; <sup>2</sup>Wildlife Conservation Society–Madagascar Program, Antananarivo, Madagascar

### **Aliens among us: how exotic predators influence the distribution of native species**

Across the world, the increased presence of exotic predators in ecological communities is negatively affecting native

populations, particularly native prey species. Madagascar is a biodiversity hotspot with high rates of endemism, but despite its importance, little research has examined how exotic predators influence the distribution of native prey species on the landscape. To address this knowledge gap, we conducted camera trap surveys at seven forest sites over multiple years (2008–2015) in Madagascar's largest protected area complex, the Masoala–Makira landscape. We examined whether habitat features (e.g., percent rainforest cover), the presence of three exotic predators (domestic dog *Canis familiaris*, feral cat *Felis silvestris*, and small Indian civet *Viverricula indica*), or both factors influenced the landscape occupancy and detection probability of nine native ground-dwelling birds and small mammals using two-species occupancy models in program PRESENCE. In most instances, habitat features were more important than exotic predator presence when explaining native ground-dwelling bird and small mammal occupancy probability. However, five species were detected less often where feral cats were present, four where domestic dogs were present, and three where small Indian civets were present. Our findings emphasize the importance of acknowledging the influence of exotic predators on researchers' abilities to detect native species, particularly when attempting to close knowledge gaps in the ecology of under-studied species.

**Amelia Olsen<sup>1,2</sup>, Arielle Van den Ende<sup>1,3</sup>, Rae Wynn-Grant<sup>1</sup>**

<sup>1</sup>Science Research Mentoring Program, American Museum of Natural History, New York, NY, USA; <sup>2</sup>Fiorello H. LaGuardia High School, New York, NY, USA; <sup>3</sup>Brooklyn Friends School, Brooklyn, NY, USA

### **Humans and conflict with bears (oh my!)**

Human-bear conflict in the Western Great Basin (WGB) in Nevada has increased with the population growth of the American black bear (*Ursus americanus*) in the region. Understanding the patterns of such conflict can aid wildlife managers in mitigating the problems and tailoring specific policies to reduce conflicts and keep humans and bears as safe as possible. In studying conflict reports from 2009 to 2014, conflicts were categorized by type, and the frequencies for time of day as well as for season were recorded. In comparing the trends over all six years, constancy was found in the most frequent time of day, season, and conflict type. However there were upward trends in the number of occurrences per year as well as an increased frequency of occurrences during the night-time.

**Libertad Orozco<sup>1</sup>, Cuauhtémoc Chávez<sup>2</sup>, Carolina Valdespino–Quevedo<sup>1</sup>, Rurik List<sup>2</sup>**

*Instituto de Ecología A.C., Xalapa, Veracruz, Mexico; Universidad Autónoma Metropolitana–Lerma, Lerma de Villada, Estado de Mexico, Mexico*

### **Effects of landscape attributes and urbanization on carnivores in Central Mexico**

The expansion of the cities of Mexico and Toluca has resulted in land change from native vegetation to agriculture and urban areas. The forests that divide the two cities are still refuge of carnivore species that have resisted urbanization. The goal of this study is to record the effect of landscape attributes and human disturbances in the richness and relative abundance of carnivores. We used camera traps, placed in seven patches, during the dry and rainy seasons to detect carnivores. Patch area, shape and distance to the nearest neighbor were the selected features for the landscape analysis. Distance from each camera to the nearest paved road, to the closest human settlement and to the edge of the patch was used as measure of human disturbance. We found a carnivore community composed of nine native species and one exotic species. Species accumulation curves showed that for the rainy season the inventory was complete and for the dry season was above the 80%. The largest patch had the highest species richness. Over the seven patches, the most abundant species was the domestic dog. Coatis and hooded skunks were the least abundant species. Models showed that for some species, like raccoons, ring-tailed cats, spotted skunks and bobcats, the distance to roads and human settlements could be a reason for their absence from patches. The results of this study will contribute to determine conservation actions for this area, one of the most populated but least studied in the country.

**Eric Osei–Kwarteng**

*Visionary Vine, Kumasi, Ghana*

### **Hippo conservation status along the Black Volta river in Northern Ghana**

Many of the world's fauna and flora are endangered either through overexploitation or loss of habitat. Many wild animal species are either locally extinct in some parts of their range or in danger of local extinction. Hippo is one such animal in Ghana. The species is already extinct in most parts of its range in Northern Ghana and is now mainly restricted to the Black Volta river. An attempt was therefore made to establish its conservation status, distribution and habitat requirements in its range in a protected area (Bui National Park) and in an unprotected range (Portion A). The population trends, distribution,

habitat requirements and threats to survival were noted in each study range. In the end, it was discovered that the species was increasing in Bui National Park at the rate of 15 Hippos per annum over the last decade whilst the species was found to be decreasing in Portion A (Unprotected Range) due to poaching and habitat encroachment, and hence urgent conservation measures are required to stop the decreasing trend of Hippo population in Portion A and help to perpetuate its survival.

**Soloniaina Mamy Razafitsalama<sup>1</sup>, Travis Steffens<sup>2</sup>**

<sup>1</sup>*Planet Madagascar, Antananarivo, Madagascar*; <sup>2</sup>*University of Toronto, Toronto, ON, Canada*

### **Resident attitudes toward endangered lemurs, forests, and conservation**

In August of 2014, we surveyed 213 of 488 residents within three hamlets in Ankarafantsika National Park in NW Madagascar about their views regarding conservation, use of lemurs and forests, and additional information about their livelihoods. Our survey consisted of 84 questions and was conducted by a team of six members. We found that all respondents felt that forest was important for their family and community. The most common use of the forest was for fuel wood and food gathering. However, 38.49% felt that they were not allowed to use forest resources in the area surrounding their village. Respondents were only able to identify two of the eight lemur species found in the park. The majority of respondents felt that lemurs were not useful in their daily life and only 20.66% knew that lemurs were important seed dispersers. Approximately half of the residents have a cultural aversion to consuming lemur as food, and 24.88% reported to have consumed lemur. Residents identified hunting and trapping as the greatest threat to lemurs. Only 4.23% of respondents kept lemurs as pets. 74.18% of respondents claimed to engage in a conservation activity, with creating firebreaks and participating in forest patrols being the most common conservation activities. Residents identified fire as the biggest threat to forests. Our survey shows that current efforts to protect lemurs in Ankarafantsika have failed to address resident attitudes towards them. We recommend improving the efficacy of education in the park and increasing capacity to prevent and fight fires.

**Ganga Ram Regmi<sup>1</sup>, Falk Huettmann<sup>2</sup>, Madan Krishna Suwal<sup>1</sup>, Vincent Nijman<sup>3</sup>, KAI Nekaris<sup>3</sup>, Kamal Kandel<sup>1</sup>, Narayan Sharma<sup>4</sup>, Camille Coudrat<sup>3</sup>**

<sup>1</sup>*Global Primate Network–Nepal, Kathmandu, Nepal*; <sup>2</sup>*University of Alaska Fairbanks, Fairbanks, AK, USA*;  
<sup>3</sup>*Oxford Brookes University, Oxford, UK*; <sup>4</sup>*Indian Institute of Science, Bangalore, India*

### **Potential distribution of Assamese macaque in South and Southeast Asia**

We developed the first quantitative potential niche distribution models using climate envelopes for the Assamese macaque *Macaca assamensis*. The model covers 12 countries of South and Southeast Asia (Afghanistan, Pakistan, Nepal, India, China, Bangladesh, Bhutan, Myanmar, Vietnam, Thailand, Lao PDR and Cambodia). We combined species occurrence records and applied high-performance RandomForest (RF), Classification and Regression Tree (CART), TreeNet (TN) and MaxEnt machine learning algorithms in parallel, using information on elevation and 19 environmental layers related to precipitation and temperature from WorldClim to develop the multivariate model predictions on a high resolution for the study area. The model outputs were assessed and the averaged into one best possible ensemble model prediction using performance metrics. Our results suggested that predicted distribution of Assamese macaque was strongly associated with BIO 18 (Precipitation of Warmest Quarter), BIO 7 (Temperature Annual Range) and BIO 4 (Temperature Seasonality). The predicted map shows a continuous and potential niche of Assamese macaque reaching from the east of the Kaligandaki River in Nepal, into northeastern India, Myanmar and Lao PDR. In this study, we provide the first robust rules and resource selection functions (RSFs) for such predictions using partial dependence plots. Our predictions also confirm that there are no ecologically suitable areas for this species in Pakistan and Afghanistan. The model outputs are freely available in Open Source GIS formats for assessment and updates, and are also helpful for understanding biogeography and historical ecological niche evolution of the species, as well as for taxonomy, genetics and conservation management.

**Anne Ricculi**

*Drew University, Madison, NJ, USA*

### **Using digital scholarship to evaluate trends in coral in 19th c. British periodicals**

I argue that the Victorian-era British press educated working- and middle-class readers about contemporary debates regarding coral activity. I conducted and analyzed key-word computer searches of scanned documents, including articles, book reviews, periodicals, and exhibition catalogues published from the 1830s through the 1910s, to document trends in the construction of a vernacular understanding of the invertebrate animal. As environmental historian Donald Worster has defined, the vernacular represents a personal “competence,” based on “the long, intricate experience that ordinary people have had with nature” as they try to “make personal sense of their surroundings.” Yet as this poster demonstrates, British



authors and editors created a vernacular understanding of coral that functioned on a societal level. My research identifies a decline in the perceived value of coral in late nineteenth-century print culture rhetoric, and my analysis attributes the shift in part to the portrayal of coral and coral reefs in textbooks. Insights gained from this historical study draws attention to the power of print and media to inform the public about unseen nature.

**Ruby Rivera<sup>1</sup>, Paul Sturm<sup>1</sup>, Steve Tamar<sup>2</sup>**

<sup>1</sup>*Ridge to Reefs, Eldersburg, MD, USA;* <sup>2</sup>*Surfrider, Rincón, Puerto Rico*

### **Tracking and addressing pollution impacting coral reefs at Tres Palmas Marine Reserve**

Rincón is a small coastal town experiencing rapid growth in the northwest region of Puerto Rico (PR) with approximately 15,000 residents. Rincón is home not only to great surfing—being the “capital of surfing” in PR—but also important coral reefs which help create the surf break and contribute to the diverse fisheries in the region. Rincón is the home of the Tres Palmas Marine Reserve, designed to protect one of the reefs with the highest percentage of live coral coverage in PR nearshore waters, and specifically what is recognized to be the healthiest and most genetically diverse stands of federally protected elkhorn coral (*Acropora palmata*) in the Caribbean. Addressing land based sources of contamination is critical to establishing resilient corals reefs which are not only being impacted by the growing population, but also by climate change. Our project goal is to track sources of contamination using several indicators including ammonia (present in sewage), optical brighteners (present in detergents) and Chlorophyll A (indicator of nutrient enrichment). The effort is leading to key areas of sewage pollution, methods to confirm pollution of nearshore waters, and specific restoration/remediation projects. One example of remediation being proposed for implementation is planting vetiver grasses which have a high nutrient uptake capacity, to uptake polluted waters before reaching the coast. Outcomes of scientific and restoration activities will be shared with the public and local Surfrider chapter through interactive maps, including transport of bacteria and nutrients through the beach berm and results of pollution abatement activities.

**Christian Rivera**

*Princeton University, Princeton, NJ, USA*

### **Exploitation of endangered mammals in the United States**

Overexploitation, including both lethal and nonlethal harvesting by humans, affects more than 30% of mammals worldwide, and ranks second to habitat destruction as the major threat to imperiled mammals in the United States. However, few quantitative studies on the specific threats facing threatened species have been conducted. In this study I conduct a fine-scale analysis on the extent to which different types of exploitation threaten the mammal species, subspecies, and populations that are protected under the U.S. Endangered Species Act. I also analyze the prevalence of different types of exploitation among different mammal groups, and among terrestrial and aquatic mammals. 65% of federally endangered mammals are threatened by exploitation, including all endangered ungulates, whales, and dolphins. Hunting is the most prevalent type of exploitation, threatening 87% of endangered mammals, followed by incidental harvest (43%), harvesting for raw materials and persecution (both 41%), bycatch specifically (28%), collisions with road vehicles (24%), subsistence hunting (18%), collisions with ships (15%), death during a scientific activity (7%), and collection for scientific purposes or public displays (both 3%). A significantly higher proportion of terrestrial mammals than marine mammals are threatened by persecution, while marine mammals are more significantly threatened by incidental harvest, harvesting for raw materials, and subsistence hunting. The results of this study highlight the extent to which different types of human-induced exploitation threaten U.S. endangered mammals, and can be used by scientists, policy makers, and managers to direct conservation efforts aimed at educating the general public.

**Isabella Romitelli<sup>1</sup>, Simone Aparecida Vieira<sup>2</sup>, Jean Paul Metzger<sup>1</sup>**

<sup>1</sup>*University of São Paulo, São Paulo, SP, Brazil;* <sup>2</sup>*University of Campinas, Campinas, São Paulo, SP, Brazil*

### **High variability and low carbon stocks of tropical forest in fragmented landscapes**

Deforestation and fragmentation, resulting from the expansion of human activities in tropical forest landscapes promote changes in landscape structure, usually with loss of mature forests for agriculture or pasture, partially offset regionally with the regeneration of young secondary forests. This process generates heterogeneous landscapes with secondary forests in different stages of succession and disturbance. The stock of carbon in these forests can thus vary greatly and this variation may occur at different spatial scales. This study aimed to understand how the different local and landscape conditions contribute to Carbon Stock (CS). The study was performed in secondary Atlantic Forest (southeastern Brazil).

CS was estimated by forest inventory data and allometric biomass models. In order to test how the CS of a tropical forest varies in disturbed landscapes, generalized linear models were constructed with four groups of variables: forest age; human disturbances; topography (terrain slope and elevation); and landscape structure. CS varied widely among study sites and this was explained by the explanatory variables. The most surprising result was the low overall CS in the study areas (30.91mg/ha). The results suggest that this pattern is mainly related to edge effects and the influence of factors directly driven by human occupation (e.g. more disturbed forests, landscapes with low forest cover and high relative occurrence of younger forests). Low carbon stocks and high spatial variability indicate the need to incorporate in carbon stock estimates a finer spatial scale for climate mitigation and maintenance of ecosystem services programs in fragmented landscapes.

**Kaia Tombak, Daniel Rubenstein**  
*Princeton University, Princeton, NJ, USA*

### **Differential exposure and vulnerability to parasites in plains and Grevy's zebras**

The plains zebra is adapted for moderately wet environments while the endangered Grevy's zebra is adapted for semi-arid environments. Historically, these two species had a very narrow overlap in range in central Kenya, but in the past few decades, a growing human population has pushed the Grevy's zebra deep into plains zebra habitat. Even within the same habitat, the two zebras use the landscape differently and may be subject to different pressures, which would promote coexistence between these very similar herbivores. Grevy's zebras need to drink only half as frequently as plains zebras, and can graze far from areas that are heavily used by herbivores and where gastrointestinal parasite larvae abound. I conducted a study of zebra parasite burden and immune response to quantify the pressure that this difference in exposure to parasites may be inflicting on their populations. Three sites were chosen based on ecological conditions. Plains zebras generally had higher parasite loads than Grevy's zebras, especially in wetter habitats. Parasite load in plains zebras correlated negatively with immune function, but Grevy's zebras showed no correlation. Overall, the results suggest that plains zebras are more exposed to gastrointestinal parasite infection and are possibly more vulnerable to infection than Grevy's zebras, which may in fact be relatively tolerant to these parasites. Given the considerable effect of rainfall on parasite survival and dispersal, climate change in this region is likely to affect parasite pressure on plains zebras, while parasites may continue to be relatively inconsequential to the endangered Grevy's zebra.

**Lina Valencia<sup>1</sup>, Cristhina Florez<sup>2</sup>, Julieth Florez<sup>3</sup>, Alejandra Osorio<sup>4</sup>, Daniela Acosta<sup>5</sup>, Jessica Otalvaro<sup>4</sup>**  
*<sup>1</sup>University of Texas at Austin, Austin, TX, USA; <sup>2</sup>National University of Colombia, Bogotá, Colombia; <sup>3</sup>Universidad del Tolima, Ibagué, Colombia; <sup>4</sup>Universidad de Caldas, Manizales, Colombia; <sup>5</sup>University of Magdalena, Santa Marta, Colombia*

### **Conserving the endangered silvery-brown tamarin in highly degraded forests**

Primates and their habitats have been strongly affected by human activities in most tropical ecosystems. Activities such as hunting, selective logging, and cattle ranching, among others, have led to the deforestation and fragmentation of primate habitat. Habitat fragmentation leads to a reduction of total habitat area and an increase in isolation between patches of forest, which further reduces the connectivity between patches and impedes the dispersal of individuals from one population to another. Although deforestation and fragmentation of habitat are considered the main threats to primate survival, more research is needed to explore the viability of primate populations in anthropogenically modified landscapes. In this study, we examine the effect of habitat degradation on the abundance and ranging patterns of the silvery-brown tamarin (*Saguinus leucopus*), an endangered and endemic primate of Colombia, to evaluate the viability of its populations in degraded habitats. We collected data regarding differences between population densities, home range and habitat use of tamarin groups inhabiting degraded forests within a heterogeneous human modified matrix in the state of Caldas. Furthermore, we worked closely with local stakeholders to (1) increase understanding of the threats and degree of endemism of the silvery-brown tamarin and its role in the ecosystem and the community's livelihood, (2) raise awareness of cattle ranchers about alternative cattle ranching practices that benefit both the beef production and the silvery-brown tamarin habitat, and (3) developed micro-scale conservation plans that use silvopastures as potential habitat corridors for primates.



Vivian Valencia<sup>1</sup>, Shahid Naeem<sup>2</sup>, Paige West<sup>2,3</sup>, Luis García-Barrios<sup>4</sup>, Eleanor Sterling<sup>5</sup>

<sup>1</sup>University of Michigan, Ann Arbor, MI, USA; <sup>2</sup>Columbia University, New York, NY, USA; <sup>3</sup>Barnard College, New York, NY, USA; <sup>4</sup>El Colegio de la Frontera Sur, Chiapas, Mexico; <sup>5</sup>American Museum of Natural History, New York, NY, USA

### **Coffee agroforestry and the conservation of native forests in a Biosphere Reserve**

Agroforestry is considered a promising alternative to conventional agriculture that can both conserve biodiversity and support local livelihoods. Coffee agroforestry may be particularly important for sustaining trees of conservation concern (CC) and late-successional stage, but this possibility remains unclear. Here, we examined whether coffee agroforestry systems can serve as conservation reservoirs of tree species native to nearby forests. We compared tree diversity, composition and structure between coffee agroforests and forests in La Sepultura Biosphere Reserve in Chiapas, Mexico. We found that, although at the landscape level the full set of coffee agroforests appears to conserve comparable tree species richness to nearby native forests, the species composition that is being conserved is different. Coffee agroforests had a lower proportion of trees of CC, had a higher proportion of pioneer trees, were dominated by *Inga spp.* and other tree species preferred by farmers, harbored lower tree species diversity at the plot level, and were composed of different tree species compared to native forests. We found that the higher proportion of pioneer trees relative to forest is mostly explained by farmers' tree selection decisions (63%) rather than as a byproduct of management practices (37%). Based on interviews and tree inventories, we found that farmers gradually replace canopy trees of neutral and disliked species by preferred species, in particular *Inga spp.* Promoting different coffee agroforest management strategies, such as discouraging the replacement of diverse agroforest canopies with *Inga*-dominated canopies, would help improve the conservation value of coffee agroforests through more sustainable practices.

Meredith Vanacker, Oswald Schmitz

Yale University, New Haven, CT, USA

### **The impact of urbanization on *Echinostoma sp.* infection of green frogs**

Anthropogenic changes to the environment are a leading cause of emerging infectious diseases that pose risks to wildlife. An important contribution to disease emergence is environmental degradation driven by pollution, habitat fragmentation, and eutrophication. Amphibians are an especially sensitive class of animals that have experienced widespread declines through habitat loss, degradation, and increased rates of disease. This research examines how urbanization affects the infection of green frog (*Rana clamitans*) tadpoles by parasitic flatworms (*Echinostoma sp.*) through changes in water quality and the alteration of landscapes surrounding ponds. This study used field sites along an urbanization gradient, which included three forested ponds, seven low-density suburban ponds and seven high-density suburban ponds located within a 35km radius of New Haven, Connecticut. The seventeen ponds were categorized to identify the percent suburbanization within 200m of the pond edge. Surveys were conducted during the months of June through August of the parasite's primary host, freshwater snails, and the secondary host, green frog tadpoles, using pipe samplers and dip-nets. Water samples and water quality measurements were taken. Snails and tadpoles were dissected to assess the presence of *Echinostoma* parasites. The results show the level of suburbanization and the nutrient load are significant in predicting the *Echinostoma* parasite presence and burden in host populations. This work contributes to the understanding of how land use mediates the *Echinostoma sp.* parasitism of frogs through altering water quality and primary host presence.