

***CONSERVATION WITHOUT BORDERS***

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**ABSTRACTS:  
CONTRIBUTED POSTER  
PRESENTATIONS**

**STATUS AND CONSERVATION NEEDS OF THE DUGONG: THE MOST ENDANGERED MARINE MAMMAL OF CAMBODIA AND VIETNAM**

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This research was conducted to locate dugongs and assess the numbers of animals, the location of population groups, and conservation issues affecting dugongs along the eastern Gulf of Thailand in Cambodia and Phu Quoc Island, Vietnam. During four days of aerial surveys in Cambodia we saw no dugongs. We conducted interviews with villagers in 2002 and 2004 along the Cambodian coast. In Vietnam, we interviewed villagers in 2002. In Cambodia, interviews in 2002 and 2004 showed that dugongs are sporadically found in fishing nets, and their body parts are sold for a relatively large profit. From interviews in Phu Quoc Island, we learned that dugongs are regularly found and hunted, again for high profits. Fishers in Phu Quoc mentioned that dugongs were found along the eastern coast of Cambodia. In both countries we recommend that legislation addressing endangered species be created and enforced. In collaboration with the Cambodian and Vietnamese governments and local NGOs, we also recommend the exploration of alternative non-destructive fishing methods and the initiation of an education campaign based on conservation of marine wildlife and the near-shore environment. National management and community-based conservation are necessary in both countries in conjunction with strategies to address overfishing and poverty.

**ECOLOGY AND CONSERVATION OF DAREVSKY'S VIPER (*VIPERA DAREVSKII*) IN THE CAUCASUS**

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The Darevsky's viper is a critically endangered endemic snake species of northern Armenia. Our project started in May 2005 and covered the south-western slopes of the Javakheti ridge. We recorded the location, elevation, and exposure of the snake capture sites; type and climate of the habitats; and size, sex, physiological condition, body temperature, and behavior of captured individuals. We captured 57 individuals, of which 21 were marked by cutting of abdominal scutes and 8 adults were additionally fitted with microchips for radio-tracking. The key habitats were stone lands and mountain moraines with large flat slabs and rocky outcrops at elevations 2300–3000 m. The landscape was subalpine meadow. The snake density was up to 10–12 individuals / ha and the estimate of population size is 250–300. The principal threat is overgrazing. It is essential to include this species in the Red Data Book of Armenia and ensure conservation of its habitats. These measures comply with the national program on establishment of Arpi Lich National Park in northern Armenia. It is also important to fence these areas, mark them with stop signs, regulate the haymaking and grazing rules, raise awareness among local people, and enforce the state control over illegal capturing.

**AN ASSESSMENT OF THE RELATIONSHIP BETWEEN HUMAN ELEPHANT CONFLICT AND CROP DAMAGE COMPENSATION METHODS IN BANNERGHATTA NATIONAL PARK, SOUTHERN INDIA**

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Understanding the status of human elephant interaction is important particularly when huge economic resources are spent on compensation to loss of lives and crop. This study assesses the efficacy of the system of compensation payment for the period 1994 to 2004. The spatial distribution of villages claiming compensation and the status of forest cover close to it were studied. A comparison of habitat usage by elephants and straying into human habitations was also made for different seasons. An average of 546 compensation claims were accounted from 105 villages and 75 of the affected villages were distributed close to fragmented forests. The percentage difference of amount between claimed and assessed was 60 (SE = 3.6) and actual payment made was only 54 (SE = 4.5) of the claim. Our results show a lack of association between elephant distribution, elephant density, villages affected, and the compensations paid during different seasons, even in the preceding years.

**LINKING UNDERGRADUATE TRAINING AND CONSERVATION OUTCOMES USING RAPID BIODIVERSITY ASSESSMENT METHODS**

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To enhance undergraduate training in conservation biology and conservation outcomes, we initiated multi-taxa biodiversity surveys in a private forest reserve of northwestern Costa Rica. The surveys follow the methods of Rapid Biodiversity Assessment Programs (RAPs) and are embedded in a full year course on tropical ecology and conservation. During four 9–10 day stays at the field site, 44 students have conducted individual projects involving netting and trapping of bats and insects and observational sampling of terrestrial mammals, amphibians, reptiles, and birds. Data were used to build species checklists for the study area, assessments of species richness for the various taxonomic groups, their habitat use and preferences, and to calculate diversity and similarity indices among habitats. This information is made available to the reserve owners and contributes to the development of their conservation plans. The quality of student projects is enhanced by the RAP framework and by building on the knowledge acquired from prior field studies. In the longer term, repeated surveys are beginning to lead to the monitoring of target groups.

**LANDSCAPE ASSESSMENT OF TREE COMMUNITIES IN THE MOIST KARST REGION OF PUERTO RICO: USING EXISTING DATA SETS AS A SCALING TOOL IN ECOREGIONAL PLANNING**

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Ecoregional planning is recognized as a major tool in setting conservation priorities in large spatial areas containing thousands of species and natural communities. In tropical regions, assessments are generally done at a coarse scale using ecosystem

targets as surrogates for species, due to the lack of species specific, geospatial distribution data. Existing spatially explicit, large datasets can be used as a mesoscale priority setting tool. The moist karst of Puerto Rico contains one of the island's largest remaining forested tracts. The region is typically considered a single vegetation type in conservation plans and forest classifications, creating a perception that the region is a relatively homogeneous forest. We asked whether there were distinct tree assemblages that would necessitate targeted conservation strategies to insure their protection. Using plot level woody plant community data, we found distinct tree communities in the west, south, and east-central portions of the study area. As planning moves from the coarse scale—with moist karst forest as a target—to selecting sites for conservation action, we recommend that sites be selected in each of these distinct forest zones. We suggest that other datasets are available that can similarly be used for scaling down in ecoregional conservation planning efforts in tropical regions.

#### **WHAT IS THE "BEST" POLICY FOR REBUILDING OVERFISHED POPULATIONS?**

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United States policy requires overfished populations of marine fish to be rebuilt to the target biomass level in 10 years if possible, otherwise in the time it would take to rebuild with no fishing plus one mean generation time. A debate is ongoing about whether this rebuilding time requirement should be replaced with some other rebuilding strategy, such as stricter controls on harvest rates. Most populations can recover within 10 years; the exceptions have very low productivity or are severely depleted. Of the five overfished populations for which rebuilding policies were compared, the swordfish and red snapper were able to rebuild in 10 years, but white marlin, sandbar shark, and darkblotched rockfish were not. For all 5 populations, decision rules which reduced fishing mortality at lower biomass levels rebuilt rapidly. Some rebuilt more rapidly under a fixed rebuilding time requirement and some under a decision rule. The decision rules had the lowest catches while the population was low, but allowed catches to increase more rapidly as the population rebuilt. Thus, there is a trade-off between relatively high catches early in the rebuilding period and higher catches as the population rebuilds to a level that can sustain a larger fishery.

#### **TERRESTRIAL CHARACTERISTICS OF STELLER SEA LION HAULOUTS AND ROOKERIES**

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Steller sea lions range across the Pacific rim from Southern California in the east to northern Japan in the west, where they have continuously occupied terrestrial resting sites (haulouts) and breeding sites (rookeries) for hundreds of years, if not longer. Anecdotal accounts describe Steller sea lions as predominantly occupying exposed, rocky shorelines, but this habitat preference has never been quantified. We compared locations of haulouts and rookeries against a coastline type database to identify and quantify the shoreline preferences of Steller sea lions and to look for other spatial trends in site characteristics. Steller sea lions were found to preferentially locate haulouts and rookeries on exposed rocky shorelines and wave-cut platforms. Shoreline types that were used in lower proportion than their availability included fine-to-medium-grained sand beaches, mixed sand and gravel beaches, gravel beaches, and sheltered rocky shores. No relationship was found between either latitude or longitude of a site and its average non-pup count.

#### **DEVELOPING A SEA TURTLE RECOVERY PLAN FOR A SMALL SCALE COMMUNITY: A COMMUNITY-BASED CONSERVATION AND MANAGEMENT EFFORT AT HELEN ATOLL, PALAU**

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Recovery of migratory sea turtles requires community-based, regional, and international efforts. In remote areas, which are frequent homes to regional subpopulations and essential habitat, local communities are often the users and primary stewards of sea turtles. In an effort to conserve sea turtles for the long-term use and enjoyment by their people, a Hatohebian community group in Palau has engaged in a long-term monitoring and conservation management project within Helen Reef Reserve. Collaborators include the Palauan government and U.S. based partners. Monitoring and data collection efforts by the community include capture-mark-recapture, nesting observations, hatchling observations, collection of tissue samples, habitat assessment, and community cross training. Field time is focused on generating observational information for use in a locally relevant sea turtle recovery plan and building the capacity of the community to implement this plan. Future work will focus on the creation of regional and international alliances that will collaborate on sea turtle conservation and recovery, and the use of satellite telemetry tracking to determine migratory patterns. This project is a model for small-scale community conservation and management of wide ranging species. Results of this effort show that organic community motivation is the key element to successful collaborative endangered species management.

#### **DOLPHINS FOR DEVELOPMENT—A PILOT CONSERVATION PROJECT IN THE MEKONG RIVER**

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Research was initiated in 2001 on the Irrawaddy dolphin population that inhabits the Mekong River. By 2003, it was confirmed that the population was very small (only approximately 170 individuals) with unsustainably high mortalities each year (16–18 individuals) and a high probability of local extinction in the next 15 years. In 2003, the Mekong Dolphin Conservation Project was formed to contribute to the long-term conservation of this population, which was recently classified as Critically Endangered by the World Conservation Union (IUCN). In addition to conservation activities throughout the dolphins distribution, a Dolphins for Development integrated conservation development project (ICDP) was trialed in two Cambodian villages on the Lao / Cambodian border. Although this project has obtained encouraging results, significant challenges exist resulting from the

transboundary location of the site, with three Laos villages situated on the adjacent bank receiving no paralleled activities. Without complemented cooperation at this critical dolphin habitat, conservation activities are severely impeded. Project results emphasised the urgent need for transboundary cooperation with conservation activities, as well as additional support for community-based conservation from local governments and the tourism sector, if dolphins are to survive in the Mekong River.

### **CONSERVATION LEASING AND OWNERSHIP OF MARINE RIGHTS: LEASING KELP BEDS TO EXAMINE THE NURSERY ROLE OF *MACROCYSTIS* CANOPY**

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It has been assumed that strategies for marine conservation must be substantially different than those for terrestrial conservation, in part because it is not possible to "buy the bottom" of the publicly owned oceans. This is an unfortunate misconception. There are significant submerged lands available for lease and ownership in the USA. The Nature Conservancy is exploring the leasing and ownership of submerged lands as a tool for marine conservation for a diverse array of ecosystems. To examine some of the benefits, considerations and strategies of this tool in California, the Nature Conservancy has received approval to lease over 1700 acres of kelp forests within the Monterey Bay National Marine Sanctuary. These beds will be monitored over 3 years to assess the biodiversity supported by the kelp canopy, and the potential impacts of canopy removal on diversity. After the initial sampling season, surveys have demonstrated a significant decrease in the numbers of settled and newly settling juvenile rockfish and invertebrates after experimental kelp canopy removal in comparison to areas of intact kelp canopy. It is our hope that the study of kelp beds as nurseries for juvenile rockfish and invertebrates may illuminate some of the key factors that control the diversity of these nearshore species and suggest best management practices.

### **THE DOMINANCE OF EXOTIC TREE SPECIES IN THE URBAN ENVIRONMENT OF RIO DE JANEIRO, BRAZIL, AND THE NEED OF A NEW GARDENING MODEL**

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Exotic invasive species presently constitutes one of the main problems for conservation. In the present study we evaluated the use of native and exotic tree species at the urban area of Rio de Janeiro City, Brazil and related the density of tree species in each district to their economical index. We also estimated the tree deficit according to the pattern expected if the original gardening plan of the city was followed properly. We sampled a total of 1701 streets of the city recording at each street the tree species and the number of exotic and native tree individuals along 300 m of extent of the street. We found a total of 20 native species and 40 exotic species. Exotic species dominated urban landscape in all districts. The larger districts which had people with higher economical resources were also those having a higher density of trees ( $F_{2,97} = 32.124$ ,  $P < 0.001$ ). Of the 1701 streets sampled, 66% had any tree planted. The total tree deficit estimated for the municipality was of 869,260 trees. A new model of gardening urbanization at Rio de Janeiro City is urgently needed changing in a long term the nowadays model for a model dominated by native species.

### **LINKING MULTIVARIATE HABITAT MODELING INTO ARCGIS WITH THE ARCRSTATS TOOLBOX**

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Predicting habitat for conservation and management requires sophisticated geospatial and statistical analysis. Translation of data formats and coordination of processes between GIS and statistics packages represents a significant hurdle to modern conservation analysis. We developed the open-source ArcRStats toolbox to overcome this obstacle. A Python scripting framework facilitates communication between ESRI ArcGIS and the R statistics package. The currently available multivariate habitat modeling techniques include generalized linear model (GLM), generalized additive model (GAM), and classification and regression tree (CART). Addition of other multivariate techniques are anticipated soon. The ArcRStats toolbox provides a suite of these methods that can be effortlessly linked to required environmental and species input data within the Model Builder visual designer. Prediction habitat maps, diagnostic statistical plots, and summary tables are automatically generated. Examples from terrestrial and marine ecosystems will be demonstrated. The toolbox is freely available (<http://www.env.duke.edu/geospatial>) and customizable, providing a flexible and robust tool for conservation modeling.

### **IS TAXONOMIC DIVERSITY IMPORTANT FOR THE PERFORMANCE OF SPECIES INDICATOR GROUPS FOR IDENTIFICATION OF AREAS FOR SPECIES CONSERVATION?**

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There is an urgent practical need for easily measurable biodiversity indicators that can guide the identification of areas important for species conservation. In this study we used data on the Danish distribution of 950 species of insects, vertebrates, and plants to test whether taxonomic diversity in species groups influence their effectiveness in representing biodiversity. We selected species indicator groups for which we systematically changed the taxonomic diversity in terms of the number of different genera, families, and orders, respectively. We evaluated the performance as the representation of species in the target groups that were independent in species composition of the indicator groups. We measured both the number and the taxonomic diversity (measured as number of genera, families, and orders) of the covered target species. Surprisingly, we found that changing the taxonomic diversity of indicator groups (both at the genus-, family-, and order-level) had no or only slight influence on the effectiveness in representing biodiversity compared to randomly chosen species groups.

### **IMPROVING THE PERFORMANCE OF INDICATOR GROUPS FOR THE IDENTIFICATION OF IMPORTANT AREAS FOR CONSERVATION OF SPECIES**

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Biodiversity indicators are needed to guide conservation planning. However, it is still unclear to what extent indicator groups, as sets of species, can guide the identification of area networks for species representation. Here, using distributional data on sub-Saharan birds and mammals, we aim to identify factors influencing the effectiveness of indicator groups. We selected sets of species, indicator groups, with systematic changes in species composition in terms of (1) the number of threatened, endemic, rare, common, and large species, respectively; and (2) the number of different genera and families. We tested the performance of indicator groups in representing the target groups which, in terms of species composition, are independent of the indicator groups. We find that even randomly selected sets of species perform much better than randomly chosen area networks, and, surprisingly, that changing the species composition of indicator groups only to a smaller extent can improve the performance further.

**PROPOSAL OF A BIOLOGICAL CORRIDOR BETWEEN TWO PROTECTED AREAS IN ECUADOR USING THE LEAST COST PATH ANALYSIS FOR THE ANDEAN BEAR**

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Actually the national protected areas of Ecuador constitute a series of natural patches surrounded by zones with human alteration. Although there is a good 20% of the terrestrial area covered by this protection, it's still not enough for species with wide habitat range areas like Andean bear. That's why we decide to establish of an ecological corridor between two protected areas: Antisana Ecological Reserve and Llanganates National Park, which are separated by 20 kilometers of paramos and montane forests, mainly in private lands. To establish the corridor, we research the conservation status of the natural areas and the land tenure and make a least cost path analysis for the Andean bear in the western portion of Condor Biorreserve. With all this information we define the limits of the proposed corridor and the different zones of the corridor like core area, buffer zone and intensive use area. The least cost path analysis for Andean bear movement was used to confirm the core areas. For the analysis (1:250,000) we used as variables the soil use and vegetation cover, slope, and variety of vegetation. The obtained routes of greater probability for the Andean bear greatly coincide with determined core areas.

**UNDERSTANDING THE RELATIONSHIP BETWEEN TRAIL SYSTEMS AND FOREST USE IN THE KAKAMEGA FOREST, KENYA**

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The Kakamega Forest is the only lowland rainforest in Kenya and is recognized as one of the most important reserves for biodiversity in East Africa. It has one of the world's highest population densities, and agricultural development has resulted in forest islands embedded in landscapes with various types of human activity (e.g. tea plantations, family farms). Trails provide community members with increased access to previously unused areas. The goal of our research was to explore variables that influenced trail patterns into the forest, and to understand if trails influence human use of forest resources. We examined 50 kilometers of forest perimeter, and located 468 trails using GPS. We found that trails range in size from 0.5–6 m in width and are most often found next to family farms (36.1%). We randomly subsampled 44 of the trails for human forest use, and found that use was highest in the eastern half of the study area where most maize for the region is grown. Our research indicates that trails may be a corollary of the type of land adjacent to them. This study will provide knowledge for local educators and managers concerning human-ecosystem dynamics that could allow for more sustainable forest use.

**ECOSYSTEM-BASED MANAGEMENT AT NESTED SPATIAL SCALES IN NORTH CAROLINA AND THE UNITED STATES SOUTH ATLANTIC REGION**

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We present three emerging place-based, science-based management structures for marine and estuarine ecosystems in North Carolina and the U.S. South Atlantic region and discuss the benefits of complementary policies at diverse ecological scales. (1) The South Atlantic Fishery Management Councils Fishery Ecosystem Plan (FEP) and Comprehensive Ecosystem Amendment amends all federal fishery management plans in the region to better protect essential habitats, characterize removals and fishing behavior and effort, and maintain stocks of prey species. The process includes the development of an Ecopath with Ecosim food web model for the regional marine ecosystem. (2) North Carolina's Coastal Habitat Protection Plan emphasizes protection of fish habitats in addition to traditional harvest controls and integrates the work of three previously separate environmental rule-making commissions. (3) The Albemarle-Pamlico National Estuarine Program is developing ecosystem health indicators for the Albemarle Sound estuary and surrounding watersheds. A related planning effort at Environmental Defense is designed to suggest targets for reserves and biological corridors, habitat restoration, fish harvest, and agricultural practices in the Albemarle region while considering likely effects of global climate change on shorelines. We highlight cooperation and partnerships as key to the development of ecosystem-based management at all scales in this region.

**PERSUADING THE PUNTERS: TRAINING BOATMEN AND THE CONSERVATION OF THE AXOLOTL (*AMBYSTOMA MEXICANUM*) AND ITS REMAINING HABITAT, LAKE XOCHIMILCO, MEXICO CITY**

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The remaining wild population of the Mexican axolotl (*Ambystoma mexicanum*), an endangered amphibian, lives in a remnant

habitat, the canals and small lakes of Xochimilco in the southern part of Mexico City. Here it is under considerable pressure from illegal development, pollution, competition and predation by introduced Asian carp and African tilapia, and possibly from collection for food, medicine, and the live animal trade. As part of a multidisciplinary project seeking to conserve this axolotl and its habitat by promoting it as a flagship species, developing nature-oriented tourism, and undertaking conservation education within the local community, a study was made of the local pleasure boatmen (remeros) and the market for nature-guiding. Three guide training workshops were subsequently developed, offered to the remeros, and run. This paper reports on the research, design, and implementation of these workshops and their effects on the attitudes and livelihoods of the remeros. It argues that the approach employed is helping develop a conservation ethic amongst this key stakeholder group as well as precipitating a significant economic incentive for the sustainable use and conservation of the Xochimilco wetland system.

### **HOW DO WE KNOW IF RESTORATION IS WORKING? EVALUATING HABITAT QUALITY FOR AN ENDANGERED BUTTERFLY**

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The Endangered Species Act is under attack, in part due to the absence of clear progress. Similarly, conservation organizations face pressure to answer the fundamental question, "Are our conservation strategies working?" In response to precariously low population numbers of the federally endangered Karner Blue butterfly (*Lycaeides melissa samuelis*) in east-central New York State, USA, aggressive, collaborative habitat restoration efforts were launched. We report on a project that uses The Nature Conservancy's Measures of Conservation Success framework to determine the effectiveness of these efforts. Habitat restoration criteria, based on state and federal recovery plan objectives, were developed to explicitly link habitat restoration goals with the long-term viability of the species. This effort supplements direct population surveys, and evaluates habitat quality based on host plant abundance, nectar diversity, within-patch structural heterogeneity, and patch size and connectivity. These key ecological attributes were measured at 25 habitat patches during 2005 in order to guide restoration in the short-term. Multi-metric analysis suggests adequate size and connectivity for most study patches, but nutrient and structure conditions may need further restoration. Overall, habitat quality scored below ecologically desirable status, but continued restoration is likely to facilitate the butterfly's recovery and long-term viability.

### **WORLDWIDE MASS STRANDING OF SPERM WHALES: LOCATIONS, NUMBERS, COMPOSITION, AND CAUSES**

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The mass stranding of sperm whales (three or more whales) is well documented worldwide because of the size and numbers of these whales. The first recorded mass stranding event (MSE) occurred in 1572 on the coast of the Denmark in the North Sea. We documented 87 MSEs for sperm whales between 1572 and 31 December 2004. The number of animals involved in these MSEs ranged from 3 to 72. Possible explanations for these MSEs include receiving misleading echolocation information, panic in shallow water, and strong social cohesion when a single individual gets stranded. The major regions where MSEs occurred are Tasmania, New Zealand, and the North Sea. These three regions comprise approximately 55% of the total number of mass strandings. During the past 15 years the number of sperm whale MSEs is ca. 30% of the total. Since 1990, anthropogenic events (acoustic disturbances and contaminants) have been suggested for the increase in these MSEs. Possible causes of these MSEs and their recent increase will be discussed, including the above possible reasons along with natural environmental effects.

### **ESTIMATING KARNER BLUE BUTTERFLY POPULATIONS USING DISTANCE SAMPLING**

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Wildlife managers need to accurately assess densities and distribution of animal populations with reliable, cost effective, and accurate methods that are specific to localized habitats. Currently, the monitoring of the endangered Karner blue butterfly (KBB) is not occurring on most sites throughout Michigan, or if done, methods rely on biased walking transect methods that concentrate sampling efforts in areas of highest site quality. An accurate and streamlined method of estimating total number of KBBs in a subpopulation would allow managers to make better decisions involving management actions. Distance sampling was conducted at eleven sites during second brood flight in July 2005. Permanent transects were systematically placed throughout each site every twenty-five meters with the first transect randomly selected. We measured perpendicular distance to all butterflies detected within five meters of transect line. Data were analyzed using Distance Program software using uniform, half-normal, and hazard-rate key functions. Model selection based on minimal AIC. Results indicate that populations vary considerably between sites, ranging from 315 to 1881 individuals.

### **REBIOMA: A WCS INITIATIVE IN MADAGASCAR FOR CONSERVATION PLANNING**

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The current Madagascar Protected Area Network comprises five Strict National Reserves, eighteen National Parks, and twenty-three Special Reserves, covering 1,700,000 ha in total. During the last Parks Congress in Durban, South Africa, in September 2003, the President of the Republic of Madagascar pledged to bring the total area protected to 6,000,000 ha until 2008. The challenge is to best choose the new protected areas in a country where almost each hectare hosts such high endemism. However, our ability to track information needed to use for conservation planning purposes to design these new reserve still lags far behind the collection of the data itself. REBIOMA, a WCS initiative in Madagascar since 2000 related to gathering available biodiversity data to help decision-making on biodiversity conservation, becomes a key part of the process. Since then,

biodiversity data and associated layers of geographic features, socio-economic information, and analytical tools for conservation planning from REBIOMA lead the process to identify priority areas for conservation to let the Malagasy Government decide more easily the first 1 million hectare in 2005 and the rest of potential areas outside current protected areas for biodiversity conservation in Madagascar.

**CONSERVATION STATUS OF THE ARARIPE MANAKIN (*ANTILOPHIA BOKERMANNI*), A CRITICALLY ENDANGERED BIRD FROM NORTHEASTERN BRAZIL, 10 YEARS AFTER ITS DISCOVERY**

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Almost ten years after the discovery of the Araripe Manakin, we present a reevaluation of its conservation status, including population estimates, increased range, genetic data related to variability, habitat evaluation, ecology, reproductive biology and major threats in order to support a Conservation Plan for the species. The Araripe Manakin is a Critically Endangered bird endemic to the moist forests in the slopes of the Araripe Chapada (plateau), in Ceara State, northeastern Brazil. Four years of systematic research and fieldwork have doubled the previous population estimates of less than 250 individuals, and increased the known range from 1 km<sup>2</sup> to 20 km<sup>2</sup>. Genetic analyses of the mitochondrial genes of 46 individuals have shown a low variability in a non fragmented population. Nests were found and monitored for the first time, always above running water, mainly in plants present in the Manakin's diet, and nidification showed a strong synchrony with the rains regime. The reproductive cycle has shown a typical piprid pattern, and incubation period was 22 days. Major threats to the Manakin's habitat are related to moist forest suppression and degradation, and water resource channeling and pollution. A Conservation Plan is being produced with local stakeholders and environmental authorities.

**MULTITEMPORAL LAND USE CHANGE STUDY: A DECISION MAKING TOOL AT SOUTH OF THE CONDOR BIORESERVE, ECUADOR**

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Multitemporal land use change studies are key tools in the process of decision making for land use management for conservation. These studies provide critical information for different applications such as the definition of protected areas and buffer zones, resources allocation, and strategies development. A multitemporal land use research was conducted at Condor Biorreserve, a conservation area of montane forest in Ecuador. This study analyzes the process of land use dynamic that has occurred in the region between 1991 and 2004. A 0.85% of land change (natural vegetation loss) has occurred in this period. This means 35.79 km<sup>2</sup> per year at the whole area. The antropoc areas grow at 8.64% which represents around 16.89 km<sup>2</sup> per year. The more affected areas are those with greater accessibility. The low evergreen montane forest showed the highest chance at the area. This information is being used to prioritize conservation actions in Llanganates National Park. For example, decisions were taken about the most critical areas for implementing control and working with local communities. The information would be used to negotiate with infrastructure project to decrease their impact in the area.

**INSTITUTIONALIZATION OF BAT COUNT PHILIPPINES: TOWARDS A SUSTAINABLE CONSERVATION PROGRAM OF ENDANGERED FLYING FOXES**

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In the Philippines, where < 10% forest cover is left and only a few of these sites are declared as Protected Areas, many of our wildlife species depend on formal protection to escape extinction. So far, the Protected Areas and Wildlife Bureau of the national Department of Environment and Natural Resources is uniquely mandated to manage wildlife and Protected Areas in cooperation with non-government organizations, academia, and people's organizations. To promote the conservation of declining flying-fox populations, our project has initiated a national awareness campaign, capacity building of local communities, and updated the status of the populations and distribution of these endangered species. While flying-fox conservation is growing in the Philippines, this project's sustainability is highly dependent on good representation and partnership with the Bureau. We have recently established a collaborative relationship and are gaining local support from the regional directors of the DENR down to the neighborhood level of each municipality. Linkages with other agencies in the government have become strengthened and many of our project's strategic goals are being met. The number of wildlife sanctuaries and local supporters of flying-fox protection in the Philippines is now anticipated to grow and sustain the conservation efforts started by the project.

***DENDROPHTHORA BERMEJAE*: ABUNDANCE, DISTRIBUTION, HOST AVAILABILITY, THREATS, AND HOPES FOR AN ENDANGERED MISTLETOE**

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*Dendrophthora bermejae* is a newly described endemic plant for Puerto Rico. It is the only endemic Puerto Rican mistletoe in the family Viscaceae and it is confined to a few localities in the southwest, where it is extremely rare. We conducted the first population survey to estimate the abundance and distribution of this species. We also studied the infection pattern and demography of its only known host tree, *Guaicum officinalis*, which is an endangered tree of the Caribbean region. We examined 389 *G. officinalis* trees and found 228 *D. bermejae* plants growing on only 30 trees. *Dendrophthora bermejae* was detected only in trees with trunks that were larger than 8 cm in diameter. Except for one individual, all *D. bermejae* plants were found in unprotected private lands under urban development and agriculture. Furthermore, the areas with more mistletoes had a low abundance of saplings and young trees of host trees, suggesting a demographically old population. We

suggest that *D. bermejæ* is highly endangered and rapid actions must be taken for its protection. Actions should include the legal protection of the species, and education programs and partnerships with local landowners aimed at protecting both *G. officinalis* and *D. bermejæ* in situ.

### **STREAM RESTORATION FOR COHO SALMON (*ONCORHYNCHUS KISUTCH*) IN THE LITTLE CAMPBELL RIVER, BRITISH COLUMBIA, CANADA**

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Coho salmon (*Oncorhynchus kisutch*) populations along the northwest Pacific Coast are in serious decline due largely to habitat destruction in their natal freshwater streams. Adult coho spawn in small streams after returning from two years in the ocean. Following springtime emergence from the gravel, juvenile coho spend a crucial year in their streams before migrating to the ocean. A Rocha Canada ([www.arocha.org](http://www.arocha.org)) has initiated three restoration projects in the Little Campbell River near Vancouver, Canada, via grants from the Pacific Salmon Foundation. Juvenile coho stream habitats have been restored through the work of numerous volunteers and staff. Invasive plants and accumulated sediments have been removed from tributaries and native vegetation has been planted. River gravels have been placed to encourage future spawning and better invertebrate production. Projects are being monitored for increased coho use and for the growth of native and invasive vegetation. These restoration projects engage citizens of the watershed through volunteer opportunities and ecological education; tours of A Rocha Field Study Centre, where one stream project is located; and our native plant nursery, scheduled to expand for more enhancement projects. These small stream enhancements through local community involvement provide an excellent process for renewing watersheds of the world.

### **ECOLOGY AND CONSERVATION OF THE MANED SLOTH (*BRADYPUS TORQUATUS*) IN THE COCOA REGION OF SOUTHERN BAHIA, BRAZIL**

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*Bradypus torquatus* is an endangered species, endemic to a restricted area of the rainforest of eastern Brazil. Southern Bahia harbors some of the largest forest fragments where the maned sloth is found. These fragments are often connected by cabruças (cocoa plantations shaded by native trees). Ecological research on the maned sloth started in southern Bahia in January 2003. Seven animals have been monitored with radio-telemetry in primary forest and secondary habitats, such as logged forests and cabruças. The results have showed a small home range (3–5 ha), especially for sloths that use secondary habitats; predominance of nocturnal activities when compared with previously studies developed in areas of higher elevation; and permitted the identification of 13 different dietary items used by the species. A puppet show on the maned sloth has been used to disseminate information on this research, current threats, and conservation issues related to the local fauna to the nearby rural schools.

### **SURVIVAL RATES FOR ELASMOBRANCHES CAPTURED BY A MULTISPECIES TRAWL FISHERY OFF ARGENTINA**

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Overexploitation of elasmobranches is matter of concern around the world. Waters off Buenos Aires Province (BAP), Argentina, are subject to a multispecies bottom trawl fishery. At Puerto Quequan (BAP), elasmobranches are the main group of fishes landed. Return of selasmobranches to the sea by the trawl vessels has been proposed as a mitigation action, but survival of elasmobranches after being discarded was not investigated. The aim of this study is investigate the survival rate of elasmobranches captured by the trawl fishery. The research was conducted onboard the trawler Punta Mogotes during austral winter and spring 2005. A total of 87 elasmobranches were randomly sampled from the deck and put into a bin that contained running seawater. An stamina index was assigned according three categories (a) alive, (b) immobile but reacting to irritation, and (c) dead, body stiffened but may resume breathing after being placed in seawater. Twelve species were sampled and the survival rate of most of them is quite important. Despite this its continued survival is not guaranteed after they are discarded because they may be consumed or mortally injured by bottom scavengers during the recovery time, which appears to be about 15–120 min.

### **CONSERVATION IMPLICATIONS OF THE GENETIC, MORPHOLOGICAL, AND PHYLOGENETIC VARIATION OF THE BLUNT-NOSED LEOPARD LIZARD (*GAMBELIA SILA*)**

CORRIGAN, GWYNNE and Ammon Corl. Cupertino, CA, USA (GC), Santa Cruz, CA, USA (AC), [cquote@comcast.net](mailto:cquote@comcast.net)

The blunt-nosed leopard lizard (*Gambelia sila*) is an endangered lizard restricted to central California. In this study, we assess genetic variation and phylogenetic structure, using cytochrome b sequence data, for populations of *G. sila* in order inform conservation efforts. Levels of genetic diversity vary among sites, but all populations have low variation when compared to that found in other studies of reptiles using cytochrome b. Populations with low genetic variation have little morphological variation, and may be constrained in their adaptive potential to environmental change. Phylogenetic analyses lend good support to the existence of three clades that correspond to the northern, southern, and central portions of the species range. We recommend that these three clades / geographic areas be considered management units for the species. After studying the morphology and mtDNA of possible hybrid populations, we recommend that these populations be covered under the Endangered Species Act. Our results will help in conservation planning for *G. sila* and will contribute to a better understanding of the perils that face endangered and threatened reptiles.

### **CONSERVATION OF NINE SPECIES OF THREATENED BIRDS IN THE COLOMBIAN EAST ANDES**

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Eastern Colombian Andes holds one of the most threatened ecosystems of the world, and is considered one of the most fragmented, degraded, and less known ecosystems in Colombia. Despite the area has been reported for endemic bird areas, some bird species have not been reported since 1952. We rediscovered endemic and critical risked *Macroagelaius subalaris*, *Amazilia castaneiventris*, and *Thryothorus nicefori* populations and reported new populations of endangered *Hapalopsittaca amazonina* and *Coeligena prunellei* at Soata, Boyaca, Colombia. Peasant private owners have inhabited this zone and protected around 15,000 ha of robledales (*Quercus humboldtii*) since 1940. However, the area is being increasingly threatened by agricultural and livestock-farming systems and continuous urban expansion. At present, we are fostering a community initiative to constitute a private reserve in order to protect these birds and its remaining habitats.

#### **USE OF AUTOECOLOGICAL DATA TO INFORM CONSERVATION AND MANAGEMENT OF MESQUITE AND ACACIA WOODLANDS IN THE MOJAVE DESERT**

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Mesquite and acacia woodlands are highly important to wildlife in the Mojave Desert, but are severely threatened by diverse human activities. In response, the Clark County Multiple Species Habitat Conservation Plan developed a Mesquite–Acacia Conservation Management Strategy, which uses the best available scientific information to protect and manage these woodlands. The strategy has ranked woodlands for conservation purposes based on their biological value, and has identified conservation actions for high priority woodlands. However, planning was hampered by a lack of data for many species the strategy purports to protect. Comprehensive autoecological data exist for the Phainopepla, a special status bird species dependent on these woodlands. Predictors of habitat (e.g. tree height, density, and food abundance) and landscape (e.g. woodland size, isolation, and elevation) occupancy by Phainopeplas, local population density, and nesting success appear to correlate well with the general requirements of many woodland species, thus were used to rank woodlands and elaborate specific conservation objectives. We discuss pros and cons of this approach to ecological community-level conservation planning, including the use of a focal species that occupies distinct habitats and political jurisdictions at different times of year. We describe the data needed to evaluate the strategy's utility and improve its robustness.

#### **USING MARXAN TO EVALUATE MARINE PROTECTED AREA NETWORK DESIGNS ALONG CALIFORNIA'S CENTRAL COAST**

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Pursuant to California's Marine Life Protection Act of 1999 (MLPA), a governor-appointed task force is evaluating proposals for a state-wide network of marine protected areas, beginning with California's Central Coast. Using data from the MLPA Initiative's California Marine Geodatabase, we identified the depth range and dominant habitat(s) for each square nautical mile of California state waters between Point Conception and Pigeon Point. We then used the simulated annealing tool MARXAN to (1) identify areas of high habitat conservation value, (2) identify networks that would conserve 10%, 30%, or 50% of each habitat while minimizing network area, negative socio-economic impacts, or a combination of those "costs," and (3) evaluate the extent to which the four proposed MPA networks meet conservation targets. Model output maps allowed us to identify specific areas that, if added to certain network proposals, would protect a given habitat (e.g. kelp forest) more evenly across the Central Coast region. While MARXAN analysis is applicable to the Central Coast process only to assist in evaluation, our results suggest that, if used as a network design tool, MARXAN may be even more beneficial earlier in the design process when the protected area network is expanded to California's northern and southern coasts.

#### **THE CONSERVATION OF THE SYRIAN SERIN *SERINUS SYRIACUS* IN LEBANON**

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*Serinus syriacus* is a vulnerable (IUCN RedList) bird species that has a restricted Western Palearctic distribution. Relevant investigation and information on the species' breeding biology and migration patterns in Lebanon are very limited to nonexistent. Within the framework of research for conservation, the project aimed at monitoring the species' migration pattern and studying its foraging sites and threats in the Al Shouf Nature Reserve in Lebanon, functioning as a baseline study. Starting March 2005, a primary screening of the reserve was conducted to identify foraging sites where regular monitoring and ringing activities were executed in collaboration with the local community. The project succeeded in identifying the species' foraging sites and migratory behavior as well as describing a previously undocumented breeding colony in proximity to the reserve. Empowerment of local communities through information sharing and fieldwork involvement ensured a strong foundation for future species conservation plans.

#### **A BAYESIAN APPROACH FOR ESTIMATING DEMOGRAPHIC PARAMETERS FROM A TIME SERIES OF SIZE DISTRIBUTIONS**

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Projection matrices have become popular tools for evaluating the effects of recovery efforts on threatened and endangered species. However, the parameterization of these models generally requires demographic studies of marked individuals, posing challenges for managers who work with species like aquatic invertebrates that are difficult to mark. To address this challenge, we describe a method that infers demographic parameters underlying a time series of field-collected size distributions for an endangered aquatic snail. Our method uses a Bayesian Monte Carlo approach to identify sets of matrix parameters whose projected population dynamics are most likely to produce a pattern of size distributions that are consistent with the observed

time series. When tested on a simulated two-year data set, the method returned estimates that exhibited reasonable accuracy, but poor precision. However, longer data sets were helpful in reducing uncertainty. We believe that with continued development, this method will be a useful tool in the viability analysis of any species for whom counting and measuring is easy, but directly measuring demographic rates is difficult.

### **DEMOGRAPHICS OF *DROSERA INTERMEDIA*: COMPARING A RECENTLY RECRUITED POPULATION TO AN OLDER POPULATION WITH A DIFFERENT HABITAT**

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*Drosera intermedia*, a state listed species in northern Ohio, has undergone population reductions due to the loss of habitat. Of the eight known populations only one is a continuously existing population. The remaining populations have been recruited from the seed bank through the planned (1 population) or unplanned (6 populations) removal of topsoil. If further restoration work is to occur, then its habitat preferences will have to be determined. This study compares the demographics of a recently recruited population to an older population. The younger population occurs in very sandy soil with sparse ground cover while the older population occurs in soil containing more organic matter, greater volumetric water content, and greater ground cover. Three counts of both populations were completed in the summer of 2005. Analysis of the preliminary data indicates that the older population has greater spring recruitment (59% vs. 45% of the plants counted were seedlings), and survivorship of young plants (92% vs. 85%) than the younger population. Of the juveniles that survived until the August count 29% in the younger population and 7% in the older population flowered, although very few of the juveniles succeeded in setting seed.

### **ISLAND CONSERVATION PLANNING: MANAGING CHALLENGING PRIORITIES THROUGH INTEGRATIVE GIS-BASED ANALYSES**

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Catalina Island, part of the California Channel Islands in the Pacific coast of the United States, faces multiple conservation and management challenges related to endangered and endemic species, rare habitats, feral animals, invasive plant species, a growing tourism demand and a complex infrastructure and road system. Deciding what areas of the Island require immediate intervention is of critical importance in order to effectively apply scarce resources and address emerging issues and problems. An integrative Critical Watersheds Database was created from an extensive amount of research-based information on rare and endemic plants and wildlife, invasive plant species, vegetation communities, and non-native animal species, which included distribution and densities for most species. Watersheds were assessed according to several criteria in order to obtain a Ranked Watersheds Map. Data sets, such as roads, management units, fire history, fuel loads and risk, recreational pressure, cultural sites, and other factors were overlaid on this map to assess threats to the ecological communities in these watersheds. This poster highlights the resulting maps and explores how they are being used as a major decision-making tool for developing intervention strategies, defining priorities, and informing management decisions.

### **USING GIS TO IDENTIFY POTENTIAL CORRIDORS UTILIZED BY NORTH AMERICAN BADGERS IN THE SAN FRANCISCO BAY AREA AND MONTEREY COUNTY**

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A small population of North American badgers (*Taxidea taxus*) lives in fragmented habitats within the San Francisco Bay area and Monterey County in northern California. Due to increasing fragmentation of badger habitats it is important to identify potential corridors that badgers may utilize to facilitate movement between the habitat patches. Using GIS, I created a habitat suitability model for badgers consisting of soil, vegetation, and slope layers. I then added road layers and urbanized areas to create cost surface layers. A Least-Cost Corridor analysis was performed on the cost surface layers to identify potential corridors within the region. Road kill data was then compared with the delineated corridors to test the model and identify the primary areas currently utilized by badgers for implementing future corridor plans. As an example of how this study model could be used, five badgers have been killed by vehicles along Reservation Road in Monterey County, which runs through existing badger habitat. Comparison with the corridor model shows this is one of the primary areas to implement a future corridor to allow for badger movement among the fragmented habitats.

### **CONSERVATION BEYOND BOUNDARIES: HIGH NOON FOR NEW ZEALAND'S RANGELANDS?**

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New Zealand's rangelands occupy 2.6 million ha of government-owned leasehold land (10% of the land area), extensively farmed by some 300 "runholders." The native biodiversity existed without land mammals until two were introduced by Polynesians about 1200 AD, and a wide range by Europeans from the 1840s. Mammalian grazing then began and, in combination with frequent burning, competing herbivory from feral animals, and weeds, the rangelands were transformed. Today, low-mid elevation areas, though often botanically highly modified, retain considerable native invertebrate diversity. A current process of government-sponsored tenure review, initiated by individual leasees and facilitated by legislation, allows productive, mostly lower elevation lands to be privatized. Land use then changes rapidly from extensive pastoralism to more intensive activities. Higher elevation areas usually revert to conservation management but issues such as elevational connectivity are only being addressed through some whole property government purchases. This paper analyses the current situation where the process lacks a national overview and where the land tenure changes, while providing some stakeholder benefits, are leading to fragmentation of conservation lands, a dearth of low-mid elevation protection, and increasing concern from both farming and conservation sectors for associated social changes, biodiversity loss, landscape transformation, access alienation, and off-property ownership.

**ECONOMIC GROWTH, BIODIVERSITY CONSERVATION, AND SCB**

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Growing numbers of biologists and economists are recognizing a fundamental conflict between economic growth and biodiversity conservation. We provide cursory coverage of the theoretical and empirical basis for this conflict. We also summarize some of the policy considerations available to address economic growth and develop an economy that operates sustainably within the limits of nature. As a key first step toward gaining a foothold in the policy arena, we emphasize the need for professional organizations, like SCB, to adopt a strong position in favor of transitioning from a growth economy to a steady-state economy.

**EVALUATING EFFECTS OF HABITAT LOSS, HUNTING, AND EL NIÑO EVENTS ON A THREATENED SPECIES**

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Much effort has been made to understand effects of direct human disturbance on declining wildlife populations, yet confounding effects of global climate cycles such as El Niño Southern Oscillations are rarely considered. We performed a demographic study of *Propithecus edwardsi*, a lemur inhabiting the eastern rainforest of Madagascar, to evaluate the impact of habitat loss, hunting, and changing global cycles on its population and to re-evaluate present endangerment categorization under the IUCN. Over 18 years of demographic data were used to parameterize a stochastic stage-structured population model. Results suggest that hunting, habitat loss, and climate change are all significant threats to the population, but that habitat loss is the most urgent problem. El Niño events resulted in temporarily reduced fecundity which may contribute to their present decline, but overall were much less important for determining population growth than hunting or habitat loss. The chance of 50 percent population decline within three generations was high for several scenarios, suggesting that current IUCN classification is justified. Our study suggests that to slow the decline of this species, it is critical to both create more protected areas and to control hunting pressures. Management strategies should focus on protecting and maintaining adult breeders.

**DISPERSAL OF KARNER BLUE BUTTERFLIES AMONG LUPINE PATCHES WITHIN A COMPLEX FORESTED ECOSYSTEM**

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Karner blue butterfly (KBB) is an endangered species that occurs as subpopulations within patches of blue lupine that are dispersed throughout a matrix of unsuitable forest habitat. It is assumed that the butterfly behaves as a metapopulation with local extinctions occurring within lupine patches (subpopulations) with subsequent recolonization from adjacent patches by dispersal flights. It is also assumed that dispersal is restricted to flights of less than 200 m and that mature forest acts as a barrier to flight dispersal (USFWS KBB Recovery Plan). However, there is a paucity of data on KBB dispersal. We measured dispersal during both first and second flights within a complex 2 km square landscape. We documented 233 cases of dispersal among patches through a matrix of closed canopy oak with 92% of the flights greater than 200 m. Mean and median dispersal for males was 440 m and 370 m and for females was 518 m and 370 m. Maximum dispersal distance measured was 1.6 km for an individual male, with 17 butterflies dispersing more than 1 km. The assumption that the butterflies cannot disperse farther than 200 m and that forested landscapes act as a barrier to flight is false.

**FLORISTIC SURVEYS AND PLANT BIOGEOGRAPHY ON SMALL ISLANDS IN THE SAN JUAN ARCHIPELAGO, WASHINGTON**

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To develop appropriate priorities and effective strategies for conserving island ecosystems, actions must be founded on a thorough understanding of the status and distribution of biota. Despite over a century of surveys, there still remain large gaps in our knowledge of the plants across the 172 islands that comprise the San Juans. The flora of many islands has never been surveyed despite their proximity to known occurrences of state and federally-listed rare species. In 2005, we initiated botanical forays that focused on collecting specimens of all vascular plants, mosses, and lichens on many of the smaller islands. To date, we have surveyed 27 islands from 0.02–14 ha in area, and have completed identifications of all vascular plants and many of the nonvascular and lichen taxa. We have identified 19 new occurrences for several state-listed taxa, and a new occurrence of an undescribed *Castilleja* subspecies. Overall, 72% of the collected vascular plants were native, ranging from 44–100% on the different islands. Future work will expand surveys to include additional islands. We also will examine the distributional patterns of rare and common native species, introduced species, mosses, and lichens, and interpret these patterns in terms of their biogeographical and conservation implications.

**THE ROLE OF LOCAL COMMUNITIES IN CONSERVATION OF THREATENED BIRD SPECIES IN THE CASPIAN REGION**

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The analysis of probable causes of the decline of rare bird species in Caspian region indicated that they are related to the impact of global natural or anthropogenic factors (climate changes, habitat transformation). Removal of such factors is either impossible or requires much resources. But for those small populations of threatened species that survived under such changes or adapted to global adverse agents, local factors become more influential. These factors are related to direct or indirect impacts of the activities of local communities (e.g. hunting or disturbance). Therefore, optimization of the relations of local land

## Conservation Without Borders • Abstracts, Contributed Poster Presentations

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users (of any age or social group) with rare species is the key in conservation. The fate of threatened bird species in studied region depends on the attitude of local people to birds and on willingness to regulate or modify steady land use practice. Specific tools for stimulating such activities in local communities are mass education actions including training in conservation techniques. The most appropriate grounds for such undertakings are Important Bird Areas (IBAs) at which small populations of threatened species survived. Just for IBAs we have shown the experience of the relevant succession of conservation activities from monitoring to introducing renewed management practice.

### **RISK ASSESSMENT OF ZOO POPULATIONS: A NEW PARADIGM**

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Small, captive populations experience threats to population viability similar to wild populations: demographic, genetic, and environmental factors interact with current size and structure to impact future population sizes. Through collaborative and coordinated programs, managers strive to develop self-sustaining, genetically diverse populations, to adapt management decisions enhancing population viability, and to identify those populations with high risk of extinction. We developed a new paradigm for assessing future risks: ZooRisk, a computer program, assists managers in making scientifically-based decisions for captive populations. The model projects population changes and provides quantitative assessments based on a population's past history, the biology of small populations, and management strategies for captive populations. In the past, the common measure of viability for programs was the population's gene diversity relative to 90% at 100 years. ZooRisk categorizes viability using five quantified demographic, genetic, and management criteria and assigns a risk score for each population, giving managers a more comprehensive assessment of extinction risk. Because these tests are standardized, the metric can be used for comparisons between populations. Sample risk assessments are presented for sunbitterns (*Eurypyga helias*) and pygmy hippopotamus (*Hexaprotodon liberiensis*), which have different structures and dynamics resulting in different risk categories.

### **NESTLING PROVISIONING RATES AND POTENTIAL AFFECTS ON THE ENDANGERED CALIFORNIA LEAST TERN AT ALAMEDA POINT, SAN FRANCISCO BAY, CALIFORNIA**

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The California Least Tern (*Sterna antillarum browni*) colony at Alameda Point, San Francisco Bay, California, has grown in this highly urbanized estuarine environment since the mid-1970s. There has been a concurrent decline in reproductive success since the mid-1990s. We investigated the possibility that changes in nestling provisioning rates were contributing to the decline in breeding success. We examined interannual and diurnal differences in nestling feeding frequencies from 2003–2005. Daily feeding frequencies to chicks differed significantly among years, with 2003 having a significantly higher average feeding frequency than 2004 or 2005. However, we did not find significant differences after controlling for differences in chick developmental stages among years. We found diurnal patterns in feeding rates, with higher feeding frequencies in the morning and evening hours compared to the afternoon hours. While feeding frequencies remained similar among years, there may have been changes in prey quality or distribution that have negatively impacted breeding success. The diurnal patterns in feeding frequency likely reflect the vertical migration patterns of prey species. Changes in composition and distribution of fish in the Bay may have impacts on the recovery of this endangered, piscivorous bird.

### **CLOSING THE LOOP: MEASURING THE STATUS OF EFFECTIVE CONSERVATION OF BIODIVERSITY WITHIN ECOREGIONS AS AN ADAPTIVE MANAGEMENT STRATEGY**

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Conservation planning processes, particularly at a large scale, such as an ecoregion, often neglect to close the adaptive management loop by incorporating measures and monitoring into subsequent planning iterations. As a result, ecoregional plans are often static blueprints that quickly become outdated in a dynamically changing landscape. This presentation will discuss the ecoregional indicators of biodiversity, threat, and conservation management status that The Nature Conservancy uses to measure the status of effective conservation. Examples from the eastern United States, the Rocky Mountains, and South America will highlight how ecoregional status measures and indicators can be used to quickly update ecoregional plans, identify urgent conservation priorities, catalyze conservation action, reallocate resources, and measure progress toward organizational milestones. The financial investment of periodically tracking data to populate these measures can be high, but the benefits of closing the loop in adaptive ecoregional planning—more responsive decision making with higher levels of confidence and organizational accountability—are worth it.

### **THE ALLURE AND THE REALITY OF BOTTOM-UP ECOSYSTEM APPROACHES TO COASTAL RESOURCE MANAGEMENT**

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The idea of a bottom-up ecosystem approach to coastal resource management is appealing due to the consideration of ecosystem structure, function, and processes, the consideration of multiple resources and human uses, and the involvement of stakeholders through collaborative decision-making. A novel experiment in combining these ideals is currently underway in Washington's San Juan Islands, where a multi-stakeholder citizen group that is advisory to county government has partnered with The Nature Conservancy to develop a science-based management plan for the marine waters of the county using an ecosystem approach. Although the prospects appear promising, the San Juan example illustrates some of the inherent difficulties in such an approach, including (1) The costs of acquiring adequate scientific information on the condition of various ecosystem components and processes (should it exist) and appropriately interpreting it for management planning may be greater than most community groups can bear. (2) For marine resource management, the community of stakeholders that should be involved extends beyond local residents to include both visitors to this popular recreational area and the broader

public who are the true owners of these public trust resources. Developing a scientifically-sound management plan requires strategies to meet the greater transaction costs of adopting an ecosystem approach, which may ultimately be more than a bottom-up effort can bear.

**CONSERVATION ON THE ENDEMIC OWLS AT LIANHUASHAN IN GANSU, CHINA**

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The conifer forest along the Qinghai-Tibet Plateau is an important endemic bird area in China with rich biodiversity. However, due to a long period of forest logging, especially selective logging of large trees, endemic owls (the Sichuan Wood Owl, *Strix davidi*, and the Boreal Owl, *Aegolius funereus beickianus*) might not find enough large nesting trees for breeding. During 2002–2004, 120 nest boxes were hung up in the conifer trees at the height around 4–6 meters in the Lianhuashan Mountains to help the endemic owls. The Boreal Owl started to breed in the nest boxes in 2003, 17 owls bred in our nest boxes during 2003 to 2005, with the breeding success rate averaged 68.2% ( $n = 7$  nests, 22 eggs). The Sichuan Wood Owl is a vulnerable species, our playback line transect census showed that it was in a very low density of about 2–3 pairs in an area of 10 km<sup>2</sup>. The first pair of Sichuan Wood Owl bred in our nest boxes in 2005, with 2 eggs laid. Both young owls were fledged and radiomarked. One young owl died within one month of fledging, the other survived to the winter, and moved 2.0 km from its nest. We believe the nest boxes gave great help to the endemic owls, and as nest boxes become familiar, more owls will breed in our nest boxes.

**INDIVIDUAL-BASED MODELING OF THE TARANGIRE NATIONAL PARK ELEPHANTS: FUTURE PROJECTIONS FOR A RAPIDLY INCREASING POPULATION**

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Recovering elephant populations in many African reserves and increasing human populations in fragmented habitats outside reserves have created new challenges for maintaining viable elephant populations. Tarangire National Park in Tanzania provides a dry-season refuge for an elephant population (as well as populations of other large ungulates), which migrates into the surrounding areas outside of the park during the wet season. The population has been individually monitored for the past 13 years and is expanding rapidly at 6 per year. Rapid growth has occurred through very high survival rates and reproductive parameters that are at the biological minima for the species: mean interbirth interval was 3.26 years (including a 22 month gestation period) and mean age at first birth was 10.2 years. We present an individual-based model of elephant population dynamics that incorporates the impact of environmental variability and density dependence on birth and death rates and is parameterized with data from this individually-monitored population. Based on our model projections the Tarangire population will continue its rapid increase in the near future. We explore the impact of various carrying capacities on the population's dynamics and discuss the challenges of predicting when density-dependent effects may begin for the population.

**COMMUNITY FORESTRY AND COMMUNITY BASED ECOTOURISM: COMBINING TWO CHALLENGING POLICY INSTRUMENTS TO CONSERVE SPINY FORESTS IN SOUTHERN MADAGASCAR**

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Policy instruments to enable community management of forests have come to the forefront in Madagascar in recent years. Having been driven to some degree by the conservation lobby, the emphasis of their implementation has often been on biodiversity conservation to the detriment of the livelihood needs and the economic factors that will determine the success of community management agreements. In Madagascar, ecotourism has often been cited as the means by which revenue can be generated to offset the loss of access to natural resources by local communities who agree to conserve forests, or who live next to formally protected areas. However ecotourism has seldom made a significant enough contribution to the livelihoods of the communities living in and near biodiverse forests. A policy process analysis has been used to determine the drivers of community forestry policy and case studies used to identify the conditions under which ecotourism and community forestry are likely to be effective. A detailed study of the Ifotaka Community Forest demonstrates where the potential exists for certain types of sites to use ecotourism revenue to offset livelihood changes from the management agreement and to implement a community reforestation initiative.

**THE IMPACT OF WHITE-TAILED DEER ON TREE REGENERATION AND PLANT INVASIONS IN AN EASTERN NORTH AMERICAN FOREST FRAGMENT**

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Overabundant white-tailed deer populations (*Odocoileus virginianus*) threaten the integrity of eastern deciduous forests through reducing tree seedling recruitment, changing understory community composition, increasing erosion, and increasing dispersal of invasive species. Because little is known about the extent to which deer enhance exotic species invasions we asked (1) does deer herbivory enhance exotic species' abilities to dominate forest communities, and, if so (2) what is the nature and effect of this interaction between deer and invasive plants on native plant communities? To examine these questions, we employed a split-plot design and manipulated the presence and absence of deer (with deer-proof exclosures) and invasive plants [with manual weeding of invasive plants, primarily garlic mustard (*Alliaria petiolata*) and Japanese honeysuckle (*Lonicera japonica*)] in the Crum Woods of Swarthmore College in southeastern Pennsylvania. We present the initial results on plant growth, tree regeneration, and shifts in community composition this ten-year study. We discuss our success in meeting our goals of raising local awareness of ecological threats in this suburban forest fragment, stimulating management efforts, and giving undergraduates hands-on research experience in conservation biology.

**BIRD POPULATION RESPONSES TO REMOVAL OF FUEL LOADS COMPRISED OF EXOTIC WOODY PLANTS**

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Over the past decade, wild fire events in riparian bosque (forested) areas along the Middle Rio Grande between Elephant Butte and Albuquerque have increased dramatically owing to flood suppression and accumulation of dead wood and exotic tamarisk and Russian olive. This problem culminated in a large wild fire in July 2003 that resulted in the evacuation of hundreds of City of Albuquerque residents and captured the national media's attention. Prior to this event, the Rocky Mountain Research Station, in collaboration with the Middle Rio Grande Conservancy District, City of Albuquerque Open Space, and Bosque del Apache National Wildlife Refuge, designed a study in 1999 to compare effectiveness of three methods of fuel removal for reducing fire risk, preventing reoccurrence of exotics, and restoring native habitats, plants, and animals. A goal of managers is to preserve cottonwoods while reducing or eliminating tamarisk and Russian olive stems, so study sites were selected that had cottonwood overstories and tamarisk and olive understories. Population and nesting responses of breeding bird species were evaluated prior to and following fuel removal treatments. My talk reports on (1) bird population responses of selected species three years prior to, and immediately exotic plant removal at 9 study sites and 3 control sites, and (2) nesting guild response to mechanical removal of exotics.

**MARINE PROTECTED AREAS ALONG THE PACIFIC COAST OF THE UNITED STATES: TOWARDS A REGIONAL CONSERVATION APPROACH**

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As the Pacific coast of the United States continues to be at the forefront of innovative, science-based, and stakeholder-informed MPA planning and implementation at the federal and state levels, it is becoming increasingly important to fully understand the scope of existing marine protected areas across the region. An initial analysis of the MPA Center's inventory of U.S. Marine Managed Areas is able to show the first comprehensive picture of Pacific Coast MMAs, including summaries of types of allowable use, level of governance, conservation purpose, and scale of protection. This first-time illustration of that suite of areas will enable managers across the region to take the bigger picture into consideration as they adaptively manage sites. The NOAA National MPA Center is initiating a West Coast Pilot of the National System of MPAs that will involve developing, testing, and applying the scientific information and analytical tools to more effectively use MPAs as a tool for maintaining healthy, sustainable marine ecosystems as well as promote regional coordination among managing entities. An overview of the protected areas along the Pacific Coast will be presented and the Center's efforts to facilitate a regional approach to marine conservation for the Pacific Coast will be discussed.

**SCIENCE IN THE EVERGLADES: THE INTERFACE OF SCIENTISTS AND MANAGERS**

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Large-scale ecosystems play a critical role in sustaining ecological integrity and stability, and in retaining important ecosystem services. The Florida Everglades is a valuable biological and ecological national treasure that has been severely degraded from flow alteration and development. The Comprehensive Everglades Restoration Plan (CERP), passed in 2000, is a joint federal, state, tribal, and local project that aims to improve water quality and quantity and ecological functions while continuing to provide water supply and flood control. Implementation of CERP's restoration has been slower than planned; many factors have been suggested as contributing to implementation problems. This research uses qualitative and quantitative analyses to address barriers that have prevented effective science communication and CERP implementation. Data were gathered through semi-structured interviews with upper-level scientists and managers involved with CERP. Barriers identified include the involvement of multiple stakeholders with conflicting agendas, historical mistrust among participants, and poor interpersonal relations among organizations and individuals. Recommendations for CERP and other large-scale ecosystem restoration projects include the designation of a specific and well-defined pathway for scientific communication, co-location of participants working on related activities, and the creation of a diverse restoration task force that is independent of agency affiliation.

**INBREEDING AND GENETIC RESTORATION IN MEXICAN WOLVES**

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Inbreeding in small populations can reduce individual and population fitnesses, making recovery more difficult. To better manage extant genetic diversity among Mexican wolves, three unrelated captive wolf lineages were merged beginning in 1996. Although each lineage had accumulated substantial inbreeding, offspring from crosses between lineages should be free of inbreeding and its adverse phenotypic effects. To evaluate the effects of inbreeding and outbreeding among Mexican wolves, we examined the probability of giving live birth, litter size, and survival of pups to six months of age among captive wolves and recruitment by wild pairs in the reintroduced population. For captive wolves, the effects of inbreeding in the dam and / or pups were apparently weak among wolves from the founding lineages, but paradoxically, were 2 to 6 times stronger among cross-lineage wolves. The three fitness measures, however, were 11 to 81% greater among cross-lineage wolves than among the founding lineages. Among wild wolves, inbreeding in the pups had strong negative effects on pup recruitment, and may largely account for the low reproductive rates observed in this population. We conclude that merging Mexican wolf lineages is resulting in genetic restoration, and that inbreeding depression may be difficult to detect in some populations.

**COMMUNICATING FOR CONSERVATION: PERSPECTIVES ON THE SCIENCE-RELIGION DIALOGUE**

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Recent editorials in *Conservation Biology*, largely initiated by David Orr, have addressed the need to more fully engage religions in the cause of conservation. Much debate has ensued about the degree to which conservation science and religion are conflicting or complimentary, as well as how conservation scientists may best approach religious groups. In light of these discussions, it is time to re-examine the diversity of existing views about the relationship between science, religion, and human knowledge in general. Science and religion began to diverge in the Middle Ages until, in our time, Stephen J. Gould has suggested that science and religion should be considered "nonoverlapping magisteria." However, many people hold alternate views about the relationship between the two, and this is important for scientists to understand as they seek to rally support for conservation. I will use original Venn diagrams and texts from various religions to illustrate these differences as well as to highlight areas of agreement that may benefit conservation. Broadening our understanding of the diversity of views as we re-examine Gould's paradigm can increase the effectiveness of our communication, put old conflicts into context, strengthen areas of convergence, and increase cooperation for the benefit of biodiversity.

**CONSERVATION AND MANAGEMENT NEEDS OF POPULATIONS OF A LONG-LIVED TEMPERATE CORAL UNDER THE EFFECTS OF HARVESTING AND CLIMATE CHANGE**

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The emblematic Mediterranean red coral (*Corallium rubrum*) is a long-lived colonial aposymbiotic coral growing in dimly lit habitats, from 10 to 200 meters in depth. The red coral is protected by different legislative rules mainly due to intensive harvesting suffered since antiquity. Recently large scale mortality events linked to climatic change have strongly affected shallow populations, posing new questions for the conservation of this species. The goal of our research is to develop conservation plans for this species derived from an interdisciplinary approach including the analysis of population structure and dynamics, population genetics, reproduction, and thermotolerance experiments. We examined populations from areas with contrasted environmental conditions and disturbance regime in the northwest Mediterranean Sea. The main results showed that marine reserves can be good tools for population recovery in front of harvesting pressure, although they cannot avoid the effects linked to elevated temperature contexts, which caused significant increase in mortality rates and reduction of reproductive output. In these mortality events, different degrees of impact were observed in populations at local as well as large spatial scales. Hence the research on the differential adaptive capacity should be envisioned. This study provided some basis to anticipate populations' trajectories over mid- and long-term scales in view of the present shift in disturbance regime.

**EFFECTS OF LIVESTOCK GRAZING ON PLANTS AND SONGBIRDS IN CALIFORNIAN VALLEY GRASSLANDS**

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We studied the effects of livestock grazing on plant and songbird communities in Californian valley grasslands. Though little-studied in California, grassland-dependent passerine species are believed to be declining and are recognized as having high conservation value. Grazing is a dominant land use in their breeding habitat, directly influencing vegetation structure and composition. Using non-metric multidimensional scaling, recursive partitioning, logistic regression, and linear mixed-effects models, we analyzed the temporal and spatial scales at which livestock grazing affects the plant community in 9 parks east of San Francisco Bay. We linked the relationships between plant community characteristics and breeding bird abundance and distribution in 2003–2005 for key species: Grasshopper Sparrow (*Ammodramus savannarum*), Horned Lark (*Eremophila alpestris*), Western Meadowlark (*Sturnella neglecta*), and Savannah Sparrow (*Passerculus sandwichensis*). Grazing was positively correlated with native plants in some parks, but plant community composition varied at the park level and was also strongly influenced by annual weather conditions. Abundance of the grassland specialists Horned Lark and Savannah Sparrow was strongly correlated with increased vegetation structural complexity. Generalist Western Meadowlark were negatively correlated. Grassland-obligate Grasshopper Sparrows were only found in grazed areas. Managed grazing can enhance native species in valley grasslands.

**MEASURING MAMMAL ACTIVITY ON DECOMMISSIONED FOREST ROADS**

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Forest managers implement various forms of road decommissioning to rehabilitate the ecological integrity of terrestrial and aquatic ecosystems in national forests. However, little research has measured the effects of road decommissioning on wildlife populations and habitat. I conducted a pilot study in the Flathead National Forest (Montana) to test sampling methods and determine an adequate sample size needed to measure the effects of road decommissioning on terrestrial wildlife. I used soot-coated track plates with anise oil / wood chip lure, remotely-triggered cameras, and scat and pellet transects to detect mammal activity on paired open and decommissioned roads. Camera data was the most effective in allowing me to determine that approximately 6–8 road pairs are needed to adequately measure mammal activity differences between open and decommissioned roads on the Flathead National Forest. In future studies, I will improve sampling methods by increasing the number of cameras and track plates used on each road, separately testing roads with cameras or track plates to eliminate lure bias, testing during various seasons including the hunting season, and improving scat and pellet transects. I will also gather existing wildlife population data in order to measure mammal activity on roads in proportion to the size of local populations.

**SUSTAINABLE BAT CONSERVATION IN CAUCASUS MOUNTAIN REGIONS**

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Karstic areas of Lesser Caucasus in Armenia and Georgia are the most biologically rich region situated between the Black and Caspian Sea, which are among the Earth's 25 most endangered hotspots. The proposed regions are situated at the biological crossroads for species from central and northern Europe, central Asia, and the Middle East. According to the literature 31 bat species occur in that region. *Myotis schaubi* is endangered, *Myotis hajastanicus* is data deficient, and 6 other species (*Rhinolophus mehelyi*, *Rhinolophus hipposideros*, *Rhinolophus euryale*, *Myotis bechsteini*, *Myotis emarginatus*, *Barbastella barbastellus*) are vulnerable according to IUCN. Based on our earlier experience in Romania and Ukraine, methods for bat monitoring, survey techniques, community work, and design of management plans for special protected areas for bats will be implemented in the proposed areas. Our aims are to identify key areas with national / international importance for bat conservation in the target regions, to make an audit of existing data, to collect all available literature and unpublished research results for providing an up-to-date status report of cave dwelling bat species, and to promote conservation of local endangered species and habitats through public awareness.

### **PROFESSIONALIZING THE CONSERVATION SECTOR: PROJECT MANAGEMENT TRAINING CONSERVATION GRADUATE PROGRAMS**

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Our objectives were to (1) examine which conservation graduate programs have courses in project cycle management and (2) develop a curriculum based on the Conservation Measures Partnership's Open Standards for the Practice of Conservation. We contacted faculty members of 49 graduate programs in conservation. We received responses from 26 of the 49 programs, of which six offer such a course. We found that among the respondents (1) Few offer a course in project cycle management. (2) Existing courses either offer the theory or practical experience, not both. (3) There is no use of standardized terminology. (4) No course offers an overview of the entire process. To address the needs highlighted in the gap analysis, we developed a graduate curriculum in project cycle management based on the Open Standards. This curriculum is divided into 12 topic modules that include the seven steps in the Open Standards, TNC's Excel tool, budgets and fundraising, leadership and ethics, and group project presentations. Instructors will present each topic through lecture and discussion and ask students to apply these concepts to semester-long projects by using a collection of instructional "application tools." This curriculum was developed to be adaptable to a variety of educational settings and is an open resource available to all interested parties.

### **AN APPROACH TO INTEGRATE BEHAVIORAL INFORMATION INTO POPULATION MODELS**

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Recently there has been a call to enhance population models by explicitly including information about behavioral strategies, particularly those affecting population dynamics (e.g. habitat selection). However, the few proposed approaches require detailed individual-based data that are rarely available for imperiled species. Here, we present a simple approach to incorporate spatial and demographic consequences of behavioral strategies in population models. We develop a spatially explicit deterministic model, a Leslie-Lefkovich matrix, that includes expected costs and changes in spatial dynamics (movement rates) of several habitat selection strategies. Model predictions were explored under multiple scenarios that vary on the expected costs and movement rates. Results suggest that including behavioral information greatly changed predicted population sizes. Increasing movement rates reduced total population size but increased homogeneity in the distribution of individuals among sites. Incorporating expected costs in survival rates also reduced population size, but reductions were greater than those expected from lowering survival rates, suggesting costs must be included explicitly. We conclude that both changes in spatial dynamics and expected costs should be considered when estimating population viability. The proposed approach provides a simple method to achieve this goal, and may be applied to more realistic population models and generalized to include other costs or behaviors.

### **MIXED OUTCOMES FOR ECOLOGICAL INTERACTIONS IN FRAGMENTED MAULINO FORESTS**

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The composition, structure, and functioning of biodiversity change with forest fragmentation. Usually, the intensity of ecological interactions is depressed in fragments due to the impoverishment of the consumer fauna. In the fragmented Maulino forest of central Chile, we have studied pollination, herbivory, granivory, insectivory, egg predation, and fecal decomposition. We also assessed the abundance of the interacting species. Compared to the continuous forest, pollination and herbivory are depressed but granivory, insectivory, and egg predation are intensified in fragments. Changes are coupled to similar variations in consumer abundance. Fecal decomposition did not change with forest fragmentation despite a reduction in the abundance of decomposers. Results demonstrate that even within a single forest type, ecological interactions might change in more complex ways with fragmentation than hitherto recognized. Management and conservation of Maulino forest remnants ought to consider these complexities.

### **INTERNATIONAL LEGAL ISSUES RELATED TO THE IMPLEMENTATION OF A TRANSBOUNDARY NETWORK OF MPAS IN EASTERN AFRICA**

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TRANSMAP is an EU funded project aiming at designing networks of Marine Protected Areas (MPAs) in the transboundary areas between Mozambique and Tanzania and the former and South Africa. Three types of research threads are being developed: biophysical, socioeconomic, and governance. For the latter, several types of information were collected including on pertinent bounding international instruments and on the ratification status for each of the three countries. The data for 73 bounding international instruments were analyzed in search of patterns of ratification for these African countries in order to determine the current commitments and predict the harmonization level required for the implementation and management of the MPAs.

Most of the instruments deal with biodiversity and marine pollution issues and only one third is within the regional level. The three countries have ratified the most emblematic instruments, both the global (Biodiversity, Climate Change, CITES, Ramsar, etc.) and regional levels (Nairobi Convention, SADC, African Union, etc.), though not always to full extent, i.e., including their subsidiary legislation. Nevertheless, some instruments that have not been ratified by any of the three countries are considered to be key elements in the development of the transboundary network of MPAs in the region.

**BENTHIC PELAGIC LINKAGES IN MARINE ECOSYSTEMS AND THEIR RELEVANCE TO VERTICAL ZONING IN MARINE PROTECTED AREAS**

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MPA design requires a science-based determination of which extractive activities (e.g., fishing) must be restricted or prohibited to achieve a site's conservation goals. Recent designations have raised the issue of whether every MPA must be "no take" to be effective, or whether some recreational fishing for pelagic species could be compatible with those MPAs focused primarily on conserving benthic communities. This management approach, termed "vertical zoning" within an MPA, requires an understanding of the nature, direction, strength, and predictability of ecological coupling between pelagic and benthic assemblages, and thus of the potential indirect effects of pelagic fishing on the protected benthic communities. To explore this issue, NOAA's MPA Science Institute convened an expert workshop of fisheries biologists, ecologists and recreational fishermen in November 2005. This diverse team summarized broad patterns of benthic-pelagic linkages in United States ecosystems (e.g. by depth, habitat, mobility guild), and identified general ecological conditions under which considering vertical zoning in benthic-focused MPAs might be (i) inappropriate due to strong benthic-pelagic coupling (e.g. nearshore habitats, coastal pelagic species, sea mounts, spawning areas), (ii) potentially appropriate due to weak coupling (e.g. offshore, oceanic pelagic species), or (iii) worthy of further study due to complex, indirect, or variable benthic-pelagic coupling.

**FERAL CATS AND WILDLIFE ON SANTA CATALINA ISLAND, CALIFORNIA: DISTRIBUTION, DISEASE AND THEIR EFFECTS ON MANAGEMENT**

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Exotic species introduced to Santa Catalina Island have had severe impacts on the ecology of the island's native plant and animal species. Feral cats (*Felis catus*), the most abundant and widely distributed invasive animal species, pose a threat to several species of conservation importance, particularly the endangered Santa Catalina Island fox (*Urocyon littoralis catalinae*) and the Santa Catalina Island shrew (*Sorex ornatus willetti*). The extent of the feral cat distribution and the associated difficulties of implementing control actions on a species closely associated with humans require carefully designed plans strongly supported by scientific data. This study analyzed the spatial distribution of endangered and threatened island endemics with feral cat distribution, habitat use, diet, and disease concentrations. Extensive distribution overlap between feral cats and island foxes was found in riparian corridors and island chaparral. Human settlements increase opportunities for cat and fox interactions that cause injuries and potentially spread of diseases such as toxoplasmosis. This data is being used to by the Catalina Island Conservancy to define priority areas of intervention for the management of feral cats.

**GOVERNING FOR CONSERVATION: A DIVERSITY OF GOVERNANCE MODELS FROM SOUTHERN MEXICO**

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What kind of governing features best foster biodiversity conservation? How can those features grow out of or be mapped onto existing governing frameworks? This paper answers these questions by describing the governance context in Calakmul, Mexico, home to Mexico's largest protected area for tropical ecosystems. In addition to county and village (or ejido) governing structures that most directly shape local conservation, the paper focuses on efforts to create a new layer of local governance responsive to a series of sustainability goals. This public-private coalition is, at present, a work in progress. Still, the coalition's aims and, importantly, its own model for governance and its ability to adhere to that model are revealing for what they say about conservation governance more generally. Is a green democracy possible in countries with weak democratic traditions? What other governing models are available that might provide the public participation and accountability that act as hallmarks of democratic models? By exploring the genesis of this new Calakmul initiative, its frustration with past governing models, and how the initiative attempts to fit with some aspects of existing governing structures and over-ride others, the paper includes an assessment of conservation governing models both in theory and in practice. The initiative's long-term prospects rest on the extent to which its processes and outcomes are viewed as legitimate to local citizens and office-holders.

**SPATIAL ECOLOGY OF TRANSLOCATED RIPARIAN BRUSH RABBITS**

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The endangered riparian brush rabbit (*Sylvilagus bachmani riparius*) occupies areas of dense, brushy cover along streamside communities in the northern San Joaquin Valley of central California. The 1998 recovery plan for this subspecies called for the establishment of three self-sustaining, wild populations within the historical range, and not including the population in Caswell Memorial State Park—the only confirmed population in 1998. Towards achieving this recovery goal, more than 250 captive-born rabbits (most fitted with radio-collars) have been released on the San Joaquin River National Wildlife Refuge since July 2002. A subset of translocated rabbits has been monitored via radio-telemetry at least twice weekly for more than 3 years. Preliminary analysis of the movements of 77 individuals indicated that males had larger home ranges and core areas than females, regardless of season. However, female home ranges were larger during the breeding season than at any other time of the year. The maximum dispersal distance was 1.1 km for females and 2.5 km for males, and mean dispersal distances were 578 m (se

109 m) for females and 897 (se 181 m) for males ( $p = 0.079$ ). No individuals were observed returning to the release enclosures.

### **AMPHIBIAN CHYTRIDIOMYCOSIS AND CONSERVATION IN OREGON AND VENEZUELA**

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One important limitation in conservation research is the difficulty in sharing advances in methodology among scientists across borders. In particular, interdisciplinary research topics involving scientists from multiple fields often leads to disparate and non-comparable results from studies examining the same questions in different regions. It is difficult to ascertain whether study methods or underlying environmental processes are responsible for reported results. Such is the case for amphibian chytridiomycosis, a globally emerging infectious disease that has been implicated in amphibian population declines in Australia and the Americas. Conservation science and ecological research alike are interested in detecting patterns of disease in both native and geographically separate ecosystems. Here we discuss field and laboratory research efforts on amphibian chytridiomycosis in the U.S. Pacific Northwest and Venezuela to highlight similarities, differences, and opportunities for standardization of methodology and conservation efforts.

### **HIGH PREVALENCE OF SYLVATIC PLAGUE IN FLEAS COLLECTED FROM BLACK-TAILED PRAIRIE DOG BURROWS IN NORTH-CENTRAL MONTANA**

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Sylvatic plague was introduced into North America over 100 years ago. The disease causes high mortality and extirpations in black-tailed prairie dogs, which is of conservation concern because it provides habitat for the critically endangered black-footed ferret. Our goal was to elucidate the mechanism *Y. pestis* uses to persist in prairie ecosystems during enzootic and epizootic phases. We used a nested PCR protocol to assay for plague genomes in fleas collected from prairie dog burrows potentially exposed to plague in 1999 and 2000. No active plague epizootic was apparent in the 55 prairie dog colonies sampled in 2002 and 2003. However, 63% of the colonies contained plague-positive burrows in 2002, and 57% contained plague-positive burrows in 2003. Within plague-positive colonies, 23% of sampled burrows contained plague-positive fleas in 2002, and 26% contained plague-positive fleas in 2003. Of 15 intensively sampled colonies, there was no relationship between change in colony area and percentage of plague-positive burrows over the two years of the study. The highest percentages of plague-positive colonies were recorded in May and June. The surprisingly high prevalence of plague on study area colonies without any obvious epizootic suggested that the pathogen existed in an enzootic state in black-tailed prairie dogs. These findings have important implications for the management of prairie dogs and other species that are purported to be enzootic reservoir species.

### **EXTRA-PAIR PATERNITY IN SANDHILL CRANES (*GRUS CANADENSIS*) REVEALED USING MICROSATELLITE DNA MARKERS**

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The presence of extra-pair paternity (EPP) in a dense breeding population of sandhill cranes (*Grus canadensis*) was tested using six microsatellite DNA markers. The frequency of EPP for this long-lived species with long-term pair bonds ranged between 4.4% (2 of 45 chicks) and 11.1% (5 of 45 chicks). The two confirmed extra-pair chicks were from different broods of one pair that has been socially bonded for a minimum 12-year period. The social male was rejected as the genetic father in both cases. The three other cases of EPP (twice the social male was rejected as the genetic parent, once the social female was rejected) may be authentic infidelity, or mate replacement prior to sampling. The range of EPP for this population of sandhill cranes is close to other species with similar mating systems. For the confirmed cases of EPP, the female was able to increase her individual reproductive success without losing her territory. For territorial female sandhill cranes, EPP may serve to both increase individual reproductive success and provide access to a territory (via the genetic father) in case of divorce or mate loss. EPP may be an effective way for sandhill cranes to increase genetically effective population sizes as these populations rebound from the near extirpation that took place in the early 20th century.

### **SEX DIFFERENCES IN THE PHYSIOLOGIC RESPONSE TO ACUTE OFF-HIGHWAY VEHICLE EXPOSURE IN THE NORTHERN SPOTTED OWL**

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Non-invasive measures of glucocorticoids in feces can provide valuable indices of anthropogenic disturbance impacts on wildlife. We are partnering with the USDA Forest Service, US Fish and Wildlife Service, and Blue Ribbon Coalition in a large-scale study of the effects of off-highway vehicle (OHV) use on the Northern Spotted Owl (NSO) (*Strix occidentalis caurina*) in the Mendocino and Shasta-Trinity National Forests of northern California. OHV use has nearly tripled in the last ten years and is a growing concern for managers. Extensive validations have demonstrated that metabolites in owl scat accurately reflect circulating levels of glucocorticoids. We used these techniques to determine that acute exposure to experimentally applied OHV use significantly increased corticosterone in male, but not female, NSO. This sex difference is consistent with previous work demonstrating that proximity to logging roads and intensely harvested forest correlates with higher glucocorticoids in male, but not female, NSO. Sex differences in demands associated with reproduction may underlie the variation in vulnerability to disturbance in this species.

**CORRELATING AREAS DELIVERING IMPORTANT HYDROLOGICAL SERVICES WITH KEY BIODIVERSITY AREAS IN MADAGASCAR**

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The remaining forests in Madagascar harbor the most unique and threatened flora and fauna on the planet yet they are being deforested as a result of human activities like upland rice cultivation, charcoal production, and mining. Loss of upland forests directly threatens habitats critical for biodiversity and may result in increased erosion and sedimentation of streams. This in turn can harm downstream irrigation works on which large populations depend for rice cultivation. It is possible that forest loss may contribute to flooding in small watersheds. In this study we devised several spatial indices that integrate population, land cover, and land use maps and hydrological information to identify the most important areas for hydrological services provided to human populations living downstream. Then we correlated these areas with Key Biodiversity Areas identified from species occurrence data. The results show significant overlap between the two.

**THE EFFECT OF NATIVE FORB ABUNDANCE DECLINES ON INVASION RESISTANCE IN CALIFORNIA GRASSLANDS**

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Yellow starthistle (*Centaurea solstitialis*) negatively impacts California grasslands through losses of forage quality, native species, and landscape aesthetics. We investigated whether shifts in native species' abundances affect the susceptibility of grasslands to starthistle invasion. This is important because changes in species abundance are more common than species extinctions, and ecosystem functions such as invasion resistance may be mediated by such changes. We created simplified grassland microcosms consisting of varying abundance levels of the native tarweed (*Hemizonia congesta*) and a functionally contrasting, dominant grass, *Bromus diandrus*. We invaded half the microcosms with starthistle and measured plant biomass, soil moisture, nutrient availability, and starthistle flower and *Hemizonia* seed numbers. Declining *Hemizonia* abundance increased microcosm susceptibility to starthistle invasion, with a non-linear relationship between *Hemizonia* abundance and invasion resistance: small declines in *Hemizonia* abundance produced little loss of function, but larger declines produced an accelerating loss of invasion resistance. Starthistle invaded *Hemizonia* even at high abundances, indicating that restoration using solely supplemental *Hemizonia* seeding may not control invasion. Interestingly, *Hemizonia* continued to contribute to invasion resistance at low abundances, indicating that even rare forbs may be important in protecting California grasslands from invasion.

**USING BIOGEOGRAPHY TO TARGET CONSERVATION RESEARCH EFFORTS IN VIETNAM**

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Lying within the Indo-Burma biodiversity hotspot and encompassing 12 ecoregions, Vietnam has attracted the interest of biogeographers for over 150 years. Despite this work, and recent attention for several large mammal discoveries, the richness and distribution of Vietnam's biodiversity remain poorly known, especially among less-frequently studied taxa, e.g. known amphibian diversity has more than doubled since 1998. Vietnam's government is in the process of expanding the forested protected area network from 1.3 to 2 million ha. To aid in site selection and to better map biodiversity distributions, we undertook comparative multi-taxa (small mammals, birds, herpetofauna, fishes, and invertebrates) inventories across elevation gradients at three forested locations, which were unprotected, poorly studied, and biogeographically varied. This effort was the first of its kind for the region. Results from vertebrate surveys include 11 newly described species, 16 new country records, and at minimum 30 endemic species. Results were analyzed using complementarity indices and biotic affinity scores to address underlying biodiversity distribution patterns and conservation significance. We conclude that two sites represent important conservation areas: the most northerly for a rich, subtropical fauna both highly threatened and currently under-represented in Vietnam; and the central site for elevated and globally significant endemism.

**TRANSBOUNDARY POACHING: A CASE STUDY OF POLICIES AND PRACTICES**

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Hungary is an important migrating fowl zone. In November 2001 Hungarian customs caught Italian poachers smuggling nearly 12,000 protected birds. Birds are standard items on many Italian menus. The Hungarian hunting associations' need for revenues and greed resulted in the mass poaching of millions of protected birds. The well-organized Hungarian-Italian group broke customs seals on trucks and attached new seals on the truck after adding the bounty. The Environmental Committee of the Hungarian Parliament investigated policies and practices which led to a few policy recommendations. (1) Lists of protected birds should be harmonized regionally, including all countries which are nesting or migratory zones for protected species. (2) Hungary takes the lead and prepares EU policies forbidding protected animals from being used for consumption. (3) Banning not only the sale of this shot, but also its use within Hungary, as well as making poaching a criminal offense. (4) Police and customs authorities coordinate their activities and all shipments of wild game should be inspected again at the border. Since 2004, this problem has become more difficult due to the elimination of trade borders between Hungary and EU, and will become even more difficult when further countries join the EU in years to come.

**NATURAL RESERVES OF KAZAKHSTAN**

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The first Central Asian natural reserve, Aksu-Dzhabagly, was established in Kazakhstan in western Tien Shan. At present time there are 10 natural reserves in Kazakhstan among 113 natural protected areas. The total areas of PAs is 21,036,283 hectares

(7.72), the total area of natural reserves is 1,075,498 hectares (0.39): Aksu-Dzhabagly (1926, 128 118 ha), Naurzum (1931, 191 381 ha), Barsakelmes (1939, 16 795 ha), Almatinskiy (1964, 71 700 ha), Korgalzhin (1968, 258 963 ha), Markakol (1976, 75 048 ha), Ustyurt (1984, 223 342 ha), West Altai (1992, 56 078 ha), Alakol (1998, 19 773 ha) and Karatau (2004, 34 300 ha). The main legislative base is the Law of Republic of Kazakhstan "About special protected natural areas," adopted on 15 July 1997, which includes 11 kinds of natural protected areas. The position Natural Reserve (zapovednik) is corresponding to Category I (A and B) of IUCN nomenclature of protected areas. The system of natural reserves of Kazakhstan is developing and integrating into regional and global net of protected areas.

### **KAZAKHSTAN RED DATA BOOK OF ANIMALS**

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The Red Data Book of Kazakhstan was established by government in January 1978. It was the first RDB in USSR. That red list included 87 animal species (4 fishes, 1 amphibian, 8 reptiles, 43 birds, 31 mammals) divided on 2 categories: rare and threatened. The second animal RDB edition was published in 1991 as a technical government document (500 copies, no pictures) and included vertebrates (129 species and subspecies) and invertebrates (105 species) divided on 5 categories; the red list included 16 fishes, 3 amphibians, 10 reptiles, 58 birds, 42 mammals, as well as 2 worms, 6 mollusks, 1 crustacean, and 96 insects. The third edition was published in 2 parts: vertebrates (1996) and invertebrates (2004). The current list of animals was adopted by government in 1995 (vertebrates) and in 1998 (invertebrates). Two species of birds and 2 mammals were excluded from the list. The invertebrate RDB part was created by specialists of Institute of Zoology and Tethys Scientific Society in 2003. The red list was reduced to 96 invertebrate species (2 worms, 6 mollusks, 1 crustacean, 2 arachnids and 85 insects). The IUCN criteria (2001) were used (4 EX-r; 5 CR, 12 EN, 73 VU, 2 NT).

### **IMPACT OF INVASIVE BLACK RATS ON BONIN ISLANDS, JAPAN**

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Bonin Islands are a Japanese oceanic archipelago, characterized by a high degree of endemism (41%). The presence of black rats (*Rattus rattus*) has raised concern for the negative impact that this invasive species can produce over native biota. Since very little information was available, we studied the rat population in Chichijima and Minamijima, two islands of the archipelago as a case study. All the main habitat types in both islets were sampled using live and snap traps. Rats were present in all plots except in those areas dominated by the invasive *Casuarina equisetifolia*. Rats were found breeding throughout the year. Habitat preferences were different in both islands: in Chichijima rats preferred secondary habitats whereas in Minamijima they preferred natural habitats. In Chichijima, rats were dependent on vegetal foods, producing severe damage on native species. On the other hand in Minamijima they consumed important amounts of fleshy foods (28.2% of their diet). This is of special concern since their diet included endangered species such as newborn marine turtles. These results suggest that black rats are likely to produce high impacts on the native flora and fauna of Bonin Islands. Management actions are urgently needed in both islands.

### **SEEKING BIOLOGICALLY REPRESENTATIVE REGIONS: A NEW METHOD FOR QUANTIFYING AND COMPARING SPECIES COMPOSITION**

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Patterns of species richness may be one of the most studied phenomena in ecology. Indeed, ". . . there has arisen a veritable midge-swarm of [richness] measures now suspended in the literature" (Whittaker 1977). In conservation planning, species richness and species endemism are most often used as surrogates for overall biodiversity. But they are inadequate metrics for discriminating among areas for conservation planning because they do not reveal how similar or different the actual composition of species may be from one area to another. A more useful metric for identifying priority conservation areas would be one that indicates the degree to which one area also represents the species composition of other areas. Here we describe a new method for quantifying the compositional similarity of species among geographic regions. We demonstrate its application to comparing aquatic communities among small drainages of the Mississippi River basin as well as to vertebrate species assemblages among ecoregions across the world's terrestrial biomes and realms. At regional and global scales our compositional metric reveals biodiversity patterns that differ significantly from patterns of species richness or endemism. It suggests which subset of regions best represent overall biodiversity based on species identities rather than species counts or endemic species.

### **RURAL LANDS STEWARDSHIP AND SPECIES CONSERVATION IN COLLIER COUNTY, FLORIDA**

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Collier County, Florida contains diverse ecosystems that support listed species such as the Florida panther, wood stork, and northern crested caracara, but it is also confronted with rapid growth and urban development. To balance development with environmental protection and agricultural sustainability, consultants developed an innovative county-level Rural Lands Stewardship Program (RSLP). This program, approved by stakeholders, scores environmental attributes (land cover, species occurrences, soils, restoration potential, etc.) on land parcels. Landowners voluntarily enter the RSLP, receiving development credits in proportion to environmental values of their land and their willingness to remove various land use rights on specific parcels. The RSLP creates powerful economic incentives to protect the most environmentally sensitive lands first, which is now occurring. Development credits may be used only in areas with low natural resource value. As an example, we document the programs impact on conservation efforts for the northern crested caracara. Although a major development project impacted a

caracara breeding area, landowners, consultants, scientists, and wildlife agencies collaborated successfully in developing a plan to restore equivalent caracara habitat that will be managed in perpetuity, and regularly monitored for use by caracaras. The RLSP has greatly enhanced landowner cooperation, including increased reporting of nesting caracara pairs.

**A DATABASE TO TRACK POPULATIONS OF ENDANGERED, THREATENED, PROPOSED AND CANDIDATE SPECIES IN NATIONAL PARKS**

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There are currently 453 species that are federally listed or proposed for listing in 193 units of the National Park Service (NPS). To meet the challenge of sharing data between parks, administrative offices and other federal agencies, NPS in conjunction with the Colorado Natural Heritage Program has developed the NPS Endangered Species Act Database. The database tracks the status, expenditures, and recovery information for each federally listed or proposed species that occurs on NPS lands. It also cross-references species nomenclatures between the NPS and the U.S. Fish and Wildlife Service, to aid in the required annual reporting of this information. Since its inception in 2000, the challenge has been to create and augment the data flow process to allow everyone from park biologists and NPS upper management to data managers to annually review and update this information. The information is also made available to the public on an internet web page; visitors can ask which listed and candidate species occur in a national park, which parks have particular species, and how much the Park Service spends on a species each fiscal year. The database also includes management summaries for recovery plans of listed species that occur in national parks.

**EFFECTS OF GRAZING ON POPULATION SIZE AND PREDATION RISK FOR RODENTS IN A COASTAL CALIFORNIA GRASSLAND**

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High-intensity, short-duration (HISD) grazing has been hypothesized to simultaneously increase forage quality for livestock while maintaining habitat for grassland wildlife. We examined effects of HISD grazing on population size and perceived predation risk for rodents in an experimental coastal grassland in northwestern California. Mark-recapture data indicate that, relative to ungrazed areas, rodent populations have plummeted on HISD-grazed fields. Depletable feeding trays were used to assess the giving up density (GUD) of food as a measure of predation risk. GUDs were consistently higher in grazed than in ungrazed fields, and they were positively correlated over time with the abundance of local raptors, suggesting that more abundant predators and less cover elevated perceived predation risk. However, raptors rarely hunted over grazed fields, and the removal of rodents by raptors appears much less frequent in grazed than in ungrazed fields. Thus, our results suggest that the decline in rodent density in grazed areas may stem more from abandonment prompted by the rodents' diminished sense of safety than from harvest by raptors.

**CAN SHADE TREES AND BIRDS HELP JAMAICAN COFFEE FARMERS WITH INSECT PESTS?**

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Shade-grown coffee has been heralded as an agricultural crop that benefits tropical economies and provides habitat for forest wildlife, especially birds. Current economic forces, however, encourage the elimination of shade trees from coffee farms, diminishing their ecological value. We examined avian insectivory in shaded and unshaded portions of a Jamaican coffee farm. Economically harmless lepidopteran larvae were placed in coffee plants to simulate an insect irruption, and larval disappearance rates were measured inside and outside bird-proof enclosures in shaded and unshaded areas. Larvae disappeared faster outside than inside enclosures, suggesting birds can play a role in suppressing irruptions. Moreover, this effect was significantly stronger in shaded than in unshaded portions of the farm. Surveys confirmed that birds were significantly more common in shaded areas, and the species most likely to contribute to insectivory in the coffee layer included primarily migratory songbirds. Lastly, damage caused by the coffee berry borer (*Hypothenemus hampei*), the most important insect pest of coffee in the New World, was inversely correlated with the amount of shade cover, suggesting birds may help control pest abundances more generally.

**POPULATION CHANGES AND GENETICS OF CHUM SALMON IN THE SOUTHERN PORTION OF THEIR RANGE (CALIFORNIA, OREGON, AND COLUMBIA RIVER) AND POSSIBLE IMPACTS OF CLIMATE AND OTHER CHANGES**

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Spawning populations of chum salmon historically extended as far south as the San Lorenzo River in California and 322 km upstream in the Sacramento River. In 1905–1906 chum salmon was the most abundant salmon species in streams surveyed between the Sacramento and Columbia rivers. Today, these populations have greatly declined, and in the Columbia River are now listed under the ESA as a threatened species. In 2006 recovery plans for Columbia River chum salmon are being proposed. Little life history, genetic, or other biological information has been developed on these fish. This information is important as southern populations may represent remnants of historical populations with characteristics essential to the successful restoration of depleted present day populations. Information developed in conjunction with ODFW, WDFW, and USFWS includes demographic, genetic, and life history data, such as presence or absence of spawning populations, age structure from scale collections, and timing of migrations. Preliminary microsatellite genetic data indicate Oregon coastal chum differ from interior populations and may contain unique genotypes and adaptations. These unique characteristics may be especially important as increasingly rapid changes in climate, pollution impacts, and development expose salmonids to pressures beyond their ability to adapt, forcing further declines and even extinction.

**EFFECTS OF DISTURBANCE ON THE FITNESS OF CAVITY NESTING BIRDS IN OAK SAVANNAS**

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The Oak Openings Region has the greatest concentration of rare species in Ohio. Cavity nesting birds are decreasing in number and disturbance in the form of standing dead trees (snags) impacts the fitness of these birds. Snags provide habitat for roosting and nesting, a foraging substrate, and amplify drumming / tapping calls for these birds. This study combines theoretical behavioral ecology with conservation biology to investigate the fitness of cavity nesting birds in relation to snag density and characteristics in oak savannas of northwest Ohio. Field surveys and a spatial database are being used to analyze the relationship between disturbance and behavior. Cavity nesters have more choices of habitat in the high snag density plots, which reduces competition for nesting locations, food, and territory. Less time is spent foraging which occurs on the snags rather than other vegetation or the ground, with an increase in weight and body fat composition. Eggs are laid earlier and fledgling success increases. This study provides guidance for current management techniques such as burning of oak savannas and girdling of trees that cause anthropogenic disturbance in lieu of natural disturbance. The final results also create a further understanding of how disturbance specifically impacts the fitness of organisms.

**WHAT MAKES SEABIRDS DEFENSELESS TO INVASIVE RATS? AN ANALYSIS OF SEABIRD CHARACTERISTICS AFFECTING VULNERABILITY**

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On rat-invaded islands, seabird populations have been extirpated or severely reduced from rat predation pressures. Although invasive species eradication is widely accepted as a conservation tool, it has been highly contested by some stakeholders, who often cite inadequately documented rat effects as reasons to forego eradication. We reviewed the literature to examine which seabird characteristics make them vulnerable to invasive rats. 66 studies cited rat impacts, totaling 85 rat-seabird interactions on 49 islands. Seabirds with low mean adult weights were impacted most severely ( $p < 0.001$ ) and were preyed on significantly more than heavier birds ( $p < 0.001$ ). Rats preyed on eggs and chicks more than adults ( $p < 0.001$ ). Ground, burrow, and crevice nesting seabirds were most vulnerable ( $p < 0.001$ ), with ground nesters enduring the most severe impacts ( $p < 0.001$ ). Nesting types preyed on varied according to different rat species ( $p < 0.001$ ), with *R. rattus* and *R. exulans* preying on mostly crevice and burrow nesters, and *R. norvegicus* preying on mostly ground nesters. 91% of studies cite rat impacts anecdotally without experimental analysis. Scientists should pursue studies that experimentally document impacts of rats on seabirds to fill in our data gaps and advance our current knowledge.

**A HABITAT-SPECIFIC EDUCATION PROGRAM TO INCREASE AWARENESS OF THE ROLE OF INTRODUCED PREDATORS IN NATIVE SPECIES DECLINE**

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In the Santa Monica Mountains of southern California, USA, amphibian species breeding in permanent streams have declined primarily due to the introduced red swamp crayfish (*Procambarus clarkia*). Most affected have been the California treefrog (*Hyla cadaverina*) and California newt (*Taricha torosa*). Of particular interest to area conservation agencies is the prospect of community-based adaptive management of predators in target streams. Key to effective community-based management is an educated populace that appreciates the native amphibian diversity of the area and problems posed by introduced predators. We have produced two education programs which combine age-appropriate PowerPoint presentations with supplemental information sheets, school activities, and evaluation instruments. The program emphasizes the dependence of native species on mountain stream habitats and the disruption caused by introduced predators. The program has been presented at six schools and seven civic events by students from Pepperdine University. Before and after evaluations ( $N = 150$  for schools and  $N = 70$  for adults at civic events) indicate a 40% increase in the ability of students to recognize species and to discriminate natives and non-natives as a result of participating in the program. Adults show an improvement of 20% in similar evaluations. Such educational programs can be instrumental in laying the ground work for community-based conservation efforts.

**GENETIC STRUCTURE OF GRAUER'S RUSH WARBLER (*BRADYPTERUS GRAUERI*), AN ENDANGERED ALBERTINE FIFT ENDEMIC**

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The Endangered Grauer's Rush Warbler (*Bradypterus graueri*) is a poorly studied species confined to highland swamps of the Albertine Rift Region. Genetic structure was studied in 36 individuals collected across the species range in Rwanda, Uganda and the Democratic Republic of Congo. A total of about 2117 bp of the mitochondrial genes ND3, ND2 and ATP6 were sequenced. The study demonstrates clearly the distinctiveness of each population and a break between central and southern populations. Although population densities are declining and suitable habitats shrinking the Grauer's Rush Warbler (GRW) is not genetically depauperate at any of the study sites. Each population constitutes a distinct evolutionary significant unit suggesting that management at each site should ensure that habitat quality is effectively monitored and maintained.

**CONSERVATION AND MANAGEMENT OF SWAMP DEER (*CERVUS DUVACELI BRANDERI*) IN KANHA NATIONAL PARK**

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Kanha National Park is well known for its scientific management and its tiger (*Panthera tigris*), which can be easily spotted and photographed. In 1973 Project Tiger was launched in Kanha for the conservation of rare and endangered endemic species of

swamp deer (*Cervus duvaceli branderi*). Its population multiplied dramatically five fold just within 15 years from 111 in 1973 to 547 in 1988. The species was virtually brought back from the brink of extinction. There after its population continued to decline and it is now stable about 350. Various management issues are reviewed and conservation strategies are discussed. Inbreeding of small fragmented population, change in climate, requirement of its specific food habit and habitat preference, loss of habitat by weed infestation of invasive alien species, encroachment of woodland over grasslands, soil erosion, degradation of habitat, over grazing and competition with spotted deer (*Axix axix*), predation by tiger, and animal diseases are the main causes of decline in its population. Park may be managed to achieve at least 600 swamp deer in next five years. To accommodate the growing population of herbivores at least 15% of geographical area of the Park must be brought back under grassland against the present area of 11.9% and 10% grasslands with sparse trees. Restoration of grassland habitat and semi-captive breeding of swamp deer of different genetic characters in a large predator proof fence are essential for its survival.

#### **MEASURING CONSERVATION SUCCESS**

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A major challenge facing conservationists, policy-makers, and donors alike is how to evaluate the success of conservation efforts in order to identify those approaches that are most effective. We report the results of a collaborative project among the diverse members of the Cambridge Conservation Forum to develop harmonised approaches for assessing conservation success. The participating organizations include international, national, and local NGOs and partnership organizations, IGOs, national statutory bodies, and academic research groups. The resulting scorecard style questionnaire is designed to help project implementers identify the impacts of their actions. It addresses seven major categories of conservation activity and focuses on the linkages between the different types of conservation action and their outcomes and ultimate conservation impact. We report the results of trial application of this tool to conservation projects from 10 different organizations, and discuss its potential for synthesizing conservation experience using common measures, and thereby opening up opportunities for quantitative identification of determinants of project success.

#### **VOLUNTARY VILLAGE RELOCATION IN INDIA'S BHADRA WILDLIFE SANCTUARY: ADDRESSING PEOPLE'S LIVELIHOOD NEEDS WHILE PROTECTING A PARK'S FUTURE**

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The future of many parks and reserves depends on protected area management efforts that reconcile socio-economic needs of people living in protected areas with biodiversity conservation. We documented a voluntary resettlement project underway in India's Bhadra Wildlife sanctuary where 11 villages were willing to relocate provided their socio-economic needs were met. We interviewed 258 of the 419 households that lived in the reserve and involved in the relocation project. Our study examined human activities and their ecological impacts, and then measured post-relocation responses for 11 of the 13 villages that were relocated. Overall, 58%–91% of people from the different villages considered the relocation project a success in the short term. In specific contexts, relocation may be a potential viable conservation tool if sought by villagers, conducted with active consultation and financial support of their socio-economic aspirations.

#### **LIMNOLOGY OF HIGH-ALTITUDE RAINFOREST STREAMS ALONG DISTURBANCE GRADIENTS IN THE BWINDI IMPENETRABLE FOREST OF UGANDA**

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Given the small extent of rainforests in East Africa and the high intensity of conversion, studies of deforestation effects on aquatic communities are critical for describing impacts and documenting pre-conversion conditions. In this study we explored the relationship between deforestation and water quality in high-altitude montane streams in and around Bwindi Impenetrable National Park, Uganda. Between February 2003 to May 2004, we quantified effects of season and level of disturbance on a suite of physicochemical characters measured across sites that ranged from undisturbed rainforest to agricultural land. Correlation analyses showed that environmental variables indicative of human impacts in the catchment were highly correlated with each other. Repeated measures ANOVA indicated significant seasonal effects for stream depth, discharge, conductivity, and total dissolved solids. Water conductivity, turbidity, and total dissolved solids also differed with level of disturbance with higher levels at anthropogenically-impacted sites than in intact forest. The findings show that riparian vegetation removal correlates with changes in water quality, and supports the role of riparian buffer strips along stream banks in agricultural areas.

#### **TRACKING ALBATROSS AND TRASH ACROSS BORDERS: A TOOL FOR INTEGRATED OCEAN, COASTAL, AND WATERSHED CONSERVATION**

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The far-ranging, long-lived Black-footed Albatross can provide useful information about human-related impacts to marine ecosystems. Albatross are surface feeders that feed on fish and squid on the ocean surface. They also ingest floating plastic debris which adults then feed to their chicks with potentially detrimental effects on their growth, contaminant loads, and survival. A satellite telemetry study to investigate movements of albatross, habitat use, and overlap with marine debris during

2004 and 2005 is being used to increase public awareness of the critical need for plastic pollution prevention. The "Eastern Garbage Patch" is a persistent oceanographic feature that accumulates plastic debris from both sides of the North Pacific in alarming densities. Results of our GIS mapping analysis indicated 13 of the 18 tagged birds ventured into this region where they spent on average 26% of their time during their post-breeding movements (July–October). Through diverse local and national outreach collaborations, including teacher workshops, development of classroom activities, production of posters and stickers, and the direct engagement of the public through lectures and beach clean-ups, we have used this charismatic marine predator as a tool to link the daily actions of people with conservation problems across borders and oceans.

### **THE IMPACT OF GLOBAL CHANGE ON BUTTERFLY SPECIES RICHNESS IN CANADIAN PROTECTED AREAS IN THE PAST CENTURY**

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Climate and land use changes are likely to force many species to shift beyond the boundaries of existing protected areas. Although many models have been constructed to test whether species will remain within such areas given future climates, very few tests of protected area effectiveness in the face of 20th century global change have been possible. In this study, we tested whether long-established protected areas in Canada have proven effective at retaining their original complement of butterfly species given the environmental changes that have occurred in the past century. We measured the change in species richness of 187 butterfly species over two epochs (1880–1949 and 1950–2000) in all protected areas established before 1940. Overall, species richness has increased in protected areas. However, richness change within park boundaries was often similar to the richness change outside the protected area boundaries, suggesting that this effect does not arise because protected areas are particularly effective at buffering species against global change. Moreover, in regions where richness has significantly decreased, there are few long-established protected areas. Our results suggest that a randomly placed protected areas network would be just as effective in conserving butterfly species richness in Canada as the present-day protected areas network.

### **IMPACT OF HUMAN PHYSICAL DISTURBANCE ON NUTRIENT DYNAMICS DURING DECAY IN A KENYAN MANGROVE FOREST**

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Human physical disturbance by coastal communities is prevalent in tropical mangrove forests, especially to provide fuelwood and construction material. However few studies have directly studied the impact of these local extraction on processing of mangrove productivity. This study aimed to determine the impact of mangrove degradation on rate of decomposition and nutrient dynamics. Litterbags of three mangrove species with known amount of leaves were exposed within sites under different levels of human disturbance. Leaves were retrieved fortnightly and dry weight, C, N, and P content determined. Rates of decomposition and nutrient content were then compared between the species and levels of human disturbance. Results of the study indicate that disturbed sites have lower rates of litter decomposition than corresponding undisturbed sites, this corresponds to lower N and P fixation during the process of decay at these sites. It was therefore concluded that human physical disturbance alters the capacity of a mangrove habitats to process and recycle nutrients.

### **IMPLEMENTATION OF AN INTEGRATED INVASIVE SPECIES-LED AND SITE-LED MANAGEMENT PLAN ON CATALINA ISLAND, CALIFORNIA**

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Invasive species are considered one of the greatest threats to biodiversity and are the leading cause of species extinctions in island ecosystems. Santa Catalina Island, California, is no exception. Faced with 76 invasive plant species threatening 98 natural heritage species and unique habitats, it becomes difficult to prioritize the allocation of limited resources. The Catalina Island Conservancy, which owns and manages 88% of the 48,000-acre island, has developed and implemented an integrated management program to protect the Island's biodiversity from priority invasive plant species. The program incorporates both a species-led and a site-led approach to prioritizing management actions. Seventy-six invasive plant species were mapped along 600 transect miles and ranked for priority of control based on their impacts, invasiveness, abundance, and distribution. Seventy-five watersheds were treated as habitat management units and ranked for priority of protection based on the presence of rare, listed, and endemic flora and fauna, and rare and sensitive habitats within them. This combination of management approaches, based on extensive research data, is guiding extensive eradication (35 species) and control (4 species) efforts of priority invasive plants in watersheds with the greatest native biodiversity.

### **GENETIC IDENTIFICATION OF FISH HOSTS OF FRESHWATER MUSSELS IN MAINE**

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The yellow lampmussel (*Lampsilis cariosa*) and tidewater mucket (*Leptodea ochracea*) are listed as threatened in Maine and are proposed for federal listing. Like most freshwater mussels, they have an unusual life cycle during which their larvae (glochidia) are obligate parasites of fish. Knowledge of host fish species is, therefore, critical to freshwater mussel conservation. Previous laboratory studies have indicated that white perch (*Morone americana*) and yellow perch (*Perca flavescens*) are potential hosts for the yellow lampmussel, and white perch for the tidewater mucket. The goal of this research is to determine if these species act as host fish in natural conditions and also to assess additional species as possible hosts by sampling naturally parasitized fish in the wild. A species-specific DNA key utilizing restriction fragment length polymorphism (RFLP) patterns of the mitochondrial ND1 gene was developed to identify glochidia attached to wild-caught fish. Hosts identified under laboratory conditions were confirmed from naturally parasitized fish. Additional fish species were also found to be potential hosts for the yellow lampmussel and tidewater mucket in Maine, with some differences among localities. These results are crucial for

understanding the complex ecological interactions between mussels and their hosts and for conservation planning.

**CAUSES OF MORTALITY TO THE ENDANGERED SOUTHERN CASSOWARY IN QUEENSLAND, AUSTRALIA**

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The Southern Cassowary (*Casuarius casuarius johnsonii*) is endemic to northeast Queensland, Australia, where it inhabits tropical rainforest. The species stands up to 2 meters tall and is Australia's heaviest bird. Of its total previous habitat, only 20 to 25 remains with much of this under pressure for development. The Southern Cassowary is listed as endangered by both the Australian Commonwealth Government and Queensland State Government. The Queensland Parks and Wildlife Service (2002) estimated 1500 to 2500 adults remain. The primary cause of the species decline is habitat loss and fragmentation, with motor vehicle strikes and dog attacks considered major threats for local populations. The purpose of our research was to quantify the causes of mortality to Southern Cassowaries. We obtained data for 140 cassowary deaths from 1848 to 2004. The leading cause of death for 110 cassowaries from 1986 to 2004 was motor vehicle strikes (55), and the second leading cause of death was dog attacks (18). Together, motor vehicles and dogs caused 74 of the cassowary mortalities for which the causes of death could be determined. Seventy-nine of the recorded cassowary deaths (63) were in the Mission Beach area, suggesting this local population is under tremendous pressure.

**SPECIES COEXTINCTIONS AND THE BIODIVERSITY CRISIS**

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To assess the co-extinction of species (the loss of a species upon the loss of another), we present a probabilistic model, scaled with empirical data. The model examines the relationship between co-extinction levels (proportion of species extinct) of affiliates and their hosts across a wide range of coevolved interspecific systems: pollinating Ficus-wasps and Ficus, parasites and their hosts, butterflies and their larval hostplants, and ant-butterflies and their host ants. Applying a nomographic method based on mean host specificity (number of host species per affiliate species), we estimate that 6300 affiliate species are "co-endangered" with host species currently listed as endangered. Current extinction estimates need to be re-calibrated by taking species co-extinctions into account.

**POSSIBLE EFFECTS OF EL NIÑO ON AN ENDEMIC SULAWESI MACAQUE: POPULATION TRENDS IN *MACACA NIGRESCENS***

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Several El Niño Southern Oscillation (ENSO) events have occurred in the last two decades. Severe ENSO events can cause decreased amounts of rainfall in parts of southeast Asia and dramatically dry out areas of rainforest. Consequently, this can create a stressful time for the flora and fauna. The present study is concerned with the possible effects of ENSO on *Macaca nigrescens*. This macaque species is endemic to the central portion of the northern peninsula of Sulawesi, Indonesia. It only occurs within Bogani-Nani Wartabone National Park and any remnant adjacent habitat. The primary data set is from population data collected during six field seasons from 1987 to 1998, including three seasons at the end of a severe ENSO. The average size of the encountered groups was lower in all three of the ENSO years as compared to the non-ENSO years. This would likely be due to more fissioning or subgrouping to cope with food availability. Still, it must be noted that this species commonly subgroups during the day and small groups were most commonly encountered every year. While many of the data also indicated a reduction in immature monkeys during ENSO years, this was not consistent throughout the data set.

**CONSERVATION OF THE ENDANGERED FLORIDA GRASSHOPPER SPARROW (*AMMODRAMUS SAVANNARUM FLORIDANUS*) USING HOME RANGE DELINEATION BASED ON RADIODIOMETRY**

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Conservation areas for endangered grassland birds must be designed to encompass sufficient area to maintain a viable population. The endangered Florida Grasshopper Sparrow (FGSP) is an endemic subspecies restricted to Florida dry prairie, a globally imperiled community. Much of the remaining dry prairie is owned and managed by state and federal government agencies to promote recovery of FGSP by minimizing habitat fragmentation and through use of prescribed fire. To examine relationships between time-since-fire and non-breeding season home range size, we tracked adult Florida Grasshopper Sparrows for up to seven months using radiotelemetry with multiple recaptures for transmitter replacement. Home range estimates show that adult FGSP are relatively sedentary throughout the non-breeding period in areas burned within the previous growing season. Home range areas reflect habitat characteristics maintained by prescribed fire and minimal habitat fragmentation, important management implications for this endangered species and potentially for other grassland bird species.

**COMMUNITY BASED CONSERVATION AS A TOOL FOR BIRDS AND BIODIVERSITY CONSERVATION: THE ROLE OF SITE SUPPORT GROUPS IN IMPORTANT BIRD AREAS (IBA)**

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The community-based conservation paradigm has been lately embraced in Africa as a key component of conservation and management of biodiversity. In this study, I look at the impacts of Site Support Groups (SSGs, a new community based conservation approach) in which local people are involved in conservation of Important Bird Areas in central Kenya. A questionnaire survey was used to examine community knowledge of birds and their habitats as well as the values local people

place on birds. The study also assessed the impacts that the site support groups are having on the local communities, and their role in helping the IBA program to meet its objectives of working with local communities in birds and biodiversity conservation. Levels of knowledge of birds were similar across sites with and without SSGS and tended to be gained from elders and peers. Members of SSGs and the community ranked acquiring environmental skills, training, and publicity as the main benefits from the IBA program. Overall the IBA partnership has improved relations with communities and other interested stakeholders. For the SSGs to be more successful, the study recommends for more provision of information, openness about the work of the SSGs, and increased interaction with the wider community.

### **LOVE THY FROGS: INCREASING AWARENESS THROUGH FROG CONSERVATION EDUCATION IN INDONESIA**

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Study of amphibians has lacked attention in south East Asian regions, especially in Indonesia. An effort to increase frog conservation awareness of school children and teachers in selected schools has been done from 2002 in the province of West Java, Indonesia. So far, there is a poor awareness on the diversity of frogs in this area. We developed a 2 hour outreach program to school children and conducted a teacher-training program. For older children (grades 10–11), we developed a 2 day Frog Camp where students joined our research group to study frogs in the field. In total 563 schoolchildren from 13 schools from grades 3–11 have been involved in this project. Nineteen teachers had attended our workshop and more schools have expressed their interest in joining the program. Although we could not measure direct impact of this program, we believe that this program has been successful in showing the children the diversity of frogs in the region and opening their eyes on the conservation issues related to frog survival.

### **THE STATUS OF FROGS IN THE MOUNT GEDE PANGRANGO NATIONAL PARK, WEST JAVA, INDONESIA**

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Mount Gede Pangrango National Park is one of the last remaining pristine areas in the highly populated province of West Java, Indonesia. The latest frog inventory was performed during the 1960s by Liem and there has been no further research since then. During 2003/2004 we revisited all but one of Liem's study sites and found 18 species of frogs. Four species recorded by Liem in the 1960s have not been found in this survey: *Fejervarya cancrivora*, *Bufo bipocartus*, *Microhyla palmipes*, and *Rana nicobariensis*. However, we recorded three additional species, *Rana hosii*, *Leptophryne borbonica*, and *Limnonectes macrodon*. Species composition differs due to several reasons: (1) change of habitat, (2) differences in survey locations, and (3) differences in sampling methods and effort. In the 1960s the endemic frog *Leptophryne cruentata* was the second most abundant frog after the common frog *Rana chalconota*. Nearly 40 years later, *Rana chalconota* is still the most abundant frog encountered, but the number of *L. leptophryne* observed has declined sharply. There is a possibility that *L. cruentata* is declining, therefore there is a need to establish long-term monitoring sites and survey programs to ensure conservation of this species.

### **SEA-LEVEL RISE AND THE LOWER KEYS MARSH RABBIT: IMPACT OF GLOBAL CLIMATE CHANGE ON AN ENDANGERED SPECIES**

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The Intergovernmental Panel on Climate Change projects a global surface temperature increase of 1.4 to 5.80 C between 1900 and 2100. One consequence of this increase is raising sea levels mainly due to oceanic thermal expansion. Estimates of sea-level rise range from 0.09 to 1.5 m by the year 2100. Sea-level rise will have many impacts on small islands including increased likelihood of coastal flooding, salinization of freshwater wetlands and water tables, and coastal land loss. Using a Geographic Information System and the best available elevation data, we modeled 3 scenarios of sea-level rise: 0 cm (baseline), 50 cm, and 100 cm. The amount and distribution of salt marsh habitat that remained under these scenarios was estimated and linked with a RAMAS-Metapop population viability model to estimate the impact of sea-level rise on the Lower Keys marsh rabbit, a federally endangered species. Sea-level rise, in general, negatively impacted persistence of the Lower Keys marsh rabbit. Our model will aid conservation planning for endangered species in the lower Florida Keys, USA.

### **SPATIAL USE OF TERRITORIES BY WHOOPING CRANES WINTERING ON THE TEXAS GULF COAST**

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Endangered whooping crane (*Grus americana*) pairs maintain territories on the wintering grounds in and around Aransas National Wildlife Refuge, on the Texas Gulf coast. Available habitat for territories has been suggested as potentially the first limiting factor the population may reach. Increased knowledge of territory characteristics and overwinter use patterns by cranes is important for ongoing conservation efforts. This study took place during winter 2003–2004 and 2004–2005 on Blackjack Peninsula, where the smallest territories occur. Territories were described using habitat type proportions (land, water, and edge) and various landscape metrics, calculated using FRAGSTATS. Crane movement paths were analyzed using Kruskal–Wallis tests to compare movement velocity (meters traveled per minute) by month and family. Territories ranged in size from 43.82 ha to 96.57 ha. Results of FRAGSTATS analysis indicate that substantial differences in the spatial distribution of ponds and edge density exist between territories. Movement velocity varied significantly by family and month, ranging from approximately 3 m / min to over 6 m / min. Whooping cranes appear to increase their exploration rate upon arrival to the wintering grounds and again prior to beginning the migration to the breeding grounds. Changes in food availability within the territory may affect this pattern.

**CLINAL AND BIOGEOGRAPHICAL GENETIC VARIATION OF THE DUNGENESS CRAB (*CANCER MAGISTER*): IMPLICATIONS FOR MARINE RESERVE DESIGN**

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Accurate knowledge of a species dispersal capability is imperative in designing a reserve that will effectively conserve that species. The Dungeness crab (*Cancer magister*) has high conservation value due to its importance in both the commercial and sport fishing industries. Recently, concerns have been raised about the sustainability of the Dungeness crabbing industry due to a decreasing catch yield and a number of fishery crashes in several areas along their range. The goal of this study is to ascertain the mitochondrial genetic variability among Dungeness crabs in order to more closely examine the dispersal capabilities of the species, which will ultimately aid in its effective conservation. A ~315 base pair region of the Cytochrome c Oxidase subunit I (COI) mitochondrial gene was isolated and sequenced from 216 adult crabs from Crescent City to Port San Luis, California January-June 2005. Nucleotide and amino acid sequences were compared within and between populations in California, and to sequences collected in the past (1997-2004) for 701 Dungeness crabs from parts of Alaska, Oregon, and Washington. Three universal nucleotide haplotypes and one amino acid haplotype were found among all locations, with slight clinal variation from Alaska through California. Genetic diversity indicates a high dispersal capability among Dungeness crabs, allowing the species to retain high amounts of gene flow between populations.

**EXPLORING THE BIOGEOGRAPHICAL IMPLICATIONS OF SEASONAL-MOSAIC FIRE REGIMES IN THE HUMANIZED SAVANNA LANDSCAPE OF SOUTHERN MALI**

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Savanna fires are a major determinant of vegetation cover. Each year fires burn vast areas of the West African savanna-woodland. Experimental studies on the long-term effects of repeated burning have shown that the tree / grass ratio is a function of the seasonality or timing of fires. Recent synchronic studies for the study region in southern Mali find that the indigenous burning regime produces a highly fragmented landscape mosaic that may influence the frequency and timing of fires for different vegetation types. This research aimed to provide a diachronic study to determine the regularity of the spatiotemporal pattern of burning for southern Mali. The study examined a series of 18 burn-scar maps generated from Landsat imagery drawn from a 30 year period (1972-2003). The burn-scar maps were combined in a GIS to determine the spatiotemporal pattern of the fire regime. Despite gaps in the data set the results indicate that the fire regime has a distinct spatiotemporal pattern that is reproduced annually creating a seasonal-mosaic landscape in which some areas regularly burn early, others regularly burn late, and some rarely if ever burn. The implications of this pattern for savanna fire management, biodiversity conservation, and savanna fire ecology are discussed.

**DNA BARCODING: A VALUABLE TECHNIQUE FOR 21ST CENTURY CONSERVATION?**

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Conservation biologists may soon be able to rapidly identify organisms with a new technology, "DNA barcoding," which relies upon a short, standardized DNA sequence (such as the conserved mitochondrial gene, *cox1*). Its advocates envision a time when anyone can simply put a small piece of an organism into a hand-held "tricolor" to identify it. Numerous biologists advocate barcoding because of its early successes and potential benefits, which have motivated extensive funding, international conferences, and diverse popular and scientific coverage. While current research focuses on whether barcoding will work, however, its broader socio-ethical dimensions have been largely ignored. In this presentation, I introduce DNA barcoding and critically assess two prevalent assumptions about its significance for conservation: (1) development of a library of barcodes and an electronic handheld field guide, the Life Barcoder, will democratize and enhance public access by empowering many more people to call by name the species around them, (2) identification of species using standardized barcodes and the Life Barcoder will engender appreciation of biodiversity locally and globally. It is important to evaluate these claims, as they are being used by proponents seeking billions of dollars to catalogue DNA barcodes.

**CHARACTERIZATION OF RARE PLANT TAXA IN VERNAL POOL ECOSYSTEMS**

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It is important to understand the distribution and characteristics of rare plant taxa present in vernal pools in order to create effective conservation and management practices. However, currently little is known about the linkage between rare taxa and particular vernal pool community types. Vernal pools were sampled throughout California from 2001 through 2005 by our University of California, Davis vernal pool team, and a subset of these data was used to characterize the distribution of rare taxa. The dataset contains 17 rare plant species in 244 plots distributed in vernal pools throughout California. The data includes information on soil, geologic substrate, location within a pool, land-use history, species lists, and cover of each species in the plot. Using these data we have been able to determine what environmental factors each plant species prefers, as well as the most common associates and community types for each rare plant species. As a consequence of this work, it should be possible to better predict the distribution of rare plant taxa and to improve policy decisions about vernal pool conservation.

**SOLITARY BEE COMMUNITIES IN A VINEYARD LANDSCAPE**

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Because bees do not pollinate grapes, the conversion of oak woodland to vineyard may present an especially difficult problem for solitary bees. These bees may lose both nesting habitat and food resources when oak woodlands are converted to vineyards. The remaining wild habitat fragments in heavily converted landscapes like the Napa Valley of California, are the equivalent of island refuges in an inhospitable sea. To study the effects of these landscape-level changes on the solitary bee

communities of the remaining oak woodlands, we developed criteria for matching sampling areas in vineyard-dominated landscapes with similar areas of oak habitat not dominated by vineyards, intensive agriculture, or development to create a randomized block design of "treatments" (areas with high degree of "vineyardization") and "controls" (oak-dominated areas). We compare solitary bee species richness and abundance in these areas and floral host use. We find a significant difference in species richness, community composition, and floral host use between treatments.

### **CAN FOREST MANAGEMENT MODEL THE WAY FOR WILDLIFE CONSERVATION ON COMMUNAL LANDS IN SOUTHERN MEXICO?**

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Mexico offers opportunities for landholders to manage forest and wildlife resources for economic gain. Can similar goals of conservation and financial growth for two different resources yield the same result on communal lands? The present study compares the purpose, application, local value, and motivation to conserve forest versus wildlife resources on communally owned land in southern Mexico. From May to July 2000, a total of 282 men from three ejido communities and two sport hunting clubs were interviewed. The sport hunting information indicates whether the ejidos could gain revenue from this sector. Using the ejido information, we explore how communal landholders can take advantage of this unique economic opportunity using their forest management as a model to boost motivation to sustainably use, and thus conserve, wildlife. Our results show that despite the short amount of time the wildlife management program has been in place and the organizational challenges of local communities under this program, the potential is high for these communities to supplement their income and increase their motivation to conserve wildlife on their lands. We also find that Mexico's resource management approach can serve as a model for other countries to follow.

### **BOLSTERING CONSERVATION BENEFITS OF THE CLEAN DEVELOPMENT MECHANISM: CAN NON-STATE CERTIFICATION SYSTEMS FACILITATE STATE-CENTERED EFFORTS?**

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To contend with the perceived shortcomings of the standard global environmental governance regime, environmental advocates have backed certification, sidestepping traditional governance institutions and in their place employing the market to generate compliance. I evaluate two recently created certification systems, the Gold Standard and the Climate, Community, and Biodiversity Standards, which have emerged in the context of conservation of biodiversity and climate change. These two certification schemes were developed in an attempt to fold non-climate environmental benefits, such as the conservation of biodiversity, into the Kyoto Protocol's criteria for emissions reduction projects. This paper assesses certification scholars Bernstein and Cashore's argument (Working Paper; November 2005), which claims that certification schemes aim to cultivate sufficient private authority and legitimacy to govern on their own. Instead, I argue that certification schemes, as demonstrated through the abovementioned two standards, can have another objective: working in tandem with and reviving public policy. This paper explores how the two standards do not fit Bernstein and Cashore's process for institutionalization and acquisition of legitimacy. It concludes with an exploration of the merits of the resultant shared private / public authority handling of climate change and conservation of biological diversity, as well as other environmental problems.

### **REDUCING TRANSACTION COSTS OF THE CLEAN DEVELOPMENT MECHANISM**

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Much enthusiasm surrounds the Kyoto Protocol's Clean Development Mechanism (CDM) and its subsequent carbon market's ability to financially justify preservation efforts. However, the growing cost increase of emissions abatement and trading credits threaten these projects' financial success. Here, we identify and analyze the transaction costs of greenhouse gas emissions trading using current knowledge of projects and existing case studies from 24 countries. By initially defining transaction costs as those that are not directly attributed to greenhouse gas (GHG) reduction and which are specific to the CDM authorization process, we were able to categorize and quantify specific costs of past and existing projects. Total transaction costs for CDM projects can range between US\$20,000 to US\$1 million depending on the type, size, and timeframe of the project. Additionally, while the highest transaction costs per unit of carbon were found to arise from small-scale projects, costs vary with project type and host country. Recommendations for transaction cost reduction include project bundling, the creation of a methodology-licensing scheme (similar to that of pharmaceutical companies), increased use of information technology to facilitate project development, and increased capacity for CDM authorities.

### **MARKET DRIVEN CHANGE COULD IMPROVE THE CONSERVATION ROLE OF TROPHY HUNTING IN AFRICA: EXTERNAL ACCREDITATION OF HUNTING OPERATORS**

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Trophy hunting is of major significance to conservation in Africa by providing economic justification for wildlife-based land uses over vast areas. However, there are limitations to the conservation role of trophy hunting, some of which are common to multiple African countries. Some conservationists have suggested independent accreditation of hunting operators to address these problems. We investigated the potential efficacy of accreditation by administering a questionnaire to hunting convention attendees. We assessed hunting client preferences and operators' perceptions of client preferences. When purchasing hunts, clients are less concerned than operators realized with guarantees of obtaining trophies and more concerned with experiencing wilderness and biodiversity, and knowing that their hunt benefits local communities. Contrary to operators' beliefs, clients are less willing to hunt where conservation issues are compromised. These data suggest that clients would select operators who contribute to conservation and community development and discriminate against those who do not. However, partly due to the nature of advertising by hunting operators, clients are unable to select among operators on these bases. An independent

accreditation system would enable market-based change in the hunting industry by creating incentives for operators to conduct hunting activities in a manner conducive to conservation and community development goals.

**SURVIVORSHIP OF ENDANGERED *SYLVILAGUS BACHMANI RIPARIUS* (RIPARIAN BRUSH RABBITS) FOLLOWING WILDFIRE AND FLOODING**

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*Sylvilagus bachmani riparius* is an endangered subspecies of brush rabbit native to the Central Valley of California. In July 2002, we began releasing captive-born riparian brush rabbits at the San Joaquin River National Wildlife Refuge (SJRNR) as part of a controlled propagation and reintroduction program. In July 2004, a major wildfire burned a significant amount of the riparian community at SJRNR. In the spring and summer of 2005, persistent rain and an unusually heavy and rapid Sierra Nevada snowmelt led to substantial flooding at SJRNR. During and following these events, we conducted intensive monitoring of the reintroduced rabbit population via radio-telemetry. Of the 47 radio-collared rabbits that inhabited areas threatened by the fire, we believe only three died as an immediate result of the event. Within 180 days of the fire's ignition, 24 of the collared rabbits had died (49.0%). During the same 180-day period in 2003, we observed 15 mortalities in 30 collared rabbits (50.0%). Of the 35 collared rabbits that inhabited flooded areas, 13 died within 15-days of inundation (37.1%), and 22 died within 180 days (62.9%). We believe the lower survival of rabbits during flooding was due to the prolonged inundation and scouring of suitable and familiar habitat.

**NOCTURNAL EMERGENCE AND FORAGING OF THE WESTERN TOAD (*BUFO BOREAS BOREAS*)**

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Published research on nocturnal foraging of the sensitive-listed (USFS) western toad (*Bufo boreas boreas*) has been primarily limited to controlled laboratory settings. Conclusions about movement and habitat use have been based solely on daytime measures, which may miss important foraging habitat and underestimate movement rates. Our study was twofold: test environmental cues that may be involved in the initiation of toad foraging, and monitor the first two hours of feeding activity to examine differences in movement and habitat use between day and nighttime periods. We examined nighttime emergence of seven adult toads at the Lubrecht Forest, Montana. Potential environmental cues, ambient light, ground temperature, air temperature, and humidity, were recorded. Ambient light appears the most closely related to emergence, with all toads delaying onset until well below 5 lux. The foraging activity study was limited to the tracking of three toads from emergence through two hours of feeding. Distance traveled averaged 21.62 m, and foraging radius averaged 8.85 m, but no consistent pattern in directionality or macrohabitat use existed. This limited study suggests that daily habitat may not be reflective of nighttime foraging habitat use, and that land use planning exercises may be underestimating land usage requirements of the foraging western toad.

**PREDICTING CHANGES IN HABITAT AVAILABILITY DUE TO MANAGEMENT DECISIONS REGARDING ARTIFICIAL WATER SOURCES: A CASE STUDY OF BIGHORN SHEEP**

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The use of water developments for wildlife conservation is a contentious issue. In Joshua Tree National Park, California, decades of pumping water for gold mining before 1960 and increased water use for urbanized areas outside the park led to the disappearance of several naturally occurring springs within desert bighorn habitat. As a conservation measure, wildlife managers established a number of water developments in sheep habitat. However the present day emphasis to maintain a "natural" environment has led to management decisions to stop future maintenance of these artificial water sources. How the loss of this water will impact the population is unknown. Based on GPS locations of bighorn ewes from 2002-2004, we used logistic regression and GIS to model past and present availability of critical summer habitat within the park. We then used GIS-based models to predict how the loss of man-made water sources would affect habitat availability. The models predict a 77% loss of currently available critical summer habitat and a substantial increase in the distance between habitat patches. In light of the anthropogenic changes to water availability, active maintenance of current man-made water sources may be essential to the future sustainability of desert bighorn sheep in Joshua Tree National Park.

**COMPARATIVE ECOLOGY OF TWO JAGUAR POPULATIONS UNDER DIFFERENT LAND TENURE AND HUMAN DISTURBANCE REGIMES IN MEXICO**

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Jaguars (*Panthera onca*) remain one of the least known felid species of the world with a trend to persist in remote pristine places, and increasingly becoming in contact with humans. The objective of this study was to compare the basic ecology of two jaguar populations under contrasting management systems to understand their conservation needs while coexisting with humans. The study sites are located in Sonora and Querétaro, Mexico. On these study areas we utilized a suite of methods (spoor, camera-traps, and prey surveys) to determine distribution, habitat association and abundance. We found significantly different habitat use between populations, where both species are mainly associated to tropical forests; also jaguars in Sonora are using oak-woodlands, and pine-oak in Querétaro, avoiding human created habitats. We found jaguar abundance in Sonora as 1.4 individuals per 100 km<sup>2</sup> in Sonora, and 0.5 individuals per 100 km<sup>2</sup> in Querétaro. Ungulate prey abundance is significantly higher in Sonora than Querétaro. Another difference between areas is the lack of human presence in Sonora.

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Although both populations are vulnerable to extirpation, the causes are different; Sonora is more exposed to poaching, while Queretaro is affected by human encroachment and habitat fragmentation.

### **MAMMAL ABUNDANCE AND RICHNESS IN A TROPICAL FOREST OF THE SOUTHERN YUCATAN PENINSULA**

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Around the world tropical forests provide shelter for more than a half of the total animal species on earth, they are one of the most productive ecosystems. Despite of their total earth coverage (only 7%) they provide countless environmental services. Nowadays Mexican tropical forests patchiness has been increasing as outcome of deforestation process, which in turn has diminished mammalian diversity. In the present work we used camera traps to evaluate richness and relative mammal abundance in a tropical forest of the southern Yucatan Peninsula, Mexico. With 32 cameras (35 mm CamTrakker) 8 plots of 4 km<sup>2</sup> were established in the study site and remained there for 50 days. As upshot we obtained 206 pictures corresponding to 18 mammal species (jaguar, ocelot, margay, mountain lion, and Bairds tapir, among others), species with highest frequency appearance were white-nosed coati, paca, and agouti. The study site has enormous ecological relevance because it shelters many species with high extinction risk like Bairds tapir, ocelot and jaguar. Long term monitoring of this site will allow us to develop better management and conservation plans.

### **EFFECTS OF HABITAT FRAGMENTATION ON BIG AND MEDIUM-SIZED MAMMAL COMMUNITY IN SAO PAULO STATE (BRAZIL)**

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Sao Paulo State is the most densely populated in Brazil, and consequently, a few patches of the native vegetation remain. However, big and medium-sized mammals are still present, including endangered species like *Puma concolor*, *Chrysocyon brachyurus*, *Myrmecophaga tridactyla*, and others. The area of this study considered 7 fragments of savanna and semideciduous forest and their surroundings, composed essentially by sugar-cane and eucalyptus monocultures. To understand how the process of habitat fragmentation influenced the occurrence of big and medium-sized mammals, 23 camera traps were installed in the study area, remaining there for 17 months. From the 15 species registered, *Puma concolor*, *Chrysocyon brachyurus*, and *Tayassu tajacu* explored the landscape most intensely, with a relative frequency index (RFI) of 12; *Leopardus pardalis* and *Herpailurus yagouaroundi*, in contrast, registered RFI of. *Chrysocyon brachyurus* showed the highest relative abundance index (RAI = 0.00485), followed by *Puma concolor* and *Tayassu tajacu* (RAI = 0.00416). MANOVA tests suggested the distribution of these mammals in the landscape is more influenced by the habitat quality in the patches and matrix than by the vegetation type. Therefore, keeping the quality of the fragments is vital to save one of the last mammal refuges in the region.

### **CAN ECOSYSTEM-BASED MANAGEMENT BETTER CONSERVE THE PROTECTED SPECIES OF THE NORTHWESTERN HAWAIIAN ISLANDS?**

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Ecosystem-based management (EBM), a method of managing increasing demands on natural resources, is often used in terrestrial environments; however, its use in marine environments has proved difficult to define and even more so to implement. Due to the dominant role of fisheries in current management, EBM in marine environments usually occurs within the framework of Ecosystem-Based Fisheries Management (EBFM), which does not provide a platform for various regulatory agencies to oversee the diverse and complex aspects of marine ecosystems. The northwestern Hawaiian Islands, a proposed National Marine Sanctuary, presents a unique case study for how EBM could provide better overall protection and management of unique resources at stake. Managing human uses for ecosystem sustainability is a difficult task due to limited understanding of interconnection among species and the impact of outside activities on these connections. However, due to remoteness and limited human presence, the NWHI provides a relatively simplified system around which to develop a marine EBM plan. Significant to the ecosystem management of this region are the conservation needs of protected species such as endangered Hawaiian monk seals, green sea turtles, and albatrosses. Given the uniqueness of the NWHI and its evolving management status, this study addresses factors affecting the design and implementation of a more integrated, comprehensive marine EBM plan and its conservation potential in this region.

### **LINKING SCIENTIFIC RESEARCH, EDUCATION AND PROMOTION OF SUSTAINABLE ACTIVITIES TO CONSOLIDATE A BIOLOGICAL CORRIDOR IN THE ATLANTIC FOREST OF ARGENTINA**

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Atlantic forest is considered one of the 5 priority world hotspots of biodiversity, whereas less than 7% of this ecosystem remains in Brazil, Argentina and Paraguay. In this fragmented scenario, ecological corridors are necessary to maintain the connectivity of the forest remnants. Since 2002 we have conducted a project to preserve and increase the ecological connectivity between two important protected areas in the Atlantic forest of Argentina through scientific research, restoration, environmental education, promotion of non-timber activities, and agroecological practices. We used satellites images to detect a reduction (+ 40%) in forest cover of the corridor in the 1987–2002 period, and to identify corridors of continuous forest between protected areas. To assess the functionality of the corridor we implemented a bird-ringing program with 72 species captured in 4500 hours / net. With this information we created an education program in local schools and a media strategy to emphasize the importance of this area. In 2005 in cooperation with others, NGO, and the provincial government we acquired a portion of continuous forest in the corridor to create the first co-managed biological corridor provincial reserve. The long-term sustainability of this novel protected area and private lands in the corridor is our challenge.

**EVALUATION OF CONSERVATION STATUS OF BIODIVERSITY AND PRIORITIZATION OF AREAS IN CAUCA VALLEY, COLOMBIA**

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The Cauca Valley is a region of Colombia with great biological diversity, especially of birds but with a protected area system designed mainly ad hoc. Based in the conservation planning framework we evaluated if current protected areas are enough to protect this biodiversity. We used ecosystems, some species of birds and mammals, and ecological processes as surrogates. With maps of potential distribution of species, original ecosystem distribution, and localization of ecological processes we set the targets for biodiversity conservation and analyze if this the target achievement of the surrogates within the current protected area system. We found that this system have to be improve in order to preserve the biodiversity in a long term. Many ecosystem types especially dry forests and shrubs are not included at all. Also many species distribution areas are not within the areas as well as a considerable extension of the components that represent ecological processes as altitudinal gradients and riverine corridors. We propose new areas in order to enhance the protected area system based in the results of an irreplaceability analysis. The outcomes of this research are going to be used by decision makers to set new protected areas or corridors.

**PRIORITIZATION OF U.S. NATIONAL WILDLIFE REFUGE LAND ACQUISITIONS FOR BIODIVERSITY PROTECTION**

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The field of conservation biology is filled with research on optimizing land protection for biodiversity and protected area design. Few studies have looked at the practical application of land protection prioritization methods used by government agencies. The U.S. Fish and Wildlife Service among federal agencies in its wildlife conservation mission and its ability to establish new national wildlife refuges without an act of Congress. The USFWS uses its Land Acquisition Priority System (LAPS) to rank land acquisition projects based largely on biological criteria. In 2001 the USFWS made major changes to its LAPS. We analyzed the land acquisition priorities and funding trends of the USFWS before and after these changes in LAPS to determine if different habitats or species groups were emphasized between years. We found that USFWS priorities prior to changes in LAPS emphasized waterfowl and wetland protection, while after changes in LAPS increased emphasis on endangered species and grassland protection. The majority of Congressionally appropriated funds, however, were for projects that the USFWS did not request funding for. Other factors appeared more important in project selection than biological need. This paper reflects on the interaction between science and policy in habitat protection.

**DIET AND FORAGING ECOLOGY OF A PARROT COMMUNITY (FAMILY: PSITTACIDAE) IN COSTA RICA: IMPLICATIONS FOR PROTECTED AREA DESIGN**

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Conservation of the parrot community (Family: Psittacidae) in Curu National Wildlife Refuge, a private reserve in Costa Rica, depends on the identification and preservation of the most important food resources in the diet of each parrot throughout the year. The area contains 6 parrot species ranging from 65–900 g, each requiring a diverse mix of seeds, fruits, flowers, leaves and bark (food types) in order to sustain themselves. From August 2003–July 2005, we documented the parrots' diets and foraging ecologies by walking transects through the site's main habitats a minimum of 3 times per week. After recording the tree species, food types, and dates and times of each parrot foraging bout over the 2 year period, we documented 1159 foraging bouts on 61 food plant species in 25 families. Larger parrots like the Scarlet Macaw (*Ara macao*) foraged mainly on seeds, while smaller parakeets foraged mainly on fruits. As a community, the parrots foraged in all habitats and areas of the reserve, and were found to forage in adjacent areas to the reserve. Protected area design and conservation on adjacent private lands will be vital to the long-term conservation of this community of parrots.

**SERVER BASED TOOLS AND GEODATABASE TO SUPPORT DISPARATE USERS INVOLVED WITH MARINE PLANNING IN CALIFORNIA**

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Geographic information systems (GIS) are increasing in popularity as a means of supporting planning efforts but traditionally complex spatial analyses have been restricted to serving the technically proficient. Planning efforts that involve scientists, GIS specialists, and stakeholders pose a unique challenge to integrate tools that satisfy the needs of all user populations. We developed a marine geodatabase and server architecture to support marine planning in California, including MPA planning by the state's Marine Life Protection Act (MLPA) and planning efforts undertaken by the National Marine Sanctuaries. These efforts require extensive geospatial data layers and visualization tools to support the stakeholder and scientists developing alternative designs for MPA networks. An extensive decision support system (DSS) was developed that includes an ArcSDE / SQL geodatabase, ArcIMS web-maps, an ArcGIS server-based MPA decision support tool, and multiple terminal servers for running custom ArcGIS model builder tools. We describe the complete architecture associated with this decision support system, including information flow and the interactions among software and hardware elements. Our GIS based decision support system may serve as a model system for marine planning efforts in other state or federal processes.

### **COMMUNITY FIELD SURVEY OF THE ENDANGERED AFRICAN WILD DOG (*LYCAON PICTUS*) IN SOUTHEASTERN KENYA**

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One of the world's most endangered predators, wild dogs have dramatically declined with perhaps only 5500 remaining. Wild dogs are particularly vulnerable to extinction because they are wide-ranging and most live in unprotected areas increasing the risk of conflict with people. Virtually nothing is known about the status, distribution, or ecology of a recently confirmed population in the Biodiversity Hotspots of southeastern Kenya. During Phase I of a long-term community-based project, locals trained in survey techniques carried out the first large scale biological survey. In contrast to reports in the 1997 IUCN / SSC African Wild Dog Action Plan, the survey team found that wild dogs are widely distributed in semi-arid bushland and woodland, and coastal forests sampled. Reported group sizes (mean: 7.7, range: 220 including pups; n = 44) are similar to other areas. Livestock owners reported almost twice as many losses due to lions or hyenas than wild dogs. Most people see 13 lions together suggesting numbers are low, which could benefit wild dogs because lion predation is a major cause of mortality. Our findings indicate there is a potentially viable wild dog population that may be an important link for the metapopulation in the Horn of Africa.

### **CONSERVATION PLANNING FOR SALMONIDS IN A CHANGING CLIMATE**

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This paper presents the application of a conceptual framework for conservation planning in a changing climate. The framework employs a climate sensitivity response (CSR) curve representing a key relationship between climate change and a conservation target as a tool for focusing adaptation planning and site management. The nonlinear relationship between increases in air temperature resulting from future climatic change and stream temperature provides a useful CSR for addressing a key impact of climate change on salmonids. The CSR approach can incorporate the impact of synergistic threats to salmonids including the removal of riparian vegetation that can increase direct solar gain, the elimination of flood flows and the removal of large woody debris that reduces hydrological complexity and deep pools that provide cold water refuges, and logging, grazing, and construction of impervious surfaces that accelerate stormwater runoff. The CSR approach also provides a tool for assessing adaptive opportunities that increase the resilience of salmonids, including the restoration of riparian ecosystems and instream habitat to increase shading and cold water refuges, managed releases of cold stored water from dams to maintain stream temperatures, and prioritization of site selection, protection and restoration efforts across sites.

### **ENHANCING EXPERT OPINION ON OREGON COAST COHO SALMON (*ONCORHYNCHUS KISUTCH*) CRITICAL HABITAT WITH A DECISION SUPPORT SYSTEM**

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The listing of Oregon Coast coho salmon (*Oncorhynchus kisutch*) as threatened in 2000 required NOAA Fisheries to designate critical habitat. An expert panel, convened for the purpose, found there were massive, unwieldy, data sets available. In order to create a transparent, repeatable decision process they adopted a fuzzy logic-based decision support system (DSS). The DSS design incorporated expert opinion by first describing the data to use, then reviewing the available data and defining the decision process. We then constructed a DSS that simulated the expert decision process. The team applied the resulting DSS to 82 watersheds on the Oregon Coast and used the results as the basis of their recommendations. They identified 42 watersheds with high value for conservation, 28 medium, and 10 low. Our experience suggests that the combination of a DSS and professional judgment works well for making recommendations regarding conservation policy. The DSS allowed for full transparency in the basis of the recommendations and allowed the final expert review to incorporate data and human experience the DSS could not analyze. Enhancing professional judgment with a DSS can result in clearer, more accurate, and more acceptable recommendations.

### **HABITAT MANAGEMENT GUIDELINES FOR AMPHIBIANS AND REPTILES**

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Habitat alteration, fragmentation, and loss are considered to be major challenges for the conservation of amphibians and reptiles (or herpetofauna). Herpetofaunal populations in the United States are declining, and as long as human populations expand, habitats will be modified. Thus, Partners in Amphibian and Reptile Conservation (PARC) recognized an opportunity to provide proactive guidance for improving the compatibility of land management practices with these animals. PARC has developed a series of regionally-specific best management practices, or Habitat Management Guidelines (HMGs). These guidelines use the best science available to produce recommendations that are easily understood and practical for land managers and private landowners. The objectives of these guidelines are to keep common species common, stem the decline of imperiled species, provide guidance on the management and restoration of amphibian and reptile habitats while benefiting other many other wildlife species, and reduce the likelihood of species becoming listed as threatened or endangered. Landowners and land managers are presented with measures to help them maximize compatibility with their existing management objectives, or to optimize their management actions specifically for herpetofauna. We will present examples of the management recommendations from the HMGs, as well as information on PARC's development of accompanying training modules.

**BIODIVERSITY ISSUES IN U.S. PACIFIC NORTHWEST MANAGED FORESTS**

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Challenges to biodiversity conservation in managed forests of the US Pacific Northwest are a complex mix of biological, socio-economic, policy, and management concerns. Biodiversity in regional managed forests are a particular concern, with about 200,000 km<sup>2</sup> (48%) of the landscape in the states of Oregon and Washington having forest cover. Current disturbances across this expanse are predominantly related to timber harvest, but also include recreation, cattle grazing, mining, fire, invasive species, disease, and the concern of habitat alteration due to climate change. Over 300 vertebrates are associated with the humid western portion of this forested landscape alone, and biodiversity concerns regionally extend to a broader array of taxa including vascular plants, lichens, bryophytes, fungi, and invertebrates. We synthesize current directions regarding ten topics: (1) regional biodiversity priorities, (2) aiming for ecological function, (3) comparing active and passive management approaches, (4) habitat modeling, (5) invasive species, (6) monitoring, and (7) information systems. Successful conservation programs must clearly identify the definitions, processes or roles of each of these areas in an adaptive-management framework in which management is conducted as learning trials from which to evaluate and readjust decisions.

**COMPARISON OF METHODS FOR ESTIMATING DENSITY OF THE ENDANGERED GOLDEN LION TAMARIN AND THE INTRODUCED MARMOSET IN BRAZIL'S ATLANTIC COAST FOREST FRAGMENTS**

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Surveys of primate species in their natural habitat yield essential information for species conservation initiatives. However, these researchers should use rigorous techniques capable of yielding accurate data. Censuses of the endangered golden lion tamarin (*Leontopithecus rosalia*-GLT) and the introduced marmosets (*Callithrix* spp.-CM) were carried out using three different methods in five forest fragments where the absolute GLTs density had been previously calculated during long-term studies. Accurate individuals densities of GLTs were obtained using line transect and play-back methods, but with large variances. There were significant differences in the variances between densities calculated using both line transect and play-back methods indicating play-back as a recommended method to survey GLTs. No significant difference was found in the densities of CM using three different methods, linear transect, play-back, and capture-recapture. Densities of CM with smaller variance were obtained using the capture-recapture method. This can be explained by the previous habituation of the marmosets with the capture sites and traps, making the capture easier during the study. Researchers usually standardize their methods to obtain comparable census data. However, this study showed for play-back methods that researchers should be aware of the behavioral differences between species and populations because it can result in biased data.

**A HOLISTIC APPROACH TO MASTER PLANNING FOR CONSERVATION AND INTERPRETATION: CATALINA ISLAND CONSERVANCY'S INTERPRETIVE PROGRAMMING**

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Land managers often find that the areas they manage have deep ties to the local community, their cultural history, and their local identity. When that community serves as a gateway to the protected land there is often a great challenge of keeping a balance between access and conservation management goals. The Catalina Island Conservancy has a dual role to protect and preserve its lands while also serving the recreational interests of the local and visiting communities. To meet this part of its mission the Conservancy has worked with local stakeholders in the interpretation of conservation management and natural history through a Master Interpretive Plan. This plan has effectively incorporated conservation goals with tourism, the mainstay of the local economy. The community-based Master Interpretive Plan integrates an in-depth survey of local and visiting community demographics and economy, several conservation forums with local stakeholders, a certification and professional development program for local guides and interpreters to ensure correct and consistent messages and facts, and evaluation tools to assess the long-term effectiveness of this approach. This poster highlights the major elements of the Plan and provides examples of specific products, concepts, and implementation strategies.

**SPATIAL ECOLOGY AND ABUNDANCE OF MEXICAN BOBCATS IN NORTHWESTERN MEXICO TO ASSESS ITS CONSERVATION STATUS**

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A lack of ecological studies on bobcats (*Lynx rufus*) in Mexico has precluded wildlife managers and decision makers to successfully determine its conservation status; the objective of the study was to gather baseline ecological data to help assess its conservation status in the sky islands of the Sierra Madre Occidental. Utilizing a suite of methods (spoor, camera-traps and observations) we determined habitat seasonal use for 2002, 2003, and 2005. Bobcats used 9 habitat types, most importantly juniper-oak woodland (34.8% records), pine forest (18%) and pine-oak (15.5%), significantly differing from availability; we also recorded significant differences between years and seasons. Habitat use was similar between 2003 and 2005, differing from 2002. We estimated a density of 1 individual per 20 km<sup>2</sup>, which is low compared to other bobcat studies. Low abundance and spatial habitat use patterns appear to be related to precipitation variation and consequently on prey distribution. Alternative restrictions on harvest and modification of conservation status should be applied to this population classifying it as vulnerable to extinction.

**A SURVEY OF CAVE DWELLING BATS OF NORTHERN MEXICO**

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## **Conservation Without Borders • Abstracts, Contributed Poster Presentations**

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The United States–Mexico border is home to the world’s largest remaining bat populations, and these bats play vital economic and ecological roles. Some borderland bats species form enormous colonies in caves, and they are exceptionally vulnerable to human disturbance and vandalism. Such species will never be secure until key roosts are identified, protected, and monitored. In 2003 we started a long term project to identify, monitor, and protect the most important bat roosts in northern Mexico. To date we have estimated a population of about 15.5 million bats in 31 undocumented roosts in the Mexican states of Baja California, Coahuila, Nuevo Leon, and Tamaulipas. Eight of them are major free-tailed bat (*Tadarida brasiliensis*) caves, three are for Ghost-faced bats (*Mormoops megalophylla*), two for lesser long-nosed bats (*Leptonycteris curasoae*), and one for Cave Myotis (*Myotis velifer*). Six free-tailed bat caves had been mined for guano, and the bat populations at three is extirpated.

### **RAPID INVENTORY, ASSESSMENT, AND STATUS OF ASPEN IN A SIERRA NEVADA WATERSHED**

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Aspen (*Populus tremuloides*) has been dramatically reduced in forests throughout the western United States, yet few land managers have systematically evaluated aspen stand condition and extent at a watershed scale. Here, we summarize results from a rapid inventory and assessment of aspen in the Clavey watershed, one of the longest remaining free-flowing rivers on the west slope of the Sierra Nevada mountains. At the watershed scale, we compared systematic drainage walks to aerial and remote-sensing inventory efforts in order to determine the most accurate and efficient methods of detecting aspen. In each stand we measured aspen canopy cover and stand composition at three different heights. Prevalence of conifer encroachment, grazing, and wildfire history were also examined. Results to date indicate that over 75% of the aspen stands are losing their overstory faster than it is being replaced and are likely to become extirpated without natural disturbance events or active management. These data will be used by a multi-stakeholder watershed group to prioritize local management actions and identify restoration opportunities.

### **LAS CALIFORNIAS BINATIONAL CONSERVATION INITIATIVE: A VISION FOR BIODIVERSITY CONSERVATION AT THE BORDER OF ALTA AND BAJA CALIFORNIA**

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Renowned as a global hotspot of biodiversity and threat, the California South Coast Ecoregion is bisected by the United States–Mexico border. Increasingly, border security measures and urban encroachment threaten to sever the ecological cohesion between the two sides. We conducted an analysis to identify a conservation reserve network within the border region that would represent the full complement of natural communities of this biogeographically rich, coast to mountains to desert landscape. We utilized a site selection algorithm (SPOT) to identify areas of exceptional biological richness (based largely on vegetation-type diversity) and high ecological integrity (based largely on degree of human land use impact). Asymmetries across the border in data quantity and quality, characteristics of land use, and public land ownership complicated the analysis. We depict our results by dividing the study area into four categories of conservation value; threats and strategies also divide into these categories. A priority of this analysis was to identify areas where binational corridors might best be protected to maximize ecological permeability across the border. Existing development impacts already constrain opportunities for such connectivity, highlighting the urgency for binational conservation action. We discuss the complementarity of this “vision” with other societal objectives, including border security efforts.

### **THE IMPACT OF FIRE ON THE FOREST TREE DYNAMICS IN BWINDI IMPENETRABLE NATIONAL PARK, SOUTHWESTERN UGANDA**

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Much as tropical evergreen forests are thought to be fire resistant ecosystems due to lack of sufficiently dry fuel loads, this assumption is rapidly collapsing with the proliferation of recent forest fires in the world including Bwindi Impenetrable Forest, a home to a diversity of flora and fauna including the critically endangered mountain gorilla. Knowledge about the effects of such fires is very limited. This study investigated fire effects in this Afromontane environment by use of plot sampling along line transects. The major goal of this study was to determine the effects of fire on seedlings, saplings, poles, and trees. Here, I present a comparison of fire impacts in 30 burnt and adjacent unburnt sites. The study was able to characterize both fire prone and fire resistant tree species and determine the regeneration patterns (recovery rate) of the burned sites. The study goes on to recommend a strategy of using fire resistant tree species as boundary markers and creation of buffer zones for conservation of this delicate Afromontane environment.

### **MANAGEMENT OPTIONS OF YALA PAPYRUS SWAMP FOR SUSTAINABLE DEVELOPMENT AND BIODIVERSITY CONSERVATION**

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Yala wetland is a rare resource in Kenya, always a center of controversy between the developers, local community, and conservationists since the 1950s. Although its ecological importance has been recognized, management options that ensures sustainable development for the locals, who live in abject poverty, and the conservation of the threatened biodiversity are lacking. A survey that involved interviewing locals living within a 20 km radius from the wetland on its utilization, resources inventory, and regeneration was undertaken. The wetland resource base was categorized into open water, wetland vegetation, and lacustrine based on ecological, economical and cultural significance. Valuation of the returns from the wetland utilized by locals as water source (53%), food (60%), grazing (58%), construction materials (68%), household equipment (98%), fish (61%), cultural significance (23%), medicinal (45%), and fuel (45%). Ecological importance of the wetland included habitat for fauna (birds, fish, and animals), and hydrological functions. Conservation and local community desires were compatible, and the management option that could ensure biodiversity conservation and artisanal utilization by locals had the best short and

long-term value of US\$12 billion per annum that was 590 and 230% higher if the resources was utilized either for agriculture or grazing respectively.

#### **IDENTIFICATION AND CONSERVATION OF NEW IMPORTANT BIRD AREAS (IBAS) IN LEBANON**

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Lebanon is on the migration "super-highway" between Africa and Europe / Siberia, hosting large numbers of migratory birds twice yearly, a resident Middle East endemic in Syrian Serin, and several breeding biome-restricted species. However, to date only four IBAs have been declared. We are working on a three-year program with the Society for Protection of Nature in Lebanon (SPNL), the Birdlife International local partner, to gain qualification for IBA status for new sites under the various Birdlife International criteria. Between 2005 and 2007 we shall survey all prospective sites in the country. In 2005 we visited twelve locations at least six times each and surveyed for avifauna and non-avian biodiversity. Additionally, we assessed threats, land use and site conservation requirements. Four locations surveyed by A Rocha Lebanon and two surveyed by SPNL have been recommended for IBA status under one or more of the following Birdlife criteria: bottleneck sites for migratory soaring birds (A4.iv), hosting significant number of biome-restricted species (A3) and breeding site for globally threatened species (A1). In 2006 we will survey more sites and will also be involving local communities in building "stakeholder" teams to protect and manage IBAs, thus achieving conservation of biodiversity in previously threatened locations.

#### **LANDSCAPE FACTORS AND COMMUNITY COMPOSITION IN A NATIVE PARASITOID GUILD: A CASE STUDY IN CONSERVATION BIOLOGICAL CONTROL**

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This study outlines the (1) temporal and spatial variation in the composition of the parasitoid guild of the native herbivore sunflower moth (*Homoeosomae electellum*), which is the most serious pest of agricultural sunflower in California and (2) the landscape factors that influence parasitoid guild parameters such as species richness and overall parasitism. At 32 agricultural and self seeding sites in California's Great Central Valley, sunflower moth larvae were collected and reared in order to survey parasitoid species richness, contribution to overall parasitism by each species, and relative life history strategies of the parasitoid guild during 2003, 2004, and 2005. In addition, sentinel larvae were exposed to parasitoids during three separate periods of the 2005 season to clarify temporal patterns. Survey and sentinel experiment results were analyzed using a principle components approach to look for landscape features that influence parasitoid guild composition factors. Presence of perennial plant habitat within one mile of the collection site and pesticide use within a one mile radius significantly affected parasitism parameters. The aim of this work is to continue to define the community, population, and landscape level factors affecting beneficial insect populations in landscapes fragmented by land use changes and pesticide applications.

#### **CONSERVATION STATUS OF THE NIGERIAN CHIMPANZEE (*PAN TROGLODYTES VELLEROSUS*) IN CAMEROON**

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Unregulated wildlife hunting, habitat loss and degradation threaten the Nigerian-Cameroon chimpanzee (*Pan troglodytes vellerosus*) with extinction. As expected, many remnant forests have lost most of their megafauna, including significant populations of chimpanzees. We undertook a review of the distribution patterns and numbers which reveals that there are only 5000-8000 Nigeria-Cameroon chimpanzees in the wild between rivers Sanaga in Cameroon and Niger in Nigeria. The rapidly declining population of chimpanzees in general merits attention because, more than any other species, they closely resemble humans genetically, behaviorally, and physically, and thus provide an important link to our evolutionary history. The current paper reviews the status of Nigerian-Cameroon chimpanzee in Cameroon and complements the action plan for the subspecies in Nigeria. Clearly, the survival scenario for chimpanzees would be improved by increasing the management effectiveness of priority sites. Significantly there is urgent need for systematic surveys of the subspecies throughout its distributional range, identify priority areas, and implement conservation interventions to ensure their long term survival.

#### **IMPACT OF INVASIVE SPARTINA ON AVIAN COMMUNITIES IN SAN FRANCISCO BAY TIDAL SALT MARSHES**

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Atlantic smooth cordgrass (*Spartina alterniflora*) was introduced into San Francisco Bay in the 1970s, and has since spread and hybridized with native cordgrass. The exotic cordgrass has become abundant in many marshes, with potentially serious impacts on native plants and animals. We assessed the impact of the *Spartina* invasion on avian saltmarsh communities by comparing the distribution and abundance of species in invaded marshes and uninvaded marshes. In spring 2005, we conducted variable circular plot surveys in seven invaded and five uninvaded marshes for a total of 65 points. We found over four times as many Alameda song sparrows (*Melospiza melodia pusillula*, a California Species of Special Concern) in uninvaded, native marshes than in invaded marshes, and, in contrast, nearly four times as many marsh wrens (*Cistothorus palustris*) in *Spartina*-invaded marshes than in native marshes. Results were more equivocal for California clapper rails (*Rallus longirostris obsoletus*, a federally endangered species) but we detected slightly more rails in invaded marshes than in native marshes. Our results indicate that while native birds may occupy *Spartina*-invaded marshes, alteration of tidal marsh habitat associated with the invasion may be favoring marsh wrens, who normally occupy fresh- or brackish-water marshes, over saltmarsh-obligate species.

**NUTRIENT COMPOSITION OF DIETS CONSUMED BY THREATENED SOUTHERN SEA OTTERS**

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The slow growth of the threatened sea otter (*Enhydra lutris*) population in California is accompanied by several phenomena, such as low and declining mass to length ratios, high and increasing time spent foraging, high dietary diversity at the population level, high dietary specialization at the individual level, and high rates of infectious disease, that are consistent with nutritional inadequacies in otter diets. We are investigating nutritional constraints on this population by combining an examination of the nutrient composition of otter prey with information on the diet consumed by individual wild otters. The diets consumed by individual otters vary greatly, with each otter concentrating on only a few types of prey. We are analyzing samples of over 80 species of otter prey including crustaceans (Cancer crabs, kelp crabs), echinoderms (sea urchins, sea stars), bivalves (mussels, clams), gastropods (*Tegula* snails, abalone) and echinoderms (fat innkeepers). Most otter prey are low in fat (less than 10%, dry matter basis), fat-soluble vitamins, and energy but high and variable in protein and calcium content. Variation among prey species in the nutrient composition of the edible fraction suggests that diet choice has nutritional consequences for individual otters but impacts at the population level are uncertain.

**PREPARING TO ASSESS CLIMATE CHANGE EFFECTS ON AUSTRALIA'S MARINE ECOSYSTEMS**

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Australia harbors a highly endemic marine biodiversity and many species of great conservation concern. Some observed shifts in ranges and phenologies appear related to predicted long-term climate / ocean changes. These observed shifts imply shifts in the composition, structure, and functions of marine communities, and thus their ecosystem services. Climate change projections are being used to inform range change predictions, but these predictions are limited by a paucity of monitoring and ecological studies that would provide baseline information for Australia's key marine biota and ecosystems (and by climate model resolution). We reviewed sensitivities of particular Australian species to variations in physical and chemical characteristics, enabling a ranking of the relative vulnerabilities of species-of-concern. However, direct studies of climate change impacts, notably on intertidal fish, invertebrates, and birds, are still generally few in Australia outside of Great Barrier Reef coral studies. Much of the knowledge of marine ecosystem responses to climate change around the world emerged serendipitously from existing monitoring programs, fisheries catch data, and paleo-oceanographic studies. Australia could vastly improve its ability to assess climate-driven changes to its marine ecosystems by implementing assessment and monitoring programs that track changes in indicator species / assemblages / ecosystems in relation to physical and chemical changes.

**USE AND NON-USE VALUES OF THE YALA SWAMP, KENYA TO THE LOCAL COMMUNITY**

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The Yala is an extensive inland swamp in western Kenya. This is a report of a four-month survey of the use and non-use values of the Yala Swamp to neighboring communities, using mainly questionnaires to interview 38 local households. Water and fish formed the mainstay for subsistence among the local people while there is a vibrant basket economy based on the *Cyperus* papyrus and *Typha* spp. vegetation. It is also an educational resource. The swamp's two satellite lakes form a medium of transport and a recreational site, and the riparian habitat is a source of medicinal plants, game meat, and wood fuel. More than 90% of the Lake Victoria Basin Biome-restricted bird species and a further four *Papyrus* endemic and one globally threatened bird species are found in this wetland. The swamp vegetation breaks strong winds, helps conserve the riparian soil, and filters off pollutants from upstream, although local people and their livestock are threatened by diseases and pests from the swamp. It has aesthetic and cultural values and is a refuge for the only remnant viable population of Cichlid fish species now extinct from Lake Victoria but are also threatened here as the swamp is currently under official agricultural reclamation.

**ASSESSMENT OF WOODY SPECIES DIVERSITY AND THE NATURAL POTENTIAL OF ITS CONSERVATION: CASE STUDY IN BURKINA FASO**

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In Burkina Faso and other low income countries in West Africa human pressure on plant resources is strong. That worsens threat on phytodiversity because of the fragile ecological balance due to climate instability. Facing this problem there is a need to state the actual plant diversity and assess their potential of regeneration for further plan of conservation. We carried out woody vegetation inventories in eastern Burkina Faso along a north-south transect. Researches included evaluation of species richness and analysis of juvenile floristic composition and population structure. Results showed a total of 204 woody species distributed into Sahel and Sudan climatic zones. Species richness decreases from global inventory to juvenile stratum. Few species are frequent in juvenile class and most of them have bad population structure due to bush fire, pasture, agriculture, and drought. Species richness and regeneration potentialities are strongly linked to climate types and local habitats. The actual diversity of woody species is important but threatened because of lack of regeneration. Many plant species and / or families could rapidly disappear from semiarid areas if urgent conservation program is not established. This program should, for example, include conservation of portions from high diversity lands and enriching of protected areas with threatened species.

**POPULATION DIAGNOSTIC OF THE SEAHORSE *HIPPOCAMPUS ERECTUS* IN THE LAGOON OF LA RESTINGA, MARGARITA ISLAND, VENEZUELA**

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*Hippocampus erectus* is a seahorse species listed as Vulnerable on the IUCN Red List, based on the inferred decline of their populations around the world. In Venezuela the conservation status of this species is unknown. The purpose of this research was to determine the current situation of wild *H. erectus* populations in the Lagoon of La Restinga National Park and provide basic biological knowledge of the species. We evaluated for a period of one year 48 transects of 50 m<sup>2</sup> each, using the underwater visual census technique. Population densities were considerably low, mean density being 0.019 individuals / m<sup>2</sup> (range 0 to 0.1 individuals / m<sup>2</sup>). We also estimated the proportion of sexes, size distribution, and reproductive season. Spatio-temporal variations in seahorse abundance were correlated with the physico-chemical parameters (temperature, salinity, and dissolved oxygen) characteristic of the sectors in the study area. These results are the baseline for the development of a line of research on the conservation of wild seahorse populations in Venezuela.

**STRENGTHENING SCIENCE-BASED CONSERVATION FOR THAILAND'S WORLD HERITAGE SITE THROUGH TIGER CONSERVATION AND LIVING LANDSCAPE PROGRAM**

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For almost half a century, Thailand has vigorously invested in protecting natural resources by establishing national parks and wildlife sanctuaries, now covering 15% of the country area. Unfortunately the policy has caused an increasing tension between conservation and utilization pressures. Although forest areas appear virtually unchanged following satellite images, wildlife populations still suffer from poaching, competition with livestock, and forest product collections. The status quo law enforcement and social community campaign cannot prevent many species from declining. The focal spot for an innovative approach is at a 6000 km<sup>2</sup> world heritage site located next to the border with Myanmar. At the site, monitoring has become a crucial measure, guidance, and warning. Monitoring by camera trapping in 2004–2005 revealed that the area supported 4 tigers / 100 km<sup>2</sup>, the best tiger density in southeast Asia. Monitoring of tiger prey using a system of line transects allows prediction of the tiger population health. Other landscape species for the site that represents all ecosystem types and threats on the site include tigers (*Panthera tigris*), Asian elephants (*Elephas maximus*), rufous-necked hornbills (*Aceros nipalensis*), and otters (*Lutra* spp.). The living landscape approach placing wildlife as a core has given managers clearer link between interventions, threats, and conservation targets through monitoring outcomes.

**RESERVE NETWORKS IN FRAGMENTED LANDSCAPES OF SOUTH-CENTRAL CHILE: CHALLENGES AND ALTERNATIVES**

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The Nahuelbuta Coastal Range, located in the central Chile biodiversity hotspot, has dramatically reduced its cover of native forest due to historical agricultural use and intensive exotic tree plantations. Recently, forest companies are becoming increasingly conscious of the value of protecting remnant fragments. We have conducted a diagnosis of the potential to create a network of reserves in private lands of the Nahuelbuta Coastal Range. We have found that most forests suitable for conservation are located in less productive, high elevation areas. On the other hand, the more productive and more diverse native forests of lowland areas have been reduced to small fragments under significant edge effects. However, there is an extensive network of riparian habitats conserved around forestry plantations, which contains samples of most habitat types. We have developed, based on international standards, a set of criteria, and indicators to prioritize conservation efforts in the area. We concluded that conservation on these highly fragmented landscapes requires a specific approach due to the scarce flexibility of conservation scenarios. We recommend to complement natural (native forests) with semi-natural (exotic forest plantations) ecosystems to ensure a more efficient and sustainable alternative.

**THE EFFECTS OF PERSONAL EXPERIENCE ON PUBLIC ATTITUDES FOR OR AGAINST THE MANAGEMENT OF *URSUS AMERICANUS* IN NEW JERSEY, USA**

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Throughout the 1800s to the mid 1900s, black bear (*Ursus americanus*) ranges and population sizes declined in New Jersey. Since the 1970s bear populations have increased, and more recently, expanded into suburban areas of the most densely populated state in the USA. From 1995–2003 bear-human conflicts rose from 285 to over 3000. In December of 2003, the state's first bear hunt since 1970 took place among much controversy. Despite its success, the New Jersey Supreme Court cancelled a 2004 hunt days before the scheduled initiation. Although management decisions should be guided by scientific research, public opinion may not be ignored. Utilizing Dillman's Total Design Method, we initiated a mail survey in areas where there are high and low population densities of black bears. The study will provide an accurate representation of the factors involved in human-bear interactions that lead to attitudes for or against management techniques. Data generated will assist in the design of educational materials and arm the state's wildlife managers and policy makers with much needed information upon which scientifically sound policy decisions can be made. Results illustrate how personal experiences with black bears affects respondents' attitudes towards bears and their management.

**ORIGINAL OLD-GROWTH FOREST COMPOSITION FOR LYELL ISLAND, HAIDA GWAII (QUEEN CHARLOTTE ISLANDS), BRITISH COLUMBIA**

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A simple question—what was the original extent of old-growth forests?—is very difficult to answer. Forest inventories have been maintained for decades, but solely for timber and the original old-growth forest information is deleted upon logging. However

that information still exists in records that pre-date logging. We used 1966 forest cover paper maps and 1937 aerial photos to reconstruct the original forest composition for Lyell Island, Haida Gwaii. We digitized and georeferenced the paper maps and interpreted the 1937 photos following standard timber inventory methods for areas logged by 1966. We found that the reconstruction methods were successful in determining original old-growth forest composition and timber attributes can be used for conservation purposes. The original extent of culturally important western redcedar forests and the most productive forests were highly underestimated in the historical forest cover model used in planning. Large individual cedar trees are visible on the 1937 air photos, so inventorying their original extent is possible. Logging by 1937 was overestimated by 300% on the forest cover maps. Early forest cover maps and air photos are readily available for coastal British Columbia, so it is possible to create environmental baselines before logging was widespread, a database that has myriad uses for conservation and restoration.

### **URBAN-NESTING COOPER'S HAWKS MONITORED BY CITIZEN BIOLOGISTS IN BERKELEY, CALIFORNIA**

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In recent decades, urban nesting Cooper's Hawks (*Accipiter cooperii*) have been studied intensively in Wisconsin and Arizona, the results raising questions about urban zones as ecological traps. During 2002–2005, we trained an average of 24 people per season to search a 2782 ha area of Berkeley and Albany, California, for nesting Cooper's Hawks. Effort averaged 570 hrs / season. During 4 years, we found 48 active nests of which 45 were successful. Ash (*Fraxinus* spp.), American Elm (*Ulmus americana*), Coast Live Oak (*Quercus agrifolia*), and Monterey Pine (*Pinus radiata*) accounted for 69 of nest trees. Twenty-two nest trees were on streets or in yards, 15 in parks, and 11 on campuses. Average density ranged from 198–309 ha / nest, comparable to the highest known Cooper's Hawk nest densities. Productivity averaged from 3.3–4.2 branchers / successful nest. Nest building was from late February to late March, incubation from late March to mid May, hatching from early May to early June, and branching from early June to early July. Just over 1000 prey items were collected at nest sites in 2002–2003, including 24 bird and 3 mammal species. Mourning Dove (*Zenaidura macroura*), American Robin (*Turdus migratorius*), Rock Pigeon (*Columba livia*), Western Scrub Jay (*Aphelocoma californica*), and House Sparrow (*Passer domesticus*) accounted for 83 of identified items.

### **BIOLOGICAL INTEGRITY AND DIVERSITY: WATERFOWL AND THE NATIONAL WILDLIFE REFUGE SYSTEM**

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The National Wildlife Refuge System Improvement Act of 1997 has a mandate of maintaining biological integrity and diversity. In the following study we asked the question of whether or not this mandate has been fulfilled for waterfowl species (ducks, geese, and swans, family Anatidae) common to the United States. We used representation, redundancy, and resiliency as indicators of biological integrity and diversity. We did so at three geographic scales: continental United States, flyway, and climatic. Within each of those geographical contexts we examined the extent to which the three above mentioned principles were achieved during each of the three stages in the life cycle of waterfowl (breeding, migration, and wintering) on each of the 545 National Wildlife Refuges. Preliminary results indicate 46 of 47 waterfowl species satisfy the principles of representation and redundancy at the national scale. In addition, 42 of the 45 waterfowl species nesting in the United States satisfy the principles of representation and redundancy during the breeding stage. If further results continue to support our preliminary findings, then the present National Wildlife Refuge System may be comprehensive enough to maintain biological integrity and diversity of waterfowl at the scale at which we conducted our research.

### **CONSERVATION OR IDEALIZATION? THE ESSENCE OF NATURE DILEMMA AND THE EFFORTS TO INTEGRATE ENVIRONMENTAL POLITICS AND LOCAL KNOWLEDGE IN PROTECTED AREAS**

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During the past five decades Italian mountains have been highly depopulated. The environmental abandonment and the erosion of traditional landscapes resulted in so severe hydrogeological risks that national and European regulations about nature protection, accordingly to concepts as community-based conservation and sustainable development, tend to enhance the ecological role of local communities and their traditional environmental knowledge. Nevertheless, cultural and social struggles remain between protected areas managers and local populations. Exploring the conflict in Parco Nazionale dei Monti Sibillini, a protected area in the Central Apennines, my anthropological research has revealed how professional ecology and biology, as political practices, seems to conceive a public, universalistic form of possession and management of nature excluding local traditional uses. The attitude of park managers consists in forms of nature protection which appears bureaucratized and insensitive to local communities needs and expectations; as a result depopulation still increase as well as populations' feelings of disillusion and hostility towards the park as a tool for sustainable development. Thus the emerging question is whether to conserve a nature—as always managed by local populations—or produce a new, idealized model of nature to satisfy the expectations of tourists and ecologists.

### **FLORISTIC COMPARISON BETWEEN A PRESERVED AND A DISTURBED CERRADO PHYSIOGNOMY IN BRASÍLIA, BRAZIL: A STUDY OF HUMAN IMPACTS IN THE VEGETATION COMPOSITION**

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The Brazilian socio-economic scenario culminated in a great human occupation process, that threatened hardly the Brazilian savanna ("Cerrado"), by conversion of vast areas of natural vegetation into agricultural or urban areas or into urban areas. Among the Cerrado physiognomies that was more jeopardized by those impacts are the "veredas" (gallery vegetation), important shelters of wildlife and essential areas in the maintenance of hydrologic dynamics. The main goal of this research was to evaluate the impacts of urbanization at a species level in a "vereda" environment. As part of this research, it was

executed a floristic survey and comparison between two "vereda" areas, in a disturbed one and in a preserved one, both in Brasilia. The vegetal species found in these two areas were collected using the plot sampling method, and identified. After the compilation of the species list, the Sorensen coefficient (a similarity index) was applied in order to verify the similarity degree between the two areas. The results obtained indicate that the "veredas" are divided into zones that order greatly the floristic composition. The impacts affect in an unequal way these zones. Many characteristic species of other Cerrado physiognomies and disturbed areas were found in the disturbed vereda.

**SYNCHRONY BETWEEN THE NIDIFICATION OF ARARIPE MANAKIN (*ANTILOPHIA BOKERMANNI*) AND THE RAINS REGIME**

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The third consecutive year of monitoring the reproductive period of the Araripe Manakin, a Critically Endangered bird endemic to northeastern Brazil, has shown a three-month delay relative to the same period in 2004–2005 and 2002–2003. In 2005, the average rainfall between July and November was the lowest observed value in the 1974–2004 interval in the study area. Although monitoring was performed only for three years, the synchrony with the dry season was evident, and was also observed for other bird species. Climatic catastrophes were observed around the world in 2005, with unprecedented series of hurricanes in the Atlantic, and the worst drought in the eastern Amazonian region in the past 100 years. There is a possibility that the temperature increase in the planet, mainly related to the emissions of greenhouse gases, may be leading to extreme climatic events, with consequences to the conservation of biodiversity.

**THE EFFECTS OF WARNINGS ABOUT DEPLETING RESOURCES ON RESOURCE CONSUMPTION: A LABORATORY STUDY**

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Depletion of natural resources continues to be a significant environmental problem. Media messages warning of depleting resources are common, yet little research has studied the impact of such warnings on resource consumption. To investigate this, we conducted two studies using a paradigm known as a resource dilemma (RD), in which maximum personal gain is in direct conflict with group welfare, to examine the impact of warnings about depleting resources on consumption of the resource. In Study 1, 90 participants played 16 trials of a 5-person RD game in which they harvested points from a common resource pool. After trial 12, participants were informed they were dangerously close to depleting the resource, and thereafter received no additional warnings. Harvesting dropped immediately after the warning, but within 3 trials returned to the pre-warning level. In Study 2, 85 participants played 22 trials of a RD game, with warnings after trials 12 and 17. Replicating Study 1, harvesting dropped after the first warning, and returned to the pre-warning level within 3 trials. Supporting a "boy who cried wolf hypothesis," consumption rates were unaffected by the second warning. Results suggest that the effectiveness of warnings about depleting resources may diminish over time if no crisis is immediately apparent.

**EFFECTS OF WILD GRAPE VINES ON UNDERSTORY AND MID-STORY VEGETATION IN A NORTHERN HARDWOOD FOREST**

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Vines use other plants for structural support allowing them to be narrow, flexible, and capable of rapid growth. Although extensive forested areas in the northeastern United States are over-populated with wild grape vines, little is known about the effects of these dense vine populations on other forest plants. The purpose of this study was to address these effects in a 13-hectare old-growth northern hardwood forest located in northwestern Pennsylvania by comparing 576 1 m<sup>2</sup> understory control quadrats (no vines) and 128 7 m<sup>2</sup> mid-story control subplots with 432 1 m<sup>2</sup> understory treatment quadrats (with vines) and 96 7 m<sup>2</sup> mid-story treatment subplots. Results show that understory biomass is 37.5% lower in plots with vines compared to plots without vines ( $t = -2.1$ ,  $p = 0.05$ ), whereas mid-story biomass was only 3.9% less (not significant) in plots with vines. Nine understory and 13 mid-story rare plant species were absent from the samples with vines, and three understory species had lower abundances in samples with vines compared to samples without vines including *Viola* spp. (-99%), *Onoclea sensibilis* (-75%), and *Dryopteris carthusiana* (-53%). Vine abundance along the forest-field edge is roughly double the vine abundance in the forest interior except in interior gaps. Management options are discussed.

**BADGER BEHAVIOR IN A FRAGMENTED LANDSCAPE: IMPLICATIONS FOR CONSERVATION PLANNING IN CALIFORNIA**

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The American badger (*Taxidea taxus*) is listed as a California Species of Special Concern. The badger's grassland habitat is currently one of the least protected habitats in the state, and is becoming increasingly fragmented by suburban and agricultural development. Recent studies elsewhere indicate that badgers range widely, and thus might be particularly sensitive to this fragmentation. However, almost nothing is known of badger habitat use, home range sizes, or dispersal distances in California. I investigated the movement behavior and habitat use of 9 radio-implanted badgers in a fragmented landscape in Monterey County, California. Badger home ranges ranged between 1 and 10 km<sup>2</sup>, and I did not observe long-distance dispersal of the 2 juveniles. Male and related female ranges overlapped, while non-related females occupied exclusive home ranges. Badgers used grassland and coastal sage scrub habitat more often than expected and avoided oak woodlands; and were often located in close proximity to residential areas. Although no radio-implanted badgers crossed the highways bordering the study area, 9 unmarked road-killed badgers were reported during the study period. These results not only identify threats to badgers, but they can also be used to guide conservation planning in California grassland habitats.

**MULTI-SCALE FEATURES FOR IDENTIFYING INDIVIDUALS IN LARGE BIOLOGICAL DATABASES**

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Identifying individual animals is necessary for answering many questions in wildlife ecology. Limitations of conventional techniques prompt for alternatives that minimize impacts on animals and improve search efficiency. Semi-automated photo-identification techniques have been developed in marine mammal research, but show moderate retrieval rates and often require extensive manual follow-up. We demonstrate a novel method that identifies individual marbled salamanders using their dorsal patterns with high retrieval performance. For example, in a database of 1008 images, 95% of 101 known matches were identified in the top 10 ranks by our method. To test it, we indexed all adult marbled salamander captures from a one year span and used our recognition method to facilitate analysis. We determined that 366 individuals were captured between 2 and 5 times. Of these, less than 2% were captured at more than one of the fourteen pond basins, suggesting that breeding migrations were strongly directional and pond-shopping among first time breeders was infrequent. There was significant variability in the duration of individual stays. The majority of males stayed between 15 and 35 days and the majority of females staying between 30 and 50 days and stay was uncorrelated with weight changes. The recognition algorithm facilitated these conclusions, rapidly. We believe that this method is generalizable to other patterned animals, and of significant value for answering biological questions.

**IMPACTS OF HUMAN RECREATION ON MAMMALIAN CARNIVORES IN PROTECTED CALIFORNIA OAK WOODLANDS**

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Surveys show that people in California value easy access to protected areas—including state and regional parks, wildlife refuges and open space preserves—but recreational use of these areas may have negative impacts on wildlife populations. We used the distributions and relative densities of four mammalian carnivores as indicators of the impacts of non-motorized recreation in protected areas in northern California. We surveyed 30 similar oak woodland sites and paired neighboring sites that do and do not permit recreation. We collected scats along on- and off-trail transects throughout each site and found significantly lower densities of native carnivores in protected areas that permit recreation than in sites that do not. Within protected areas that permit recreation, native carnivore detections were lower in areas with a high frequency of domestic dog visits. This research reveals the need for reconsideration of the way we view non-motorized recreation in reserves intended to protect wildlife. Results are being extended to land managers and conservation planners in order to balance the increasing demand for recreation and wildlife conservation in urbanizing landscapes.

**OCCURRENCE AND CONSERVATION OF ALLUVIAL GROUNDWATER ECOSYSTEMS IN THE WESTERN UNITED STATES**

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In mountain and piedmont valleys, rivers may recharge their aquifers at large spatial scales (1–2 km lateral to the channel). Distributed across this extensive recharge area is a unique suite of groundwater organisms, including hyporheic stoneflies, amphipods, and copepods. Biological diversity of fluvial groundwaters is perhaps the Atlantis of freshwater conservation: they are not addressed in any of the major freshwater assessments or conservation plans in North America. *Stygobromus* amphipods show high rates of endemism, and many organisms are new to science, belong to cryptic taxonomic groups, or are not well described for North America. Poor taxonomic treatment, lack of comprehensive collections and general view of these systems as transitional areas are major impediments to evaluating and conserving this ecotype. At the same time, with the overlap of urban and agricultural land use and the demand for fresh water, there is a high risk to surficial groundwaters. We describe a conceptual model of groundwater invertebrate biogeography based on the Hyporheic Corridor Concept, with river networks as the potential link between populations of karstic or marine origin. We predict that alluvial groundwater ecosystems are widely represented throughout the western United States, and are critical to the conservation of groundwater biodiversity.

**CHILEAN DOLPHIN—AQUACULTURE INTERACTIONS IN SOUTHERN CHILE: IS AQUACULTURE A THREAT FOR THE CONSERVATION OF THIS ENDEMIC SPECIES?**

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The expansion of the aquaculture industry in southern Chile has been fast and extensive, but with important environmental costs. Since this activity is developed in coastal waters, there is an important overlap with unique marine species, such as the endemic Chilean dolphin (*Cephalorhynchus eutropia*). The main goal of this study was to evaluate the effects of aquaculture activities, including boat traffic generated by it, on habitat use and behavioral patterns of Chilean dolphins in Chiloe Island. During summer 2002, dolphins' movement and behavior were assessed by digital theodolite tracking and GIS analysis. Dolphins concentrated their use in shallow areas with low or no mussel cover and avoided areas with more than 60 mussel cover, indicating that high mussel coverage restricted dolphins from using areas. Boat traffic generated by aquaculture activities caused significant dolphin behavioral shifts. During boat presence, dolphins increased their swimming speed up to 41 and altered in 88 their swimming reorientation rate. Since dolphins use the study area mainly for feeding, the negative effects caused by aquaculture activities represent a potential threat to this dolphin local population. We propose that better regulation should be applied for marine concessions criteria, which should include for example marine mammal habitat use.

**ENVIRONMENTALISM WITHOUT RESISTANCE**

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To overcome opposition to environmentalism, we could learn from psychotherapists' concept of resistance—people's unconscious struggle against change. "Therapy without resistance" addresses three questions: Is the problem solvable? Are

there competing intentions? Am I the kind of person you think can help you solve this? Resistance to environmental messages might likewise be overcome. Is the problem solvable? The task of healing the planet can seem overwhelming, causing some people to avoid and deny. One answer is to share success stories and to frame the environmental movement in the tides of history (citing successful past movements for change). Are there competing intentions? Greed, addiction to material goods, and a perceived need to feel like top species (or top nation) are obstacles to environmental awareness. These apparent "gains" and such traits as narcissism, uncritical nationalism, and consumerism impede the change of paradigm. We need to reveal the costs of these "gains" and to persuasively articulate other gains to replace them. Am I the kind of person? If people dismiss the messenger, the message never has a chance to be heard. By reducing the dissonance between the messenger and the intended audience, we might improve the likelihood that the message will be heard.

**MOUNTAIN LION CONSERVATION IN A FRAGMENTED URBAN LANDSCAPE IN SOUTHERN CALIFORNIA**

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Urbanization eliminates natural habitat and fragments what remains, presenting particular challenges for wide-ranging species, such as mammalian carnivores. Mountain lions are the largest remaining carnivore in many areas of western North America and represent perhaps the ultimate challenge for carnivore conservation in urban landscapes. Since 2002, we have been studying the behavior, ecology, and conservation of mountain lions in and around Santa Monica Mountains National Recreation Area, west of the city of Los Angeles, through the use of GPS radio collars. Although habitat quality and prey populations appear to be sufficient, based on home range sizes the Santa Monica Mountains and other remaining blocks of open space in the region are too small, on their own, to preserve viable mountain lion populations. Thus, it is critical that mountain lion movement occur between these habitat blocks and across freeway barriers, particularly for young dispersing animals. We have documented movement by lions across one freeway to the north, but as of yet no movement across the largest and busiest freeway (Highway 101). We have documented successful lion reproduction in the Santa Monica Mountains, but the fate and dispersal of these kittens will have critical implications for the long-term viability of the species.

**THE CONSERVATION STATUS OF POPULATIONS OF THE TROPIDURID *LIOLAEMUS LUTZAE* ALONG ITS GEOGRAPHICAL RANGE: AN ENDEMIC LIZARD THREATENED WITH EXTINCTION**

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The endemic and threatened with extinction lizard *Liolaemus lutzae* has a relative small range restricted to beaches of sand dune habitats (called restingas) of Rio de Janeiro State in Brazil (only 200 km extent of range) which are under intensive anthropic disturbance. Some populations have dramatically declined. There was no information on the actual status to any population. We estimate an index of population size in all areas where the species still live, the actual geographic distribution, evaluate habitat condition, and present suggestions of habitat conservation and restoration to minimize risk of local extinctions. The density of *L. lutzae* at each area was strictly related to the present types and extent of habitat disturbances. We detected that the lizard disappeared from at least four areas it used to occur. The most common negative sources of habitat degradation were the removal of beach vegetation to construction of houses, coastal roads and / or sidewalks, trampling on vegetation, vehicle traffic on vegetation, and littering, which presently constitute important sources of threat for the species existence. If conservation actions are not carried out urgently, the simultaneous population loss in most areas along its range will lead to a risk of the species disappearance in the near future.

**NATIONAL ECOSYSTEM GAP ANALYSIS FOR PARAGUAY**

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Recent ecosystem mapping efforts in Paraguay have identified all terrestrial ecosystems, and interest in representative conservation of these ecosystems is a priority of the government and NGO conservation community. To prioritize those ecosystems most deserving of conservation attention, a national gap analysis was conducted to determine the representation of these ecosystems in the national system of protected areas. Ecosystems and protected areas were spatially combined, and statistics were generated on the representation of each ecosystem in the protected area estate. Ecosystems were assigned into the following representation categories: Poor (0–5% of the total area of the ecosystem represented in the protected area system), Moderate (6–10%), and good (> 10%). The results of this analysis will be described with a focus on those ecosystems which were found to have no representation whatsoever in protected areas.

**MORPHOLOGICAL AND BEHAVIORAL DIVERSITY SUGGEST THAT BREEDING POPULATIONS OF LARK SPARROWS SHOULD BE CONSIDERED IMPORTANT UNITS OF CONSERVATION**

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It is commonly believed that the sharing of common overwintering grounds and increased dispersal capabilities of long-distance migratory bird species promote genetic cohesion and prevents local adaptation of their breeding populations. We compared genetic, morphological and behavioral diversity of four breeding populations of Lark Sparrows (*Chondestes grammacus*) distributed throughout most of its range. Genetic analyses of the mtDNA control region (47 samples) revealed no significant differences in levels of genetic diversity and no obvious pattern of regional groupings, suggesting either relatively high degree of population interchange or recent isolation. In contrast, discriminant analysis of 5 morphological traits from 93 individuals measured revealed three regional groups corresponding to the California, Texas, and Ohio / Illinois breeding populations. Sonogram analyses from at least ten males from each population revealed higher levels of syllable sharing within rather than among populations, suggesting the presence of regional song dialects. In spite of their apparent lack of genetic differentiation, morphological and behavioral characteristics suggest that breeding populations of Lark Sparrows should be considered

important units of conservation concern.

### **IS SURVIVAL DEPENDENT ON PATCH SIZE? SURVIVAL OF FOREST BIRDS IN SOUTHWESTERN COSTA RICA**

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Habitat loss and fragmentation is currently signaled as the primary cause for worldwide population declines and species extinctions. Current research on the effects of habitat fragmentation on populations has mainly focused on quantifying differential reproductive success between fragmented and continuous habitat. Not until recently has research begun to focus on the effects of habitat fragmentation on survival. We analyzed the effects of patch size on survival for five forest birds in the region of Coto Brus, Costa Rica. All individuals were marked and recaptured in six forest fragments, ranging in size from 0.09–30.0 ha, from 1994 until 2005. The effects of patch size on survival varied between species, with *Platyrinchus mystaceus* and *Atlapetes bruceinucha* showing the strongest effect ( $R^2 = 0.95$  and  $R^2 = 0.43$ , respectively). We then grouped all species by degree of forest dependency. As expected, the effect of patch size was strongest for the group with a high degree of forest dependency ( $R^2 = 0.47$ ) compared to the group with a medium degree ( $R^2 = 0.13$ ). These findings suggest that highly forest dependent species might have an estimable threshold patch size at which the probability of survival will be too low to sustain the population.

### **A NEW SOFTWARE PROGRAM FOR DESIGNING, MANAGING, MONITORING, AND LEARNING FROM CONSERVATION PROJECTS**

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The Conservation Measures Partnership has recently released the Open Standards for the Practice of Conservation to help conservation practitioners design, manage, monitor, and learn from their projects. The Partnership is now working with Benetech, a Silicon Valley based non-profit software developer, to create a user-friendly software program to help practitioners implement these standards. This program is based around a friendly step-by-step interview that guides practitioners through the steps involved in defining their project scope and targets, developing schematic conceptual models and spatial maps of their project site, ranking threats, developing objectives and actions, and choosing appropriate monitoring indicators and methods. The program also enables projects to easily export their project data to donor reports and (if they so desire) to a central database where other practitioners can learn about their work. This software has the potential to truly transform the practice of conservation. In particular, it will help field practitioners to plan and implement their projects more efficiently and effectively, managers to get standard information to improve the execution and coordination of programs, donors to benefit from better information and common forms and reports to minimize transaction costs, and members of the entire conservation community to learn from one another.

### **RIPARIAN AREAS IN THE FRAGMENTED LANDSCAPE OF SOUTHERN PORTUGAL: APPLICATIONS FOR CONSERVATION PLANNING**

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Riparian areas encompass a low percentage of land and are extremely vulnerable to disturbance, consequently a valuable resource for conservation. Current drought, desertification, and fragmentation patterns of arid Mediterranean areas of southern Portugal may irreversibly affect riparian habitats. We assessed the status of riparian areas using combined methodologies to understand riparian plant composition and structure and its use by mammalian carnivores as focal species (POCTI/MGS/47435/2002). We found (1) rich and diverse riparian plant community with patchy distribution, (2) strictly riparian plants mostly bordering rivers, whereas streams and creeks were invaded by Mediterranean sclerophytes, (3) carnivores were positively correlated with plant diversity and negatively correlated with the area devoid of vegetation, and (4) carnivores used mostly riparian galleries, especially when surrounded by agricultural fields. Our results indicate that in southern Portuguese arid Mediterranean areas, the distribution and diversity of riparian plants are decreasing due to a plant community shift towards a sclerophyte Mediterranean assemblage. However, riparian habitats are important for wildlife, especially in highly altered areas. Conservation of riparian landscapes in southern Portugal may require designing restoration and conservation guidelines for listed riparian habitats that avoid diversity loss and acknowledge their potential effects in the nationally protected cork oak woodlands.

### **HIGH PREVALENCE OF CHYTRIDIOMYCOSIS IN WILD POPULATIONS OF ANURANS**

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Chytridiomycosis has been implicated in some of the catastrophic declines in amphibian populations in various regions of the world. Despite strong associations between the disease and dying frogs, little is known about the ecology of the pathogen. In the spring and fall of 2004, we sampled nine seemingly healthy populations of the Lowland Leopard Frog (*Rana yavapaiensis*) and four populations of the American Bullfrog (*R. catesbeiana*) from Arizona for the presence of chytrid using PCR amplification. We found that individuals in ten populations carried the disease pathogen, and in some populations the infection frequency was greater than 50%. We were unable to detect the pathogen in three populations that were either hydrologically isolated or associated with thermal hot springs. Our results indicate that the chytrid pathogen is widely distributed and abundant in this region even when host populations are not experiencing catastrophic declines. Our results also suggest that thermal springs

likely serve as refugia from the pathogen.

**CONSERVATION IN AGRICULTURAL LANDSCAPES: A DEMOGRAPHIC STUDY OF A FOREST HERB, *TRILLIUM GRANDIFLORUM*, WITHIN HEDGEROWS AND FOREST PATCHES**

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Biodiversity conservation in agricultural landscapes depends on the maintenance of suitable habitats at the margin of production land. Efficient conservation strategies in these landscapes require sound knowledge of the processes driving population dynamics in fragmented habitats subject to recurrent anthropogenic disturbances. In this study, we compare the demographic response of a self-incompatible forest herb, *Trillium grandiflorum*, in three habitat types frequently found in agricultural landscapes: forest interiors, forest edges, and hedgerows connected to forest patches. Analysis of the stage-structure of 19 populations reveals that habitat type has a significant effect on recruitment, with substantially lower proportions of juvenile individuals in hedgerows, followed by forest edges and forest interiors. These differences may be partially explained by the lower rates of flowering and pollination observed in hedgerows as compared to forest patches. Moreover, seed set in natural and experimental populations was significantly affected by flower density and spatial isolation. Our results raise important questions about the capacity of linear structures, such as hedgerows, to support viable populations of forest herbs and therefore to act as corridors linking isolated populations. Understanding the processes affecting population persistence in these habitats will contribute to optimizing conservation efforts in agricultural landscapes.

**DEVELOPING BIOLOGICAL GOALS AND OBJECTIVES FOR PROTECTED AREA MANAGEMENT: LESSONS LEARNED FROM CANADA, MEXICO, AND THE UNITED STATES**

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Managers of publicly protected areas in Canada, Mexico, and the United States are mandated by law and regulation to develop science-based goals and objectives to guide conservation and management. We examined lessons learned from land management plans for National Protected Areas in Canada, Natural Protected Areas in Mexico, and National Wildlife Refuges in the United States, identifying several areas of common concern. We conclude that management direction is strongly influenced by local managers and tradition. Biological goals and objectives frequently lack a connection to broader ecosystem concerns. Often there is inadequate use of available and relevant scientific information in developing objectives, and objectives contain insufficient detail. Monitoring of progress toward achieving objectives is generally limited, with insufficient staff and funding being major contributing factors. Public involvement is critical to the success of land management plans. Specific recommendations for improvements in developing biological goals and objectives are presented. Use of available science can be increased through improved access and training. Ecosystem level goals should be created to provide guidance to local areas. Monitoring can be improved through training and prioritization of efforts. In addition, we encourage the use of standard metadata to allow accurate transfer of data and information holdings.

**CARNIVORE COMMUNITY RESPONSE TO A LARGE WILDFIRE IN SAN DIEGO COUNTY, CALIFORNIA**

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Understanding wildlife response to fire is crucial for assessing fire management practices in fire-prone habitats such as chaparral in southern California. From 25 October to 5 November 2003, the largest wildfire in recent California history burned 113,425 hectares of this diverse semi-arid shrubland in San Diego County. Beginning August 2005, we examined the impact of this wildfire on the carnivore community through motion-sensored digital cameras, track plots, and hair snares three times per year within 3 km of the fire perimeter, within the burn interior, and in unburned chaparral. Cameras detected coyotes (*Canis latrans*) most frequently (22.7 overall capture rate). Gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and striped skunk (*Mephitis mephitis*) were detected at lower frequencies (capture rate). Initial data suggest similar levels of coyote activity across perimeter, interior, and control sites. Track plots indicated presence of coyotes and a higher frequency of bobcats compared to camera surveys. Hair samples were collected at 30 of camera stations and 70 of track plots, suggesting differences in detection methods. Hair analyses can increase sample size for presence / absence surveys and provide genetic structure to carnivore communities. Through these methods, we will continue surveys to determine differences in the carnivore community across burn perimeter, interior, and unburned sites.

**BRINGING RESEARCH INTO K-12 CLASSROOMS**

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Education in the sciences is a vital component to the continued success conservation efforts. A National Science Foundation sponsored program at the University of Maine (NSF GK-12) helps meet this need. The program provides fellowships for outstanding graduate students to recurrently demonstrate science in local K-12 classrooms. A major goal of the NSF GK-12 program is to enhance K-12 science education by providing expertise, equipment, activities, and role models that would not otherwise be available to K-12 teachers and students. This poster will focus specifically on facilitating the understanding of the scientific method through hands-on fish research. Under the guidance of their Fellow, sixth grade students designed and executed an experiment testing the effects of different fish species and densities on water quality. The students researched the topic, formed hypotheses, compiled and analyzed the data, and presented the results. The Fellow formulated lesson plans for each step to emphasize the role and application of the scientific method. This experience ties directly to their annual school science fair where they will put their new knowledge into practice. These hands-on activities in research are great tools for enhancing science education in K-12 classrooms and instilling a lifelong appreciation for science and conservation.

**ELEVATIONAL LIMITS, CLIMATE CHANGE, AND AVIAN EXTINCTIONS**

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Climatic, ecological, and physiological effects of elevation impose limitations on species' range sizes that are key determinants of extinction risk. For nearly 8500 extant land bird species, an index of elevational limitation of range size explains 94% of the variation in of the probability of being in an extinction risk category. A modeling approach that combines elevational limitations and an intermediate IPCC surface warming estimate of 3.5 C by 2100, projects approximately 600 bird extinctions and close to 2000 species that risk extinction. Utilizing a tested and standardized index based on elevational distributions can improve conservation assessments of terrestrial species and will help identify those most vulnerable to global climate change.

**TOURISTS FEEDING WILDLIFE COULD PHYSIOLOGICALLY CONDITION ANIMALS TO THE WRONG ENVIRONMENT**

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The study of physiological responses of animals to tourist disturbance is receiving increased attention. Of little direct examination, however, is the physiological effect of tourists feeding wildlife. In the present study the physiological impact of tourists providing a non-natural diet (squid from temperate-zone waters) to a wild, free-ranging Southern stingray population (*Dasyatis americana*) in the Cayman Islands is investigated. We show using a classification and regression tree analysis (CART) of serum non-esterified fatty acids that the fed population of rays is completely dependent on the provisioned food source. CART differentiated fed rays from two Cayman sub-populations of unfed rays based on a single fatty acid (FA), regardless of the root node FA, and misclassified published fatty acid profiles of squid (*Illex* spp.), the prey item, as a fed ray. Additionally, fed rays had significantly higher proportions of omega-3 polyunsaturated FA (PUFA) and lower omega-6 PUFA, exhibiting an essential FA signature - critical for disease resistance, membrane structure and function, and immune response - similar to that of marine animals found in cooler waters. Our results suggest that tropical stingrays fed a non-natural diet are becoming physiologically conditioned to inefficiently respond to the metabolic demands posed by their tropical environment. Management measures for this wildlife-tourism site are recommended.

**HUMAN-LEOPARD PANTHERA PARDUS ENCOUNTERS IN NEPAL**

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Human-leopard encounters are not only one of the biggest threats to the leopards, but also a serious problem for communities sharing landscapes with leopards. This study aimed to assess distribution and abundance of forest leopards (*Panthera pardus*) and to examine causes of human-leopard encounters in Nepal. A total of 441 people were attacked and 121 killed by leopard, whereas 84 leopards were killed in retaliatory actions during 1994 to 2004. By integrating encounter data with GIS, we evaluated the distribution patterns and correlated with forest cover. The human-leopard encounter as a proxy indicates the leopards are distributed throughout the country and are increasing after mid nineties due the improvement of habitat by successful adaptive management of community forest (CF) in late eighties. However, encounter patterns varied geographically and seasonally but increased leopard population, inadequate habitat and prey base in the CFs, lack of connectivity, hiding covers in the crop fields are main causes of increased human-leopard encounters. The CFs significantly improve habitat for the wildlife but because of small sizes and lack of connectivity, the CFs are inadequate to support wide ranging species like leopard thus increasing encounters.

**MEETING THE CHALLENGES OF CANADA'S SPECIES AT RISK ACT: PARKS CANADA'S WEST COAST SPECIES AT RISK PROGRAM**

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Canada's first national endangered species law, the federal Species at Risk Act, came into full force in June 2004. The Canada National Parks Act (2000) sets the maintenance and restoration of ecological integrity (through the protection of natural resources and natural processes) as the top priority for all aspects of national park management. To respond to these challenges, Parks Canada has been building its science capacity, internally and through partnerships with Universities and other agencies. Parks Canada staff have also been developing extensive partnerships with First Nations, private landowners, and industries in "greater park ecosystems," recognizing that park boundaries mean little to species and ecosystems, and that landscape approaches to conservation are key to maintaining and restoring ecological integrity inside park boundaries. To meet the challenges related to the recovery and conservation of rare and endangered species, Parks Canada initiated a national Species at Risk (SAR) Program in 2001. Key elements of the program include inventories and conservation assessments, research, recovery planning and implementation activities, and public education. On the west coast, a number of initiatives have shown clear positive results, including the restoration of Garry Oak ecosystems in the new Gulf Islands National Park Reserve along the Canada / United States border.

**TESTING AN ABIOTIC FRESHWATER CLASSIFICATION SYSTEM IN THE HUDSON RIVER WATERSHED—DO FISH SEE WHAT CONSERVATIONISTS SEE?**

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Priority-setting in conservation is a topic of considerable debate. Biodiversity conservation planning often includes the identification of a set of priority areas intended to capture the full range of biological diversity. To accomplish this task, The Nature Conservancy relies on measures of environmental condition to estimate patterns of diversity in large-scale assessments. A GIS-based freshwater ecoregional assessment was developed which assigns watersheds to aquatic ecosystem types based on drainage size, geology, elevation, and landform. The highest-quality examples of each ecosystem type were identified,

assuming that they were representative of freshwater biological diversity. To test the efficacy of this assumption, we used an existing statewide data set to compile presence / absence data for native resident fish species in the Hudson River watershed and, using Multi-response Permutation Procedures (MRPP), tested for differences in fish communities among ecosystem types for 81 tributary watersheds. Overall, the classification performed fairly well, distinguishing between fish communities better than expected by chance. It was most reliable for large tributary watersheds and in the upper portion of the drainage. A further cluster analysis revealed many community groupings which spanned several ecosystem types, likely reflecting additional local-scale factors influencing fish community distribution.

#### **MULTI-SCALE SPATIO-TEMPORAL ANALYSIS OF ROAD NETWORK IN THE LAND BETWEEN ECOTONE**

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Most conservation initiatives are geared towards conservation of representative areas, while failing to address conservation issues in complex ecological transition zones (ecotones). These highly heterogeneous and patchy areas, which have been recognized as zones of control for ecosystem functioning, are increasingly threatened by the development pressures. This is particularly true for those near the urban centers that can induce exurban growth. The Land Between ecotone in the southern edge of the Canadian Shield in Ontario is an example of such a case where the existing land use management has left the ecotone vulnerable to increasing development threats from exurban growth. This study analyzed the threats associated with exurban growth in the Land Between ecotone using the road network as a surrogate for development pressure, since the road network alters the structure of existing land cover while also enabling further land use changes. The spatio-temporal pattern analysis of the road network in relation to various parameters and mapping of road density at multiple scales and functional distance to urban centers highlighted potential hotspots of future development. Initial conservation recommendations are identified in light of these results.

#### **THE IMPORTANCE OF CARNIVORES IN THE PRINTED MEDIA IN CHILE AND ITS RELEVANCE TO CONSERVATION PRACTICE**

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The knowledge of people on the species involved in human-wildlife conflicts can influence human attitudes toward carnivores and news in newspapers can influence the perceptions and what the general public knows about carnivores. We investigated the articles published by 15 Chilean newspapers between 2001–2005 and examined the news in terms of the species involved, the contents reported, and the sources of information cited. Seven species were reported in 57 articles. The cougar was the most cited species (66%), followed by Darwin's fox (11%). The main issues covered were depredation on livestock and rescue of injured animals in the case of cougar, and conservation initiatives for the other carnivores. Most articles published favourable information on the carnivores' public image (except for depredation events), giving information that contribute to increase the knowledge of people about carnivores conservation status. Articles concerning cougar show highly utilitarian and humanistic attitudes, articles concerning other carnivore species show mainly conservationist attitudes toward them. Newspapers could be used as a cost effective strategy to reach many people in conservation initiatives, but still remains to understand how these could influence human attitudes.

#### **WHO IS YOUR MAMA? MATERNITY TESTING IN ASIAN ELEPHANT**

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Southeast Asia is the home of the Asian elephant, an endangered species that requires large home ranges that cross political borders. Tourism represents a major source of income in the developing countries of this region, and baby elephants are highly prized as charismatic tourist attractions. A single baby elephant may be worth as much as US\$3000, leading wildlife authorities to require proof that young elephants were born in captivity rather than having been illegally captured from the wild. Genetic testing using polymorphic microsatellite DNA markers can provide the data needed for verification of maternity. We screened six polymorphic microsatellite loci developed for African elephants to assess polymorphism in 29 Asian elephants and to test the efficiency of assigning maternity in 6 putative baby elephant / mother pairs. As expected, we found that the number of alleles and the level of heterozygosity was lower in Asian elephants than in the African species. Although the level of polymorphism was sufficient for individual identification, it was not adequate for maternity assignment when candidate mothers from the same population were included. To provide scientific evidence for law enforcement, parentage assignment will require additional polymorphic loci, preferably ones that were developed specifically for the Asian elephant.

#### **DEVELOPMENT AND IMPLEMENTATION OF A RANGEWIDE CONSERVATION PROGRAM FOR THE RELICT LEOPARD FROG (*RANA ONCA*)**

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The relict leopard frog (*Rana onca*) was considered extinct until its rediscovery at several locations within the Lake Mead National Recreation Area, Nevada, USA, beginning in 1991. A total of seven populations were identified, six within Lake Mead NRA and one in Mohave County, Arizona, but two are now extirpated, and the global population of this species was thought to number fewer than 1100 individuals in 2000. Conservation efforts for this species are complicated by its historic distribution encompassing trans-boundary areas of three US states, multiple jurisdictional regions of federal management agencies, and a

unit of the National Park Service. Coordinated conservation actions were initiated in 2001 with formation of the Relict Leopard Frog Conservation Team and a comprehensive Conservation Agreement and Strategy was completed in fall 2005. Concurrent with conservation strategy development, RLCT partners have successfully implemented captive breeding and head-start programs, established four additional populations in the wild, completed critical life history research activities, and developed a cooperative field monitoring program. Future efforts will focus on adaptive management to enhance and expand existing wild and experimental populations, and on developing additional viable populations of the frog within historic range outside of Lake Mead NRA.

### **USING MARXAN AND CLUZ TO PRODUCE A PRELIMINARY CONSERVATION ASSESSMENT FOR MAPUTALAND, SOUTH AFRICA**

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Most protected area (PA) networks have developed in an ad hoc manner and fail to represent important elements of biodiversity, so a variety of planning techniques have been proposed to improve this situation. One such approach is systematic conservation planning, which is a target-driven process for designing PA systems and other ecological networks, but their use by practitioners has been limited. There are several reasons for this, including a perception that the required software is difficult to use and requires a large amount of biodiversity data. Thus, even when these planning exercises are undertaken, they often occur at the beginning of the planning process and rely on outside expertise. These perceptions are problematic because systematic conservation planning should be at the heart of all land-use zoning and protected area design. Moreover, it is important that all stakeholder organisations have the capacity to update these plans to reflect changes in land-use, land ownership and patterns of biodiversity. This poster illustrates how a user-friendly software package (CLUZ) was used together with basic landcover data to produce a preliminary conservation assessment that has already been used to inform important land-use decisions in Maputaland, South Africa.

### **LOSING THE SANCTUARY: DRY FOREST LOSS IN THE LAST ELD'S DEER STRONGHOLD**

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To assess long-term decline in dry deciduous forests at Chatthin Wildlife Sanctuary (CWS) in Myanmar (Burma), we analyzed five satellite images covering 32 years (Landsat MSS: 1973; Landsat TM: 1989, 1992; Landsat ETM+: 2001; ASTER: 2005). CWS is one of the last strongholds for dry deciduous forests and the associated endangered Eld's deer. Both are becoming increasingly rare throughout Asia. We compared deforestation inside and outside CWS to evaluate the sanctuary's effectiveness in preserving habitat. Our results demonstrate major habitat declines between 1973 and 1989 due to encroachment. 1989-2001 saw little habitat loss, presumably resulting from increased sanctuary protection associated with an Eld's deer conservation project. Construction of Thapansaik Dam and subsequent flooding in 2001 caused a new increase in habitat loss at CWS. Overall, habitat loss was significantly higher outside the sanctuary, resulting in almost complete deforestation and clearly demonstrating the enormous pressures on the reserve. We conclude that despite habitat loss, CWS provided significant protection for Eld's deer in the past. However, without changes to government land use policies in surrounding areas, CWS and its associated Eld's deer population will continue to decline.

### **UNGULATE INTRODUCTIONS IN SOUTH AFRICA: THE POOR GET RICHER THAN THE RICH**

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Humans rely on exotic species for their survival, especially for food. Exotic species are also transported worldwide for recreational and aesthetic reasons. Yet the humanaided movement of organisms is a great threat to biodiversity. Humans could be expected to introduce the highest number of exotic species to species poor areas. However, studies have shown that, for plants, species rich areas have more invasive species than other areas. Ungulates have been moved globally since prehistoric times for food, tourism, sport hunting, aesthetic, and other reasons. In South Africa many ungulates are being introduced throughout the country to satisfy hunting and tourism interests, on private land. These practices raise concern due to the high likelihood vertebrates have of becoming invasive. This study aimed to quantify the introduction of exotic ungulates in South Africa and to determine the relationship between the introduction of exotic ungulates and the species richness of indigenous ungulates. Game sale data between 1963 and 2005 was obtained. It was found that in the last five years about 40% of ungulate species sold were exotic to the location of sale. The highest number of exotic species sold was in areas with the lowest species richness of indigenous ungulates.

### **CATTLE FACILITATION OF ALEUTIAN CACKLING GOOSE FORAGING PATTERNS IN HUMBOLDT BAY PASTURES**

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A conflict between the dairy and cattle ranchers around the Humboldt Bay near Arcata, California, and the once endangered Aleutian cackling goose (*Branta hutchinsii leucopareia*) has arisen. Through successful conservation initiatives, the Aleutian goose has made a remarkable recovery from the endangered species list with a current population estimated at more than 60,000 individuals. In recent years, the Aleutian geese have incorporated surrounding pastures of Humboldt Bay as a major spring staging site prior to their long-distance migration to their Aleutian Island breeding grounds. The geese are dependant on nutrient-rich pasture grasses to build endogenous reserves that are critical to breeding success. However, local ranchers are dependant on these same pasture grasses for cattle milk and weight production. We describe livestock management regimes of coastal grasslands that may influence Aleutian goose pasture use in the Arcata Bottoms spring staging site with an emphasis on cattle grazing facilitating Aleutian goose foraging patterns.

**DISTRIBUTION AND ABUNDANCE OF ENDANGERED MARINE TURTLES AT PALMYRA ATOLL, CENTRAL PACIFIC**

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Sea turtles at Palmyra Atoll live in a unique environment removed from pervasive anthropogenic influence, offering singular opportunities for research and conservation. Marine chelonians are endangered worldwide, and human activities play a major role in population declines. Research at Palmyra will enhance understanding of sea turtles where they are relatively unaffected by people, providing an essential baseline for understanding natural processes and human impacts on these animals. Our research objectives at Palmyra are to study the distribution and abundance of sea turtles with regard to ecological interactions, behavior, conservation, and health issues. Future work will additionally focus on connectivity and movements within a regional context. In field surveys, green turtles (*Chelonia mydas*) were the species most commonly recorded, although hawksbills (*Eretmochelys imbricata*) were also present. Sea turtles were often flanked by juvenile sharks. Marine chelonians were observed along the north and south fringing reefs, in the hole east of East Pass, in the Central Lagoon, and off deeper reef slopes. There was evidence of infrequent nesting efforts, indicating this is not a major rookery. The information on distribution and abundance, in concert with foraging behavior observations, was instructive in identifying factors to be considered in restoration efforts at Palmyra.

**EFFECTIVENESS OF PROTECTION STRATEGIES IN TANZANIA: ASSESSING A DECADE OF SURVEY DATA FOR LARGE HERBIVORES**

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Considerable controversy surrounds strictly protected areas that prohibit consumptive resource use. We compared the effectiveness of heavily protected National Parks and Game Reserves, partially protected Game Controlled Areas, and areas with little or no protection in conserving populations of large herbivores in Tanzania. Comparisons based on surveys conducted in the late 1980s / early 1990s and again in the late 1990s / early 2000s show three consistent patterns across the country. First, significant declines in the densities of surveyed grid cells between two snapshots in time overwhelmingly outnumbered significant increases in all protection categories. Second, higher percentages of species fared well (increased significantly or showed no significant change) in strictly protected National Parks than in areas with partial or no protection and in heavily protected Game Reserves relative to areas with no protection. Third, significantly more species fared poorly (densities in surveyed grid cells declined or were too low to detect a decline) than fared well in areas with partial or no protection. While our analyses show that heavy protection is generally more effective than partial or no protection, continued long term monitoring is needed in Tanzania to inform managers if many large herbivores are experiencing declining population trends even within heavily protected areas.

**POPULATION DYNAMICS, HABITAT USE, AND TROPHIC RELATIONS OF THE SOUTHEASTERN BEACH MOUSE IN A COMPLEX COASTAL SETTING**

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Among beach mice, the southeastern beach mouse (SEBM, *Peromyscus polionotus niveiventris*) occupies the greatest diversity of habitats. This derives from the fact Cape Canaveral, on the east-central coast of Florida, is unique in that dune and coastal scrub vegetation offers landward widths of up to 3 km. Elsewhere, suitable habitat is found less than 200 m landward of the coastline. Cape Canaveral is under federal management because of aerospace enterprises. These habitats have been subjected to lightning derived fires, various salinity stresses, and periodic hurricanes since the sea level stabilized about 5000 years ago. We studied the SEBM on six trapping grids distributed from coastal dunes to as much as 3 km inland at biweekly intervals for three years. Our data show the inland populations were less variable than coastal ones. Coastal dunes experienced a total loss of SEBM following hurricanes in 2004. Recovery of plant cover on the dunes took five months; recovery of SEBM lagged about 12 months. Stable isotope ratios demonstrated important differences between coastal and inland diets. Genetic structure as revealed by microsatellite markers indicated minor genetic isolation by distance. Fire management of the coastal scrub will be essential for this species.

**RELICT PLANT POPULATIONS: MAINTAINING SPECIES DIVERSITY IN SMALL, ISOLATED PATCHES**

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Southern Missouri supports eight known paleoendemic populations of *Anticlea elegans* ssp. *glaucus*. The contemporary range for *A. e. glaucus* is approximately 650 km north. The purpose of this study was to estimate genetic similarity among eleven widely distributed relict and core-range populations of *A. e. glaucus*, including five Missouri populations, using intersimple sequence repeat (ISSR) molecular markers. I also monitored demographic structure and stage class transitions in three Missouri relict populations across four years. Missouri populations were among the most highly differentiated, although they occur in close geographic proximity, and Missouri relict populations as a group represented a broad spectrum of surveyed total species diversity. For species with paleoendemic populations, even small, isolated populations may contain significant amounts of species total genetic diversity, possibly including portions of genetic variation left behind in Pleistocene refugia. The monitored Missouri relict populations showed similar demographic structure and no evidence of recruitment via sexual reproduction. Persistence of these populations is primarily via long term survival of and vegetative reproduction by individual genets. These paleoendemic populations exhibit characteristics of little-studied alternative long-term population persistence strategies involving low recruitment, long term survival of established plants and asexual reproduction.

**PARTNERS IN RESTORATION AND AGRICULTURE: AGREEMENTS TO REDUCE REGULATORY BURDENS ON FARMERS AND LANDOWNERS WHILE ACHIEVING RESTORATION GOALS**

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Neighboring landowner concerns about endangered species regulations often generate opposition to habitat restoration. EDAW is partnering with The Nature Conservancy and the Sacramento River Conservation Area Forum's Advisory Workgroup of farmers, landowners, and land managers to reduce adverse effects of regulations on neighboring stakeholders while attaining restoration goals. Our work along the Sacramento River, where riparian woodland is proposed for restoration amid an agricultural matrix, is applicable to any partnership between habitat restoration and neighboring land uses. This poster compares 7 types of agreements that enable both restoration and neighboring landowner goals to be met. These agreements include Good Neighbor Policies, Neighboring Landowner Agreements, Memoranda of Understanding, Safe Harbor Agreements, Habitat Conservation Plans, streamlined permitting, and self-mitigating restoration design principles which reduce the risk of transboundary wildlife conflicts. We compare these agreements with 9 criteria: formality of assurances for neighboring landowners, level of protection for wildlife, flexibility, simplicity, level of responsibility held by restoration proponents, level of responsibility held by neighboring landowners, timeline to completion, length of time the agreement is binding, and financial cost. We offer an approach that restoration entities and neighboring landowners may use to identify the best tools to meet their specific concerns.

**AVIAN USE OF A MANAGED POND: A CASE STUDY IN SOUTH SAN FRANCISCO BAY AND THE IMPLICATIONS FOR SALT POND RESTORATION**

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The San Francisco Bay area contains the most important salt pond complexes for waterbirds in the United States, supporting significant numbers of migratory waterfowl and shorebirds and large numbers of nesting shorebirds, terns, and gulls. The current plan to restore tidal action to most of the existing salt ponds in the Bay places an important emphasis on understanding how to manage the remaining ponds for waterbirds. We analyzed a decade of waterbird numbers at a managed pond to look at use by avian species. Shorebirds, gulls, and waterfowl used the managed pond for wintering and migratory stopover habitat with year, season, taxonomic grouping, and water level important factors in determining use. The pond had numerous management challenges that are directly relevant to the proposed managed wildlife ponds within the salt pond restoration plan. These included sediment deposition, an unreliable water intake system, and the inability to maintain high salinity levels. This pond did not provide habitat for special status species or high-salinity specialists, nor provide for ground nesting birds. Maintenance of this pond will require active management in perpetuity. These results stress the importance of adaptive management and long-term planning in the Bay restoration project.

**CHELONIAN RESEARCH, EDUCATION, AND CONSERVATION IN SOUTHWEST CAMBODIA**

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The distributions of many species are uncertain owing to a lack of records and because almost no records exist for wild tortoises or turtles. According to previous records, there are 11 native and two introduced species of freshwater turtles and tortoises in Cambodia. The 2004-surveyed project funded by the BP Conservation Programme resulted that there are seven species of turtles and tortoises and there should be all 11 species in this area according to shell discovery, and that chelonian species are extremely threatened (local consumption and trading for market demand). The goals of the 2005-2006 follow-up project funded by BPCP are to further find out the distribution, abundance, threats, and habitat occurrence and to raise awareness of local people and the public. The project has three phases: (1) education of university and local students, village committee, authorities, and government rangers, (2) research on the endangered *Indotestudo elongata*, *Pelochelys cantorii*, *Hieremys annandalii*, *Platysternon megacephalum*, and *Manouria impressa*, and (3) creating a national working group to collect all turtle and tortoise information through meetings between government, NGOs, and rangers and at the end we will make a chelonian distribution map for Cambodia. Until now we found 137 shells and 47 live individuals of eight species, of which seven are globally threatened, and one that has never been recorded in Cambodia. The species include *Hieremys annandalii*, *Indotestudo elongata*, *Manouria impressa*, *Heosemys grandis*, *Siebenrockiella crassicollis*, *Cuora amboinensis*, *Amyda cartilaginea*, and *Cyclemys atripons*. Also, we successfully did two ranger training courses on turtle identification to rangers and a training course to university students.

**MICROSATELLITE VARIATION IN TWO SICHUAN JAY (*PERISOREUS INTERNIGRANS*) POPULATIONS IN WEST CHINA**

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The Sichuan Jay is one of the least known endemic bird species inhabiting the high mountain conifer forest in western China; it is listed as a Vulnerable species in IUCN's red list and has a small, declining, severely fragmented population as a result of extensive deforestation throughout its range. In this study, genetic variation in two Sichuan Jay (*Perisoreus internigrans*) populations at Zhuoni, Gansu, and Jiuzhaigou, Sichuan, were assessed using six microsatellite markers. The Zhuoni population showed a low heterozygosity, and was deviated from Hardy-Weinberg equilibrium corresponding a higher observed heterozygosity than expected, while the Jiuzhaigou population was in a Hardy-Weinberg equilibrium, although it also had a slight excess of observed heterozygotes. The bottleneck test found significant heterozygosity excesses ( $HE > Heq$ ) in both populations, which indicated both populations have suffered recent declines in population size. Considering its low heterozygosity and negative FIS, we suggest that Zhuoni population might have become fragmented and endangered, probably due to high habitat loss. The Jiuzhaigou population did not show any obvious signs of alleles lost.

**THE IMPACT OF LONGLEAF PINE STRAW RAKING ON NATIVE REPTILE AND AMPHIBIAN POPULATIONS IN THE SANDHILLS OF NORTH CAROLINA, USA**

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Efforts to promote restoration of critically endangered longleaf pine ecosystems on private lands in the southeastern USA continue to be financially hampered by the slow growth rate of longleaf compared to other pine species. Recently, however, the commercial harvest of longleaf pine needles ("pine straw") for use as landscaping mulch has rapidly increased in the region, yielding high profits for landowners but potentially severe impacts on native organisms. I conducted a two-year study of the response of reptile and amphibian populations to ongoing pine straw raking at 16 trapping sites (4 raked and 12 unraked) within a contiguous landscape of public lands in the Sandhills area of south-central North Carolina. A total of 1346 individuals of 27 species were caught during the study. Significantly more hognose snakes, spadefoot toads, and green anoles were captured on the unraked sites as compared with the raked sites, and on average more than twice as many total animals of all species were caught per site in the unraked areas (98.2 vs. 42.0). It appears that while some common species can tolerate the disturbance caused by pine straw raking, the practice as generally performed results in a pronounced decline in native reptile and amphibian populations.

**TEMPORAL ACTIVITY PATTERNS OF THE SANTA CRUZ ISLAND FOX: A NEWFOUND ANTI-PREDATOR DEFENSE FOR AN ENDANGERED SPECIES?**

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Research was conducted to inform conservation management of the critically endangered Santa Cruz Island (SCI) fox (*Urocyon littoralis*) by examining the possibility that strong predation pressure has altered fox circadian activity patterns. The SCI fox is a unique, endemic subspecies, whose population dramatically declined from over 1300 individuals to under 100 individuals over the past 14 years, due to novel, diurnal predation by recently invasive golden eagles *Aquila chrysaetos*. A mixed model ANOVA was used to compare levels of diurnal and nocturnal activity between 2004–2005 and 1992 fox activity data. Results showed that foxes exhibited significantly ( $p.0001$ ) lower levels of diurnal behavior in 2004–2005 (38.5) than in 1992 (61.7) and significantly higher levels of nocturnal behavior in 2004–2005 (87.7) than in 1992 (76.7), although the degree of significance was less pronounced for nocturnal behavior ( $p.0447$ ). These results indicated a definite, population-wide shift in the activity behavior of the SCI fox since 1992. Further study will examine whether this is more likely a long-term effect of natural behavioral selection by the novel, diurnal golden eagle or a temporary effect of reduced fox density. This distinction is crucial for accurate assessment of both the current predation threat to SCI foxes and the ongoing predation threat to SCI foxes as population density increases.

**INCIDENTAL CAPTURE OF SEABIRDS IN COASTAL TRAWL FISHERIES**

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The incidental capture of seabirds is well documented for longline and offshore bottom trawl fisheries but the information about interaction of seabirds with coastal fisheries is scarce or remains unknown. The mortality of seabirds in bottom trawl nets generally fits into two categories: impact with cables and nets entanglements. Trawl fleets are widely distributed along the coastal waters off Argentina, but 80 of the coastal vessels (> 275) fish on the north grounds (Buenos Aires Province, BAP). An onboard observers program was established for studying the incidental capture of seabirds in Puerto Quequen, BAP. We recorded 166 hauls in 55 fishing days from July 2003 to November 2005. We recorded the incidental capture of two species, Great Shearwater (*Puffinus gravis*,  $n = 18$ ) and Magellanic Penguin (*Spheniscus magellanicus*,  $n = 2$ ) in seven hauls. Additionally, preliminary observations show at least that two species were impacted with cables: Great Shearwater and Black Browed Albatross (*Thalassarche melanophris*). Considering 14,400 hauls per year, an estimated 1562 Great Shearwater and 174 Magellanic Penguin may be trapped annually by this fishery only for nets entanglements.

**STUDY OF STATUS, DISTRIBUTION, AND ECOLOGY OF BENGAL FLORICAN (*HOUBAROPSIS BENGALENSIS*) IN THE GRASSLANDS OF ROYAL CHITWAN NATIONAL PARK, NEPAL**

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Survey of an endangered bird, the Bengal Florican, were done in the grasslands of Royal Chitwan National Park (RCNP) to know the status, distribution, and ecology. The research period was of six months and different field visits were organized in the months of March, April, and May. Mapping was done with the help of GPS and Arc View. Seven grasslands were surveyed in the RCNP and only two Phantas (Sukivar and Buddhanagar) holds the Bengal Florican and the encounter rate was found to be 0.06 / hr and 0.07 / hr respectively. A total of 103 man hrs was spent in the grasslands of RCNP, which results five separate sightings BF. Thus, the density of the Florican in the surveyed grasslands (2.35 km<sup>2</sup>) is found to be 0.85 male / km<sup>2</sup>. The total population is estimated to be 3–8. If we assume the equal sex ratio, the estimated population in the RCNP should not be more than 16 Florican. Quadrat method was used in which the plot size of (1x1) m was laid. Area species curve was used to determine the minimum plot required for survey. 2099 individuals of 41 different species were recorded in the entire patch of Phanta of Sukivar, which corresponds to 17 different families. Grass Family were dominant and the IVI value was maximum for *Imperata cylindrica*, which is 43.5. There is decreasing in the trends of the population since 1982 was noted. The main cause in its decline is the natural succession and the disturbance by the human activities in the park. The result acquired during this research is consider to facilitate the ongoing management activities inside the park and recommendation provided will ensure the survival of this endangered species in RCNP.

**MORTALITY OF FIRST BORN MAMMALS: IMPLICATIONS FOR DEMOGRAPHIC ANALYSES OF WILD POPULATIONS**

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Conservation actions often depend on generalizations from theory and / or hypotheses with ambiguous empirical support (e.g., sex allocation theory, small population paradigm). Tests of biological generalities—for example within and / or among taxa—are important for improved confidence in the analyses and management of wild populations. We tested an oft cited family of hypotheses about mortality of first born mammalian offspring: that mortality is greatest for “first born” mammals, that increased mortality is due to lack of behavioral maturity and / or physiological immaturity, and that first born males have higher mortalities than females. Our results have implications for the design and evaluation of population viability models, captive breeding programs, demographic projection models, and reintroduction success. We analyzed data for 51 populations (species) of zoo primates (8200 total births) and found few significant differences in mortalities for birth order, gender, or whether an individual was hand- or mother raised. Heterogeneity tests revealed differences for one or more variables in few species, which suggests that birth order or sex related differences in infant mortality are the exception, rather than a rule, for primate demography. These results demonstrate the need for caution when using species surrogates in the development of species management plans.

**THE HEART OF BORNEO: THREE COUNTRIES, ONE TRANSBOUNDARY CONSERVATION VISION**

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The transboundary forests of the island of Borneo are possibly the last opportunity for large-scale conservation in Southeast Asia. The world’s third largest island possesses staggeringly high levels of endemism across all groups of plants and animals. This is one of only two places on earth where orangutans, elephants and rhinos still co-exist and where forests are currently large enough to maintain viable populations. Ensuring the connectivity of the upland forests is crucial to the very survival of its many rare and endemic species, the cultural survival of its indigenous people and the locally and regionally important ecosystem services provided by the forests. WWF has developed the Heart of Borneo program to conserve 22 million hectares in the Heart of Borneo through a network of protected areas and sustainably-managed resource areas. This depends on international cooperation led by the Bornean governments and supported by a global effort to eliminate large-scale threats from forest, agriculture, and mining sectors. We discuss the adaptation of multi-party transboundary conservation models from other regions and highlight the potential benefits for large-scale conservation of the Heart of Borneo.

**ASSESSMENT OF GENETIC DIVERSITY IN POPULATIONS OF *SANGUINARIA CANADENSIS* USING AFLP ANALYSIS**

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*Sanguinaria canadensis* (bloodroot) is a perennial, medicinal, woodland species native to the Appalachian Mountain region in eastern North America. Due to the asexual propagation and concentration of the alkaloids of interest in underground rhizomes, populations are sensitive to environmental stresses and destructive collection practices. To determine the practicality of ex situ conservation methods, the genetic diversity must be characterized. We examined the genetic structure of 72 populations of bloodroot representing geographic regions of western and central North Carolina. Amplified Fragment Length Polymorphism (AFLP) fingerprints were used to assess genetic diversity, develop phylogenetic representations of the population genetic structure, and develop a conservation requirement strategy.

**PARTICIPATORY ACTION RESEARCH: A STRATEGY FOR GENETIC CONSERVATION IN MT. KITANGLAD NATURAL PARK**

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One of the challenges that biodiversity conservation is facing today is to come up with a field-based approach / strategy that would maximize people participation. There are initiatives but only a few venture into participatory action research as a strategy for biodiversity conservation. This research presents the process and results from using PAR as a strategy to promote social learning and collective action for the conservation of genetic resources in MKNRP. This approach constitute the community’s cyclical and iterative reflection / planning, implementation, and monitoring of outcomes. The community adapts strategies according to the needs, learning from the past and failure of actions until issues and problems of conservation are successfully addressed. The research observed that using this facilitative process, the community gained knowledge with the importance of particular species and their uses as well as the processing techniques. This shared learning encourages the community to increase diversity of these species in their backyards and gardens thus reducing impact inside the park. Although it’s too early to say, we expect that this effort will have a positive impact on the community in terms of giving the community access to the resources in the park without sacrificing the government’s effort in the protection of its resources.

**IMPLICATIONS OF VARIABILITY IN THE LOGGERHEAD SEA TURTLE NEST ENVIRONMENT TO HATCHLING QUALITY, MORTALITY, AND PRODUCTION ESTIMATES**

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We studied patterns of mortalities in posthatchling loggerhead sea turtles from 103 natural nests deposited on beaches in Florida. Turtles were collected during the first major emergence and were brought to the lab alive and in robust condition for rearing in a separate study. Sporadic mortalities were recorded and investigated. Although turtles were housed in different tanks and at two different facilities we found that the mortalities tended to be concentrated in some clutches and not others. Mortality was higher from nests that were excessively wet from either tidal inundation or prolonged rainfall. We found that the hatchlings incubated in wet conditions were more likely to die within a few weeks than their counterparts who incubated in drier conditions. This is important because not every hatchling that makes it to the water has an equal survival probability.

Hatchlings from the affected nests experienced mortality 4 times greater than the turtles collected from drier nests (40% vs 9%). Therefore, emergence success may not be a true indicator of hatchling survivability. Hatchling production estimates must be modified to take into consideration incubation conditions. At sites that are managed to maximize production, nest conditions should be monitored to minimize inundation risk. These results suggest that it may be desirable to relocate nests in danger of inundation to maximize both hatchling production and quality at rookery sites suffering from a decline in nesting.

**EDGE EFFECTS AND FRAGMENTATION: CONSERVING BAT BIODIVERSITY**

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Habitat fragmentation constitutes one of the main ecological problems worldwide, follow-on the quick loss and extinction of biodiversity. Bats, as other groups, are sensitive to habitat perturbations; little is known about consequences of edge effects on bats and its applicability to conservation. Our objective was to investigate edge effect on bat abundance and diversity in tropical subdeciduous forest, Veracruz, Mexico. During one year we captured 144 bats (12 species): inside forest fragments 25 bats (9 spp.), in the edge 102 (7 spp.), and in the matrix 17 (5 spp.), at three different fragments. Shannon–Wiener ( $H'$ ) indexes were significant between interior ( $H' = 0.7877$ ) and edges ( $H' = 0.2868$ ), also between exterior ( $H' = 0.6898$ ) and edges. Two bat species, *Sturnira lillium* and *Carollia perspicillata*, benefited with abundant food supply provided by *Piper auritum* and *Cecropia obtusifolia*; other bats used edges as corridors. Edges' importance for bats and their habitat are provide a wide quantity of food for some frugivorous bats, function as a source of pioneer plants-bat dispersed, contributing to tropical forest regeneration, are used by bats like connection among fragments, diminishing isolation among populations. Although edges are perturbed areas, they conserve most bat richness, so, edges should be considered as an essential element in developing actions directed toward diversity conservation, not only for bats, but also for all biodiversity.

**THE NSF GK-12 TEACHING FELLOWSHIP: SIXTH GRADERS EXAMINING THE EFFECTS OF CONTROLLED BURNS IN SUNKHAZE NATIONAL WILDLIFE REFUGE**

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The NSF GK-12 teaching fellowship is designed to bring exemplary undergraduate and graduate students majoring in science and engineering into local elementary, middle, and high school classrooms. The intention of the program is to provide a spark of interest in science by doing hands-on activities designed to engage the students and conduct real scientific research. Working with the 6th grade at Lewis Libby School and Sunkhaze National Wildlife Refuge the students developed a project examining the effects of prescribed burns on the abundance and species richness of small mammals in the refuge. Posing the students with this question, I guided them through the steps of the scientific method in which they formed hypotheses and designed the methods needed to answer that question. With the help of several volunteers the students were able to go out in the field and live trap small mammals. Thus far with a low sampling effort we have been unable to detect a difference between the burned and unburned areas. The project will continue with more trapping sessions and lessons on data analysis, and will culminate with a student presentation to the refuge manager on our findings.

**REDISCOVERING THE GUANACOS OF THE PARAGUAYAN CHACO**

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The guanaco (*Lama guanicoe*) is one of the least known species of the Chaco ecosystem in Paraguay. The isolated Paraguayan population marks the northeastern limit of guanaco distribution, and is classified as critically endangered. Largely unknown in Paraguay, the guanaco could be a flagship species for the Chaco, as it forms an important prey for large carnivores (*Panthera onca* and *Felis concolor*). Work carried out since 2002 in the northern Medanos del Chaco National Park (485,888 ha) and surrounding area has focused on evaluating the impact of hunting by indigenous communities. Two communities, together comprising over 150 families, were recently translocated to an area close to the park boundary. Hunters from the communities are known to take guanacos. The impact on guanaco population biology was evaluated, using camera traps to estimate population and range. The value of hunting for local livelihoods was also assessed, and a framework developed for collaboration between conservation interests and the community to promote sustainable use practices.

**IDENTIFYING THE CONTRIBUTION OF DIRECTIONAL HYBRIDIZATION BETWEEN TWO TOAD SPECIES (GENUS: BUFO) TO THE DECLINE OF A PARENTAL SPECIES**

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Habitat disturbance leading to the breakdown of ecological barriers has resulted in hybridization between numerous sympatric species and the decline or extinction of the parental species. Despite strong postzygotic selection against it, hybridization occurs between two normally ecologically isolated toad species, *Bufo nebulifer* and *B. fowleri*, as a result of human disturbance. This hybridization is potentially resulting in a decline of the rarer species, *B. fowleri*. Hybrids are morphologically cryptic; therefore, molecular methods were used to identify them. Single nucleotide polymorphisms (SNPs) are a recent technique utilized to identify hybrids that cannot be conclusively identified by morphological characteristics alone. Twelve species-specific SNPs from a 660 base pair fragment in a nuclear intron of the Rhodopsin gene were used to identify each species, and hybrids were identified based on heterozygosity at these sites. Ninety-two individuals from eight mixed breeding populations were directly sequenced and three male hybrids were identified. Although hybrids represent a low segment of the sample population, directional hybridization of male *B. nebulifer* with female *B. fowleri* may be a historical factor in the decline of *B. fowleri*. Furthermore, infertile male hybrids are thought to preferentially mate with *B. fowleri* females, potentially causing a devastating loss of reproductive effort in females of that species.

**RAPID BIOLOGICAL AND SOCIAL INVENTORIES: PROTECTING PRIORITY AREAS IN ANDEAN AND AMAZONIAN PERU**

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A critical first step in conserving biodiversity is broad-scale conservation planning. We use rapid biological and social inventories for the next step: translating conservation planning into conservation action. In 1996 the Peruvian government approved a countrywide conservation plan, identifying 38 priority areas for conserving the full spectrum of biodiversity in Peru. Eleven areas were already covered within the Peruvian park system (SINANPE); the remaining 27 were not sufficiently protected or totally unprotected. In close collaboration with our Peruvian partners, during 2000–2005 The Field Museum conducted rapid inventories of six of these priority areas and preliminary overflights in an additional one (total 5.7 million ha). We evaluated the biological singularity of each area, and surveyed the organizational strengths and conservation vision of nearby local communities to identify ways to engage local residents in long-term conservation. Based on our integrated recommendations, three areas are now strictly protected (Cordillera Azul, Megantoni, Gueppi), and four are on the road to becoming protected (Ampiyacu, Yavari, Matses, Sierra del Divisor). Together these seven areas represent 4.4% of the land area and an almost complete complement of terra firme and foothill habitats in Peru.

**IDENTIFICATION OF PRIORITY AREAS IN VIETNAM FOR BAT CONSERVATION**

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Bats play an essential role in most ecosystems and currently represent approximately half of mammalian diversity of Vietnam. However, bat studies in the country are especially limited. Among a total of 126 protected areas in Vietnam, comprising 4 biosphere reserves, 28 national parks, 44 nature reserves, 11 species / habitat reserves, and 39 landscape reserves, only 10% have been surveyed on bats. Yet over 100 species have been recorded and numbers of new taxa to the country, and, in some cases, new to science have rapidly increased with the latest surveys. Unfortunately, the bat fauna of Vietnam is currently threatened critically by a variety of such factors as hunting, over-exploiting of natural resources, or eco-tourism development. These factors may also disturb not-yet-surveyed habitats of bats. It is noteworthy that several species or subspecies endemic to Vietnam have not been re-documented for several decades. Based on the results from previous bat studies, together with on habitat status of each indicated area, the protected areas are systematically ranked according to the priorities for bat conservation.

**PHYSIOLOGICAL MEASURE VALIDATIONS FOR THE SOUTHERN RESIDENT KILLER WHALE**

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The southern resident killer whale (*Orcinus orca*) population in the Pacific Northwest was recently listed as endangered under the federal ESA. Possible threats facing this population include poor nutrition, disturbance, contaminant burdens, and immunosuppression. A critical component of successful mitigation will be the ability to differentiate the relative contribution of these stressors to population decline. We are developing a panel of non-invasive physiological measures in feces to determine which one(s) are having negative effects on the orcas. This panel measures thyroid hormone as an index of nutritional stress, cortisol and reproductive hormone metabolites as indices of disturbance stress and associated reproductive functioning, and several immunoglobulins as measures of immune functioning. Each measure must undergo a series of validations to test for the presence of the hormone or immunoglobulin in feces and the accuracy of the measurement. Thus far, we have successfully validated cortisol and thyroid hormone (T3) in killer whale scat using parallelism tests. These results show that these hormones are present in killer whale feces and can be measured. When applied to wild orcas, these measurements will allow us to physiologically monitor nutritional and disturbance stress as guiding tools for the southern resident management plan.

**RESOURCE USE RELATIONSHIP OF SYMPATRIC LARGE HERBIVORES IN THE WASGOMUWA NATIONAL PARK, SRI LANKA**

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Food habits and habitat use of the sympatric herbivores, axis deer, Asian buffalo, and Asian elephant in Wasgomuwa National Park, Sri Lanka were studied in the rainy and the dry seasons. Due to their invasion into the park, food habits of domestic cattle were also studied. Though each species had different habitat preferences, all of them preferred grasslands and forest-grassland ecotones to forest habitats. These animals showed particular food preferences. In spite of these preferences, their staple foods were commonly grasses. Cattle food included more than 92% of grasses in both seasons. Therefore, they reduce the grass resource for wild herbivorous mammals in the park significantly. Grazing pressure in the study area seemed to be high enough to suppress plant growth. Estimated biomass of the grassland in the dry season decreased to less than one-fourth of that in the rainy season. The high overlap in both habitats and foods for these herbivores in the dry season and, further, the overgrazing of commonly shared grass species suggest the possibility of competition among the animals in the dry season. In spite of differences between these herbivores, resource partition seems to be difficult in the confined area or limited size park.

**WHAT'S A CENTURY TO A SNAIL? AN OLD INVADER FINALLY ARRIVES IN SAN FRANCISCO BAY**

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In July 2005 we discovered the first known population of *Batillaria attramentaria*, an invasive mud snail native to Japan, in San Francisco Bay (SFB). Surveys suggest that this invasion is relatively new (i.e., less than 5 years old), offering a unique

opportunity to investigate invasion impacts over time. The invasion lends support to the theory that diversity does not limit invasion success, as SFB is one of the most heavily-invaded, and in that regard species-rich, estuaries in the world. While it is known that *B. attramentaria* affects invertebrate community composition, it is not clear what impact the invasion will have on ecosystem function and on other species in SFB. Specifically, this study involves a basic description of the invasion (genetics, parasites, population demographics) as well as an analysis of short term removal impacts on chlorophyll levels (as a proxy for primary production), and community composition. If *B. attramentaria* expands its range in SFB, it could have Bay-wide impacts on the mudflat communities, including invasion facilitation and changes in benthic diatom abundance. The results from the removal experiments can inform eradication decisions, contribute to our knowledge of estuarine health, and influence oyster aquaculture siting decisions, as non-native oysters (genus *Crassostrea*) are the mostly likely vector for this species on the west Coast of North America.

**DO NEST PREDATORS INFLUENCE HABITAT SELECTION AND NEST PRODUCTIVITY OF FOREST SONGBIRDS IN AN URBANIZING ENVIRONMENT?**

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Populations of many nest predators have increased in association with urbanization, which triggers conservation concern for songbirds breeding in remnant forest patches. From 2002 to 2004, we explored the relationship between diurnal nest predators (corvids and sciurids) and native songbirds in an urbanizing environment of the Puget Sound. Five of the ten songbird species we studied were negatively associated with combined predator abundance at the "landscape" scale (a 1-km<sup>2</sup> area surrounding forest patches), while two species were positively associated with predators. At a smaller scale (within the forest patches), six of the ten species appeared to avoid areas of more frequent predator activity, either by Stellar's Jays, American Crows, or all predators combined. All species bred in habitat used by nest predators, with relatively high success: 49.4% of all nests found (N = 411), and 49.0% of all territories monitored (N = 2125) fledged at least one young. However, estimates of "predator load" (the probability of detecting predators at a particular location) for American Crows were higher at failed nests than at successful nests. Similarly, Stellar's Jays were more likely to be detected around failed territories than around successful territories. Such consequences to reproductive success may reinforce the avoidance behavior that we documented at patch and landscape scales.

**THE HABITAT DELINEATION AND RESTORATION OF SACRAMENTO PERCH USING CONSERVATION PHYSIOLOGY**

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The translocation success rates for fish are less than 40% with habitat quality at the translocated site and number of individuals released cited as the main factors influencing the success rates. Even though the success rates are relatively low, this technique is employed in greater than 80% of fish recovery plans. Subtle changes in water quality, particularly those characteristics overlooked, can disrupt the physiological homeostasis in fishes producing a coordinated set of physiological and behavioral responses that can have long-term effects on individuals and their offspring. The determination of the physiological optima and sub-optima is useful for the habitat delineation and conservation of Sacramento perch (*Archoplites interruptus*), a threatened California sunfish. We investigated the physiological tolerances at three life stages (larval, juvenile and adult) to critical maxima and minima temperatures, dissolved oxygen minima, pH maxima, and salinity maxima at acclimated four temperatures; as well as measured the oxygen consumption rates of these fish exposed to varying temperature regimes. The determination of the physiological optima and sub-optima is useful for the habitat delineation and restoration of Sacramento perch to its critical habitat; in addition this information can focus restoration efforts on sites that are not exploited by non-native species.

**ANALYSIS OF THE NATIONAL INVENTORY OF MMAS: REGIONAL PERSPECTIVES**

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As part of an ongoing effort to design a national system of marine protected areas (MPAs), NOAA's MPA Center is conducting an assessment of an inventory of marine managed areas (MMAs). This unique and comprehensive database of United States place-based management represents a major collaborative effort by federal, state and territory managers. Analysis of the database produces national and regional pictures of the collection of MMAs (n = 1989), including summaries of existing protections and regulations, purpose, scale and duration of protection, types of allowable use, and level of governance. The descriptive results reveal important similarities and differences in the way MMAs are used among regions and in the ways they affect specific fishing activities. For example, preliminary analysis reveals the eight United States regions sharing similar percentages of MMAs managed by the federal government (approximately 20-30%), except for 6% in the Great Lakes. Florida state contributes the most MMAs to the Gulf of Mexico and South Atlantic (62% and 47% respectively), while California contributes the most MMAs to the Pacific Coast (55%). Finally, the Caribbean has 20 times more MMAs that restrict all fishing compared to the Mid-Atlantic with one MMA prohibiting fishing.

**NEGATIVE IMPACT OF INVASIVE MONGOOSE ON AMAMI RABBIT AND ITS CONSERVATION**

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For monitoring of impacts of invasive mongoose, we investigated the animal fauna by censor camera and the change of distribution by fecal pellet counts census of Amami rabbit (*Pentalagus furnessi*), which is one of the most flagship species on Amami Island in Japan. The island (712 km<sup>2</sup>) is originally lacked predatory mammals and located in the subtropical zone in southern Japan. The frequency of photographs of mongoose in the northern area was high (10%), but low (1-2%) in the southern area where rabbit density is high. In addition, our investigation also found that a mongoose entered into the breeding nest of a rabbit in daytime in the low mongoose density in the south. Furthermore, the rabbit population was found to be

rapidly decreasing and disappeared in less than eight years in relatively high-density mongoose area, especially in the north. These results indicate that if a small population of mongooses remains in rabbit habitat, the rabbit will become extinct due to predation by mongooses not only on adult rabbits but also on juveniles inside the breeding nest. Therefore, it is necessary to eradicate mongooses in the habitat of the rabbit and to prevent of their invasion into other rabbit habitat.

### **SCALLING UP FOR THE CONSERVATION OF THE GIANT PANDA: FROM PINGWU ICDP TO MINSHAN LANDSCAPE**

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For the conservation of the Giant Panda threatened by logging and poaching, Pingwu Integrated Conservation and Development Project was officially launched supported by WWF in 1997. The project focused on the effective management of Wanglang reserve and community-based conservation in Baima community. After five years implementation, the evaluation results stated that poaching in the reserve coming from other communities was still a big challenge, and tourism and habitat fragmentation became the main threats to the survival of the Giant Panda. The traditional individual protected area focused conservation strategy could not ensure the long-term survival of the Giant Panda and the effective management of the protected area itself. The conservation focus should move to the whole landscape conservation and ecological management. The priority action for the panda reserve management should be the networking among different protected areas including the Natural Forest Protection Areas both in function and structure.

### **GEOGRAPHIC INFORMATION SYSTEM ASSESSMENT OF FISHERY, TOURISM, AND MARINE PROTECTED AREA DYNAMICS ON THE BORDER OF BELIZE AND MEXICO**

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The Mesoamerican Barrier Reef System (MBRS) Program has established a network of marine protected areas (MPAs) in the western Caribbean to conserve marine habitats and to promote transboundary conservation. Fieldwork for comparative case-studies occurred at two transboundary MBRS MPAs, the Bacalar Chico Marine Reserve in Belize and the Xcalak Reef National Marine Park in Quintana Roo, Mexico. Interviews with stakeholders in the region identified their use of marine habitats by drawing maps of their coastal use patterns. Interview data for each case-study was recorded for two time periods: "before" and "after" MPA designation. These "map biographies" of the stakeholders' coastal use patterns were subsequently integrated into a geographic information system. Fieldwork in Belize suggested that the spatial extent of the range of commercial fishers has decreased while the range of touristic activities and MPA management activities has increased. Fieldwork in Quintana Roo suggested that the spatial range of commercial fishers has remained the same while the range of touristic activities and MPA management activities has increased. The difference in coastal use patterns between Belize and Mexico suggests that different intervention strategies are necessary in order to involve stakeholders in the conservation programs of each MPA.

### **COMPARING A SPATIALLY AND A NON-SPATIALLY EXPLICIT POPULATION VIABILITY ANALYSIS MODEL IN THE CONTEXT OF A GOLDEN-HEADED LION TAMARIN METAPOPULATION**

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Population viability analysis (PVA) has become a powerful tool in the management of populations of endangered species. To date few generic PVA platforms directly incorporate landscape features in simulations of demographic processes that affect small populations. Because threats facing endangered species are often mediated through habitat availability and configuration, the predictive power of PVA models may be limited without the inclusion of landscape features. One of the few generic spatially explicit PVA tools available is PATCH (Program to Assist in Tracking Critical Habitat). The objective of this study is to compare simulations run in PATCH to those generated in the widely used non-spatially explicit PVA program VORTEX. We modeled a metapopulation of golden-headed lion tamarins (*Leontopithecus chrysomelas*) ranging on 30 forest fragments in southwest Bahia, Brazil using both programs. Based on the results of our scenarios, we outline the strengths of each PVA tool in modeling a meta-population system. We determined that many demographic and landscape parameters can be incorporated into the programs, although often indirectly, depending on the program. We recommend that modelers use VORTEX when simulating populations affected by threats predominantly mediated through demographic processes, whereas PATCH is extremely useful for modeling territorial animals moving on dynamic and complex landscapes.

### **CHRONOLOGICAL AND SPATIAL ANALYSIS OF WESTERN JUNIPER (*JUNIPERUS OCCIDENTALIS* VAR. *OCCIDENTALIS*) IN CENTRAL OREGON**

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Western juniper (*Juniperus occidentalis* var. *occidentalis*) occupied 3 million ha in the western United States. Close to 95% of this juniper is post European settlement and is blamed for ecosystem degradation. Western juniper eradication by mechanical means and controlled burning has become widespread throughout portions of the northern Great Basin in efforts to restore sagebrushdominated systems. The goal of this study was to identify areas in central Oregon where western juniper seedling reestablishment following the removal of mature trees may be rapid and concentrated. We examined 35 areas treated by fire and mechanical removal that varied widely in slope, aspect, elevation, plant community, and understory diversity. Seedling densities within 900 m<sup>2</sup> plots in each site were determined and samples were from all junipers within plots for tree-ring dating. Field collected data in conjunction with remotely sensed data were used to build a model predicting regenerated seedling densities in treated, unsampled areas. Dendrochronological analysis indicates that the interval between removal of mature trees and seedling regeneration ranges from 1 to 18 years and that nearly 60 of the trees sampled established following treatment. The results from this study will be used to inform land managers, and to indicate areas for continued restoration efforts.