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2001: A SPATIAL ODYSSEY SEARCHING FOR A NATURAL BALANCE

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PROGRAM ABSTRACTS

CONFERENCE HOSTS

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Paper and Poster Abstracts (first author alphabetical order)

ARAYA, SARA E. Amistad Caribe Conservation Area, Ministry of Environment and Energy, Limon, Costa Rica, arayad@ns.minae.go.cr. **The alliance between Amistad Caribe Conservation Area and The National Institute of Biodiversity: A model for saving, knowing and using biodiversity.**

In the last years Costa Rica has made enormous efforts for managing and protecting biodiversity. One model applied since 1998 for achieving this goal was a particular alliance between the government and an NGO whose interest relays on saving, knowing and using biodiversity. The government and The National Institute of Biodiversity found a way of working together in the National Biodiversity Inventory. In the Caribbean Region it takes place along four Protected Areas including National Parks, Biological Reserves and Wild Life Refuges. Samples of six taxonomic groups such as marine and terrestrial mollusks, bees, butterflies, and others are being collected and analyzed. Important findings have been obtained from the inventory. In the Group of marine mollusks 472 species were inventoried. More than 200 species were new registers for the country, 43 species are new for science. It is estimated that the number of species of marine mollusks could be around 800, that is more than 10% of the fauna found along the Pacific and Atlantic coast of the continent. Besides the National Biodiversity Inventory, INBio has given important support for enforcing institutional capacity helping to develop infrastructure, equipment; staff, stakeholders and teachers training in biodiversity, among other activities.

BACCHUS, SYDNEY T.* Applied Environmental Services, Athens, GA, USA, appliedenvirserv@mindspring.com. **Groundwater impacts: The unseen destroyer of terrestrial and nearshore natural biodiversity.**

Significant reductions in numbers and species of reptiles, amphibians and other animals utilizing wetlands have been documented in areas associated with wellfields in the southeastern Coastal Plain (SCP). Adverse impacts are linked to depleted lower levels of the food chain and conversion/loss of habitat (e.g., destructive wildfires, alien species) – all representing loss of natural terrestrial biodiversity. Similar loss of nearshore biodiversity is linked to groundwater mining and aquifer-injection of wastes onshore, influencing submarine groundwater discharge. The primary water source in the SCP is the Floridan aquifer system, a regional karst aquifer system extending throughout Florida and parts of Georgia, South Carolina, and Alabama. Private and public (federal, state, regional, and local) “preservation” areas are experiencing significant adverse impacts due to groundwater mining in this region (e.g., Tosohatchee State Preserve, Myakka River State Park). Waste injection and aquifer “storage” and recovery (ASR) appear equally hazardous (e.g., Everglades National Park, Florida Keys National Marine Sanctuary, Indian River Lagoon). Unfortunately, people overseeing these natural resources have limited awareness of groundwater-related problems, and limited alternatives for detecting, monitoring, and predicting problem areas. Recently, a method was developed using a hydroecological indicator and NIR reflectance for detecting terrestrial areas with significant perturbations from groundwater mining. This methodology provides both a highly technical, and a rapid, simple approach for addressing the biodiversity conservation problem.

BACONE, JOHN.* Indiana Department of Natural Resources, Indianapolis, IN, USA, jbacione@dnr.state.in.us. **The Indiana Nature Preserves Act: a legal system of dedication.**

The 1967 Indiana General Assembly passed the "Nature Preserves Act," establishing the Division of Nature Preserves within the Department of Natural Resources (DNR), and establishing a

means for providing in perpetuity protection for areas dedicated as state nature preserves. Declaring "it is necessary and desirable that areas of unusual natural significance be set aside for the benefit of present and future generations," the Nature Preserves Act made it the public policy of the State of Indiana that these areas be set aside. When areas are "dedicated," the DNR acquires a perpetual conservation easement. Only in the event of "an imperative and unavoidable public necessity," and then only following a public hearing and concurrence by the DNR and the Governor, can an area be taken for another use. To date, 178 areas encompassing 24,000 acres have been dedicated as nature preserves.

BARBORAK, JAMES R. Conservationist Mesoamerican and Caribbean Program, The Wildlife Conservation Society, Gainesville, FL, USA, wcsfl@afn.org. **The Growing Role of Latin American Municipal Governments In Protected Area Management.**

In recent years most Latin America central governments have devolved considerable power to local governments. To analyze how this trend has affected the involvement of Latin American municipalities in protected area management and to highlight innovative examples, I conducted a literature search on the topic. I also asked Latin American members of the World Protected Area Commission and local informants to provide information on this subject. Municipal park and reserve management in Latin America is in its infancy, but there are a growing number of functioning municipal reserves. There is also a trend towards greater involvement of municipalities in aiding overburdened central government agencies in co-management of national protected areas. The growth of municipal involvement in protected area management has received inadequate international attention and support. Bolstering municipal park systems in Latin America can help protect many endemic species not found in national park systems and can provide educational, recreational, and watershed protection functions for local communities. Such parks can often serve as buffers around and corridors between national protected areas. Increased municipal co-management of nationally protected areas can ensure that local concerns are addressed in their management, and can mobilize local resources and support for threatened national parks and reserves.

BARKER, J.R.*¹, M. BOLLMAN², AND P.L. RINGOLD³. 1-Dynamac Corporation, Corvallis, OR, jbarker@dynamac.com; 2-Dynamac Corporation, Corvallis, OR; 3-US EPA, Corvallis, OR, USA. **Tree dominance in a riparian coniferous forest.**

Riparian forests are critical for maintaining water quality and providing terrestrial and aquatic habitat. To manage these systems, it is important to understand changes in tree composition with ecoregion, stream size and past forestry practices. A probability sample stratified by stream size and forest type selected 110 sites on public and private lands in western Oregon. Riparian tree data were collected from 40x40-m plots aligned along the stream channel. The up-slope distance was divided into 5-m zones. Relative basal area, density, and frequency were calculated for each tree species by plot zone. The values were then summed to define an importance value index. Study sites were grouped by ecoregion, stream order and management practice to evaluate the pattern of tree composition along the up-slope gradient. For example in the Coast Range ecoregion, Douglas fir and western red-alder were dominant regardless of stream order or management practice. Species such as western hemlock, western red cedar, and Sitka spruce were sub-dominant. The general pattern of species composition was that western red-alder dominated near the stream, while Douglas fir dominated up-slope. The importance of the sub-dominant species increased within the middle portion of the gradient. Tree composition differed with stream size and management practice.

BASEY, GARY L.* AND K. BADGER. Ball State University, Muncie, IN, USA, kbadger@bsu.edu. **Using GIS and remote imagery to monitor the effects of fire management on plant communities at Big Oaks National Wildlife Refuge.**

Big Oaks National Wildlife Refuge (BONWR) is a 22,000 ha refuge located on the former site of Jefferson Proving Ground in South-eastern Indiana. The use of fire as a management tool is essential in maintaining the biodiversity associated with the grassland habitats within BONWR. The aerial extent of grasslands at BONWR has been increased and maintained by the frequent use of fire as a management tool and wildfires associated with munitions testing from 1941 to 1994. The extensive grasslands support viable populations of many species of plants and animals, such as Henslow's sparrow (*Ammodramus henslowii*), that are declining elsewhere throughout their range. One of the challenges of assessing the effectiveness of the fire management program at Big Oaks National Wildlife Refuge is that a large portion of the grasslands are in areas where human foot traffic is forbidden due to the presence of unexploded ordinance. Assessing burn effectiveness in restricted areas necessarily depends on the use of remote imagery. Changes in vegetation from 1995 – 2001 were determined using aerial photographs and GIS software. All vegetation patches ≥ 1 ha identified in the refuge were classified based on percent cover of the dominant vegetation type using the National Vegetation Classification System (NVCS). Spatial statistics for each vegetation class and each individual patch were determined to evaluate changes in the landscape matrix over time. Field data collected during 2000 and 2001 was used to assess the accuracy of the vegetation data layers.

BAUER, GERALD P. US Forest Service International Institute of Tropical Forestry, Rio Piedras Puerto Rico & US Agency for International Development, Panama City, Panama, gbauer@sinfo.net. **Protected Area Management in the Panama Canal Watershed, Panama.**

In 1979 the Carter-Torrios Treaty was signed between the US and the Republic of Panama, which would culminate on December 31, 1999 with the reversion to Panama of all US properties and the Panama Canal. With this political change, not only did the country of Panama gain the responsibility for management of the canal, but it also assumed a new responsibility for land management in the entire Panama Canal Watershed. This includes the responsibility for establishment and management of protected areas within this watershed. To date five National Parks have been established within the watershed and several national parks and other natural areas are becoming established in the watershed buffer area. These parks are being managed by the Government of Panama as well as by non-governmental and community organizations in special arrangements with the Panamanian Government and are models for protected area management in other parts of the republic. The US Forest Service's International Institute of Tropical Forestry is providing technical expertise to the Panamanian organizations to assist them with the improved management of these parks.

BECKAGE, BRIAN* AND W. J. PLATT. Louisiana State University, Baton Rouge, LA, USA, bb2@duke.edu. **The link between global climate and fire regime in Everglades National Park.**

Global temperatures have been rising at the rate of 0.2C/decade for the last three decades with a 2xCO₂ world expected to be 2.8 to 5.2 degrees C warmer than today. Rising temperatures are expected to impact ecological communities through a general species migration towards the poles or to higher elevations. However, global warming may also exert strong indirect effects on ecological communities through increased frequency and severity of El Nino-Southern Oscillation (ENSO) events. We examined the frequency and severity of fires in Everglades National Park from February 1948 to December 1999 to determine if fire regimes were associated

with the ENSO cycle. We demonstrate that fire regimes in Everglades National Park (ENP) are closely linked to ENSO events. La Nina events result in conditions that facilitate fire at the dry to wet season transition when drought is most severe. Fire regime largely controls community structure and distribution in the Everglades; the relationship between global warming, ENSO, and fire regime is an indirect path whereby increasing temperature will effect ecological communities. More frequent ENSO events associated with global warming will likely result in increased large-scale fires, with concomitant effects on community structure and distribution.

BECKER, CARL^{1*}, DUANE DEFREESE^{2*}, BOB DJUPSTROM^{3*}, CLAY HENDERSON^{4*}, and DEAN SAUNDERS^{5*}. 1-Illinois Department of Natural Resources, Springfield, IL, cbecker@dnrmail.state.il.us; 2-Hubbs-Sea World Research Institute, Orlando, FL, defreese@iu.net; 3-Minnesota Scientific and Natural Areas, St. Paul, MN, bob.djupstrom@dnr.state.mn.us; 4-H&K Conservation Solutions, Orlando, FL, chenderson@hkconsulting.com; 5-Saunders Real Estate, Lakeland, FL, dean@saundersrealestate.com. **Establishing a Natural Areas System in Florida: a panel discussion.**

The State of Florida has long led the nation in acquiring land for conservation purposes, with over 1 million acres purchased as state parks, state forests, and wildlife management areas in the previous ten years alone. While most Floridians consider these lands “protected” in perpetuity, there are no legal requirements for the state to do so. State conservation lands are managed by various public agencies with different, and sometimes conflicting, mandates. There is no agency or program that identifies areas of great natural significance with the intent that such areas be dedicated in perpetuity to the “highest and best use” of natural areas protection. The panel will discuss how Florida might create a comprehensive natural areas system similar to those found in other states, and some of obstacles to establishing such a system.

BIRCH, ANNE^{*1} and C. ROSS HINKLE². 1-Brevard County Environmentally Endangered Lands Program, Melbourne, FL, abirch@brevardpark.com, 2- Dynamac Corporation, Kennedy Space Center, FL, USA. **Environmentally Endangered Lands Acquisition and Conservation Program in Brevard County, Florida.**

In 1990, Brevard County voters supported a bond referendum to purchase environmentally endangered lands. Since its origin, the Environmentally Endangered Lands (EEL) Program has protected more than 13,000 acres of threatened habitat. Buying lands for conservation also requires a commitment to continued land management. County land managers recreate natural cycles of fire and water, remove invasive non-native species, and replant native vegetation to restore degraded areas. Each site acquired by the EEL Program will have a management plan that outlines both management goals and compatible recreational and educational activities. The EEL Program provides its Sanctuary Management Manual as a downloadable file on its web page. Florida's counties share similar management issues, such as fire management, invasive species control, visitor management and facilities maintenance. Most of these activities are conducted without state funding assistance, although some cost-sharing programs exist. The management experiences of the EEL Program offer an insight into what other counties or states should consider when pursuing land conservation program of their own.

BIRCH, ANNE. Brevard County Environmentally Endangered Lands Program, Melbourne, FL, USA abirch@brevardparks.com. **Financing the Future: local government endangered lands programs.**

Over one third of Florida's sixty-seven counties have created local land conservation programs. One example, the Brevard County Environmentally Endangered Lands (EEL) Program, was created through a bond referendum to purchase environmentally endangered lands in the county. The referendum authorized issuance of limited tax bonds for a period of twenty years for the purpose of purchasing, protecting, and maintaining these lands, and for improvements for passive recreation and environmental education. This is a model that other counties have followed. The Brevard EEL Program has a stated mission to acquire, protect, and maintain environmentally endangered lands guided by scientific principles for conservation and the best available practices for resources, stewardship and ecosystem management. A brief overview of funding mechanisms used by the other Florida local government programs will be presented, followed by a review of experiences of the Brevard EEL Program.

BLACK, DAVID W. South Florida Water Management District, West Palm Beach, FL, USA. **Characterization of the habitat of *Nemastylis floridana* (Iridaceae) in the DuPuis Management Area (Palm Beach Co., FL).**

A large clumped population of *Nemastylis floridana*, a rare Florida endemic plant, exists in the eastern part of the DuPuis Management Area. The objective of the study was to identify the physical, biological and historical characteristics of the habitat of this population in order to better understand the requirements of the plant and how to manage land to maintain it. Places where *N. floridana* grows abundantly were mapped during the fall blooming season and information was collected on those areas. *N. floridana* habitat is typically very shallow wetlands (as determined by the Florida Unified Wetland Delineation Methodology), with little shrub or tree cover, on Riviera, Pineda and Pinellas sands with approximately neutral surface soil. Nearby marl flats, which have a higher pH, supported few if any *N. floridana*, although they appeared to have appropriate hydrology. The area where the population occurs has been used as native range and has a long history of frequent burning but was not disked or fertilized. Feral pig rooting is evident and there is a history of high pig populations. Frequent prescribed burning and maintenance of natural hydrology are probably vital for preserving *N. floridana* populations, since shallow wetlands of the kind that support this species are quickly overgrown by shrubs and trees when fire is excluded or drainage occurs.

BLACKADAR, JANET E.*¹, G.J. FORBES¹, AND S.P. BASQUILL². 1-University of New Brunswick, Fredericton, NB, Canada; blackadar@unb.ca; 2-Atlantic Canada Conservation Data Center, Sackville, NB. **Human-induced changes in the forest landscape of Kejimikujik National Park from pre-European settlement to the present.**

Park managers mandated to understand ecological integrity feel it is essential that relevant and detailed baseline data exist to properly evaluate the effects of natural or man-made disturbance. This study provides a baseline within Kejimikujik National Park (KNP) in Maritime Canada, a region where European activity has long been established but where little information exists on land cover change. Pre-European settlement vegetation cover for the area of KNP was compared with present day cover. A total of 2000 panchromatic aerial photographs from the 20th century, land surveyor records from the 1800s, historical maps, and current land cover maps, were analyzed using the Image Analysis extension of ArcView and the PCI geographical information system. The period from 1920 to 1940, which coincided with the advent of portable sawmills, saw the greatest changes in the forest structure and composition. Witness tree data from a sample

of 83 land surveys completed between 1830 and 1936 ($n = 222$) were extracted and placed in geographic information system (GIS) as a point layer. These tree data give an approximation of the forest composition at the time of European settlement. Changes in the forest were quantified by calculating differences in abundance and relative importance at presettlement time and at present. Our results showed a decline in the relative abundance of pine and an increase in aspen and other hardwoods.

BOETSCH, JOHN R.* AND L. P. THOMAS. National Park Service, Prairie Cluster Long-Term Ecological Monitoring Program, Republic, MO, USA. **Differential survivorship and fecundity of an endangered winter annual: the influence of microhabitat conditions.**

Missouri bladderpod (*Lesquerella filiformis* Rollins) is restricted to limestone glades in southwestern Missouri and northern Arkansas. Habitat conversion for agricultural and urban development threatens this species range-wide. The vegetative structure of many limestone glades has been altered by wildfire suppression and subsequent woody species encroachment, and by exotic species establishment. Prescribed fire and mechanical removal of woody species have been employed by NPS land managers in an attempt to restore glade habitat at Wilson's Creek National Battlefield. By determining how plant occurrence, survivorship and reproduction vary with habitat characteristics, we hope to provide feedback regarding the effectiveness of habitat management actions. Stratified random demographics quadrats ($n = 42$) were installed following germination in fall 2000. The locations of individual seedlings were mapped using a mapping table with clear acetate overlays. The fate of each plant was tracked during subsequent visits. Rates of survival and fecundity varied between glade microhabitats, and indicated a possible divergence between conditions favoring survivorship and those favoring reproduction. Plants in exposed microhabitats had significantly lower survivorship rates, but surviving plants tended to produce more stems, flowering positions, and fruit. Exposed sites with shallow soils are more susceptible to frost heaving and drought, which are likely important determinants of winter mortality rates and subsequent adult population size.

BRANDT, LAURA A., U.S. Fish and Wildlife Service – A.R.M. Loxahatchee NWR, Boynton Beach, FL, USA, laura_brandt@fws.gov. **Inventory, monitoring, and research for better management of our national wildlife refuges: examples from the Arthur R. Marshall Loxahatchee National Wildlife Refuge.**

The Arthur R. Marshall Loxahatchee National Wildlife Refuge is 59,646 ha of northern Everglades habitats. It is one of over 530 NWRs that are managed for "Wildlife First". The refuge provides habitat for over 700 vertebrate species, 63 of which are considered as imperiled. Three major challenges must be addressed in order to successfully manage the refuge. They are: water quality, water quantity, and exotics. Successful management requires an applied science framework that addresses maintenance and restoration of the habitats and wildlife in the face of these challenges. Currently underdevelopment is an Inventory, Monitoring, and Research Plan that provides such a framework for future management. The plan outlines the inventory, monitoring, and research needs of the refuge and discusses strategies for addressing those needs. Key aspects of the plan include identification of key management related research issues, the rationale for the selection of key species or groups for monitoring, and a discussion of strategies to meet the research and monitoring needs. Included in these strategies are projects conducted by refuge staff that address refuge, regional, and global issues, projects conducted on site by individuals and organizations, and projects conducted in cooperation and collaboration with Universities and other agencies.

BREININGER, DAVID* AND DONNA ODDY. Dynamac International, Kennedy Space Center, FL, USA, BreinDR@ksce.ms.ksc.nasa.gov. **Florida scrub-jay source-sink population dynamics in pine flatwoods.**

We used 12 years of demography and dispersal data to study source-sink dynamics within a site having different arrangements of oak scrub. Oak scrub on well-drained soils was designated primary ridge. Within poorly drained soils, secondary ridges were oak patches ≥ 0.4 ha and tertiary ridges were < 0.4 ha. Primary ridges were sources because recruitment exceeded mortality and emigration exceeded immigration. Secondary ridges were sources when they had 0.13 ha of optimal oak (120-170 cm tall) and when population densities were not great (< 5 pairs/40 ha). Most secondary ridges were pseudo-sinks (mortality temporarily exceeded reproduction) during high population densities. Correlations coefficients between pair density and demographic performance were -0.31 ($p = 0.331$) and -0.70 ($p = 0.012$) respectively for primary and secondary ridges. Tertiary ridges were sinks because mortality exceeded recruitment and immigration exceeded emigration. Because demographic performance in tertiary territories was not correlated with population density ($r = 0.18$, $p = 0.587$), many tertiary territories were true sinks. We found that 0.4-1.2 ha of optimal oak/territory resulted in the greatest demographic performance, even during high-density years. Nearly all scrub temporarily occurred as a sink depending on fires, which produced shifting mosaics of optimal habitat. We estimate that at least half of the Florida scrub-jay population along the central Atlantic coast uses secondary habitats, which are not distinguished as suitable habitat in landcover and natural community classifications.

BRENNAN, K. M. Palm Beach County Department of Environmental Resources Management, West Palm Beach, FL, USA, kbrennan@co.palm-beach.fl.us. **Using natural areas for ecoguide training.**

The Palm Beach County Environmental Education Network (PalmNet) has developed a 36-hour introductory course for training of interpretive naturalists. The course complements the Florida Master Naturalist Program. County natural areas and preserves associated with municipal and university environmental education centers are used as instructional sites. The course also includes classroom instruction, a final examination, and a field practicum consisting of a 30-minute interpretive walk. Students are introduced to native ecosystems and species in Palm Beach County, basic principles of interpretation, trail techniques, fundamental skills for the development and presentation of interpretive talks, and land management and restoration techniques for natural areas. After completion of the course, a student receives certification as an ecoguide in Palm Beach County. Ecoguides act as mentors for future students and serve as trained personnel or volunteer tour guides for nature centers, agencies, and private ecotourism businesses that provide environmental education. PalmNet maintains a database of certified ecoguides for use by employers. The first session of the course was funded by a grant from the South Florida Community and Urban Resources Partnership and supported by the Nature & Heritage Tourism Association of Palm Beach County, Inc. PalmNet is a 501(c)(3) nonprofit organization whose membership includes nature centers, state and local environmental agencies, educators, and others interested in environmental education and promoting public awareness of and appreciation of Palm Beach County's natural resources.

BRUNCKHORST*, DAVID J. AND P. COOP. Institute for Rural Futures and UNESCO Centre for Bioregional Resource Management, University of New England, Armidale, New South Wales, Australia. **Triumph of the Commons: Cross-property synergies for ecological conservation and restorative land use.**

The loss of ecological function across landscapes is a global priority, not only because of the direct impacts on biodiversity and the processes it sustains but also the social consequences arising in communities whose very existence is dependent on this natural capital. Conventional attempts to address these inter-related issues have generally failed and are hampered by narrowly focused agencies, entrenched property rights, other institutional impediments, and inappropriate scales. The enduring Common Property Resource (CPR) management institutions are not "Tragedies", but rather "Triumphs", demonstrating collective resource management Commons contribute ecological and social resilience despite an external context of high risk and uncertainty. The sustaining vigor of successful common property regimes has provided the interface through which the demands placed on the natural environment by CPR institutions are better matched to multi-scale natural processes that supply ecological goods and services. We need to revisit these institutional forms and determine, through application, if these social organizational arrangements are socially and ecologically robust, to deliver sustainable rural futures. We outline the "on-ground" development of a modern grazing commons model. A group of ranchers in Australia are developing a contemporary CPR from private parcels of land in an attempt to address the degradational spiral that continues to challenge them, and their rural counterparts worldwide. In doing so they have created a linked system of natural areas for conservation as well as ecologically restorative programs linked to land use and economies of scale.

BUCH, RAMESH P.*¹ AND EMILIE M. YOUNG *². 1- Alachua County Environmental Protection Department, Gainesville, FL, 2- Miami-Dade County Environmentally Endangered Lands Program, Miami, FL, USA. **Comparing land conservation programs in a highly urbanized Miami-Dade County to more rural Alachua County, Florida.**

Miami-Dade County is home to over 2 million residents, with all of these people and their infrastructure crammed into some 1,300 square miles – or almost 2,000 residents per square mile. Miami-Dade is also home to less than 4,000 acres of globally imperiled rockridge pinelands, which contain endemic endangered species. Miami-Dade created its Environmentally Endangered Lands Program in 1990, funded through a voter-approved ad valorem tax that raised \$90 million for land acquisition and stewardship. Alachua County is 970 square miles in area, with a population of 210,000 residents, which equates to a density of 216 people per square mile mostly concentrated in the City of Gainesville. Alachua County created its Alachua County Forever Program in 2000 also after a voter referendum authorized \$29 million in bonds for land acquisition and stewardship. Alachua County contains hundreds of thousands of acres of upland forests, sand hill communities, stream-to-sink watersheds and lakes. A comparison of these counties' programs operating in such widely different natural, political and social environments, offers some insight into the challenges and opportunities facing local governments in funding and implementing land conservation programs in the state of Florida.

BURZYCKI, GWEN. **The use of GIS/GPS technology to map invasive exotic plant distribution in the South Dade Wetlands, southeastern Florida.**

The South Dade Wetlands consists of 49,000 acres of subtropical freshwater and coastal wetlands in southeastern Florida located between Everglades National Park and Biscayne National Park. The area supports a large variety of wading birds and other water dependent wildlife. In 1994, Miami-Dade County and the South Florida Water Management District initiated joint acquisition of this area. As of June 2001, 12,718 acres had been publicly acquired and approximately 15,000

acres permitted for a private mitigation bank. Management plans are complicated by ownership patterns, as the reserve is currently a patchwork of public and private land. One of the most important threats to the region is invasive exotic plants that crowd out native vegetation and diminish habitat value. Invasive plant distribution was assessed by combining extensive fieldwork with Global Positioning System (GPS) and Geographic Information System (GIS) technology to produce a spatial database. The database identified the following taxa as the most common: *Casuarina spp.* (>4200 acres), *Schinus terebinthifolius* (>3900 acres), *Ardisia elliptica* (>800 acres), and *Melaleuca quinquenervia* (>300 acres). In addition, *Neyraudia reynaudiana* occurs along most of the roads. The database is currently being used to prioritize exotic control efforts using ownership, exotic plant occurrence, and site accessibility information. The usefulness of this technique is directly related to the availability of trained staff and other GIS-based information to support data analysis.

CASTILLO, DANIEL. Florida International University, Miami, FL, USA, DC197424@aol.com.
Population analyses of managed cat (*Felis Catus*) colonies located in Miami-Dade County, Florida, Parks.

Since the early 1990's, some concerned United States citizens have formed coalitions whose goals are to promote the welfare of homeless stray and feral cats (*Felis catus*) through the use of non-lethal population control methods. The non-lethal methods consist of trapping, testing, vaccinating, altering (sterilizing), clipping the tip of the ear, and releasing (TTVAR) cats into managed cat colonies located on private and public lands, including state and county parks. However, the establishment of colonies on public parks also creates management, health, and socio-political problems. The purpose of my study was to collect data on managed cat colonies located in two Miami-Dade County, Florida, parks, in order to test the following assertion put forward by proponents of the colonies: Managed cat colonies will decline in size over time. I collected observational and photographic capture-recapture data in order to track colony population dynamics. The non-parametric Cox and Stuart test for trend and regression curves with 95% confidence intervals were used to analyze and graphically display trends in colony population size. My results contradicted the assertion that managed cat colonies decline in size over time. Even though the number of original colony members decreased over time, illegal dumping of cats prevented the colonies at both parks from decreasing over time. Furthermore, my findings demonstrate that the establishment of colonies on public lands encourages dumping of cats and creates an attractive nuisance.

COLVERSON, PETER J. The Nature Conservancy, Gainesville, FL, USA, pcolverson@tnc.org.
The Natural Areas Training Academy.

The Natural Areas Training Academy is a partnership of The Nature Conservancy, University of Florida, IFAS and Valencia Community College. It was formed in Florida to address the multiple challenges created by state acquisition of natural areas, the need for well-qualified managers and the rapidly changing field of natural-areas management. An advisory team composed of representatives from several of the state's major land management agencies guided the development of a series of five workshops that leads to the Certificate in Natural Areas Management. Each workshop lasts 3 - 5 days and provides up-to-date training using hands-on methodologies. After just one year of operation, 84 professionals from state and county agencies, non-profits, private firms and educational institutions have completed at least one workshop. Eight people completed the entire certificate and many more completed two or three workshops. This power point presentation will provide information on the academy and its workshops. The rationale for the academy, the partners involved the content of each workshop and the kinds of

people served will be included. Plans for program modification and expansion in the foreseeable future will also be presented.

COOPRIDER, M.A., R.L. LARIMORE*, AND J.E. EBINGER. Illinois Natural History Survey, Champaign, IL, USA, rllarimo@inhs.uiuc.edu. **Soils and vegetation of the Oliver's Grove region, Livingston County, Illinois.**

During the growing seasons of 1999 and 2000, soils were examined and woody vegetation surveyed at three woodlots in the Oliver's Grove region. The geology of the region is a result of glacial activity that occurred around 17,000 years ago during the late Wisconsinan glaciation. Glacial plains, moraines, and a large erosional channel characterize the landscape. Soils formed in glacial deposits (till and outwash), loess, and organic material. Prairie soils dominate but forest soils, young floodplain soils, organic soils, and buried organic soils are also present. The woodlot at Turtle Pond was dominated in the overstory by large *Quercus macrocarpa* Michx. (bur oak) averaging 48.9 cm dbh. *Prunus serotina* Ehrh. (black cherry) and *Crataegus mollis* (T. & G.) Scheele (red haw) formed a relatively dense understory. At the Gerth Farm woodlot the overstory was exclusively bur oak, with an average dbh of 64.2 cm, and *Carya ovata* (Mill.) K. Koch (shagbark hickory), with an average dbh of 42.8 cm. At the Oliver Farm woodlot the dominates in the overstory were *Tilia americana* L. (basswood) averaging 53.1 cm dbh and *Celtis occidentalis* L. (hackberry) averaging 42.6 cm dbh. We compared General Land Office survey maps and past aerial photographs with existing forests and soils and found little correlation. In this study, soils were more useful in determining former hydrologic characteristics of the region than estimating the extent of presettlement groves.

COX, DAVID L.* David Cox Consulting, Vero Beach, FL, USA, davidlcox@earthlink.net. **Local Benefits of Natural Areas Acquisition: Critters, Cash & Kids.**

If purchasing natural areas is viewed as a strategic investment for our future, then what are the likely future returns on this investment? The subtitle of this talk hints at the shape of the answer. Future benefits of natural areas acquisition were analyzed along three main lines: (1) protection of natural ecosystems; (2) provision of ecosystem services; and (3) preservation of a lasting legacy for future generations. Results of an ecological economic analysis of natural lands in Indian River County, Florida, will be presented.

DATTILO-BAIN, KEITHA M.¹, C.A. DUNLEVY², AND P.A. SCHMALZER³. 1-Dynamac Corporation, Environmental Support Contract, MS-ESC, Patrick Air Force Base, FL, USA, keitha.dattilo-bain@esc.patrick.af.mil ; 2-Kimley-Horn & Associates, Raleigh, NC; 3-Dynamac Corporation, MS DYN-2, Kennedy Space Center, FL. **Rapid Quality Assessment for Scrub Habitat Restoration Efforts at Cape Canaveral Air Force Station, Florida.**

Rapid field surveys were conducted to assess aspects of scrub habitat quality and difficulty of restoration within the majority of the 134 scrub management compartments on Cape Canaveral Air Force Station. Characteristics surveyed included mean scrub height, mean trunk diameter, presence and size of openings, presence and density of exotics, and presence and density of vines. Geographic Information System (GIS) coverages of these data indicated spatial variability across the landscape. The scrub height and size of openings combination appeared to be the most important indicator of scrub quality. A comparison with the Florida Scrub-jay surveys conducted at Cape Canaveral indicated compartments that coupled greatest mean height with the lack of openings were devoid of jays. Scrub height and diameter are useful indicators of restoration's mechanical treatment hindrances, while density of exotics suggests the need for other forms of

treatment such as herbicide. This rapid analysis technique provides a fast determination of scrub quality to aid in future restoration planning.

DIAMOND, DAVID D.*, TAISIA M. GORDON, RONNIE LEA, AND C. DIANE TRUE. Missouri Resource Assessment Partnership, Columbia, MO, USA. **Conservation opportunity areas for the Midwestern USA.**

We used the National Land Cover Database (NLCD), TIGER road files, and the National Elevation Database (NED) as basic input data to create flexible data layers and identify conservation opportunity areas (OAs) for the Midwestern USA. We created new grids in GIS from the NLCD by reducing the number of classes to six, plus creating a new 'mosaic' land cover class. We then created distance grids for roads and for the new land cover grids in which each cell has a value of 0 to 9, with each larger number being either farther from the edge of a land cover class (e.g. forest, grassland, shrubland) or farther from a road. We identified OAs under several scenarios by stacking these grids and selecting cells based on different threshold cell selection values. Finally, we created new landform models in GIS using information derived from Digital Elevation Models (DEMs, contained in the NED), and intersected the results with soils or geology data to identify geolandforms. We then used one version of OA results and intersected OAs with modeled geolandforms to identify OA groups (OAs with similar geolandforms) by ecological subsection. The advantage of this approach is its do-ability using nationally available data, and its flexibility, since different end users (planners, researchers) can select OAs in different ways, and can add new variables into the model as desired.

DIBBLE, ALISON C.*¹, J. C. BRISSETTE², D. FUNK³, AND S. C. FAY⁴. 1-U.S.D.A. Forest Service, Northeastern Research Station, Bradley, ME, USA, adibble@fs.fed.us; 2-U.S.D.A. Forest Service, Northeastern Research Station, Durham, NH, jbrisette@fs.fed.us; 3-U.S.D.A. Forest Service, Northeastern Research Station, Durham, NH, dfunk@fs.fed.us; 4-U.S.D.A. Forest Service, White Mountains National Forest, Laconia, NH, sfay@fs.fed.us. **RNA criteria applied to three sites: Is RNA status appropriate in every case?**

We considered three potential reference ecosystems for applicability to the U.S.D.A. Forest Service Research Natural Areas (RNA) Program. In the White Mountain National Forest, NH, Gibbs Brook (737 ha) and Shingle Pond (ca. 200 ha), are old growth mixed softwoods at ca. 600-1300 m elevation with red spruce to 350 years old. Both have no evident timber extraction except near trails. The Atlantic white cedar ecosystem (ca. 409 ha) in the 1800 ha, low elevation Massabesic Experimental Forest, ME is surrounded by an eastern white pine-northern red oak forest that burned in 1947. The swamp burned minimally and has had little other disturbance. The Atlantic white cedar alliance is not yet represented in the RNA Program. We found all three areas to be relatively pristine. In the two NH areas, hiking trails are a potential source of invasive weeds, erosion and camping impacts. At Gibbs Brook, trampling might affect fragile alpine vegetation, and some monitoring and controls may be necessary. RNA status for Gibbs Brook and Shingle Pond would increase appreciation for their old growth attributes, help protect rare plants, lead to added focus for research, and help re-assess possible restriction of some recreation activities including camping. At the Massabesic, a buffer is needed to best protect the cedar swamp ecosystem. Rare turtles and insects are present, including the Hessel's hairstreak butterfly that depends on young shoots of Atlantic white cedar. Habitat manipulation could be required to regenerate Atlantic white cedar or accommodate hydrologic requirements of rare dragonflies. A long-term hands-off approach might be detrimental to rare species here. RNA status would probably not contribute a substantially higher level of protection than that already afforded by status as an experimental forest.

DOLAN, BENJAMIN J.* AND G.R. PARKER. Purdue University, West Lafayette, IN, USA, bjdolan@fnr.purdue.edu. **Understory response to disturbance: An investigation of prescribed burning and understory thinning treatments.**

Lack of disturbance in the Central Hardwood Region has caused a decrease in abundance of shade-intolerant species, such as oaks (*Quercus spp.*) and hickories (*Carya spp.*), in the forest understory, while shade-tolerant species have proliferated. The goal of this research is to determine how two disturbances, prescribed fire and mechanical understory removal, affect woody species regeneration, as well as herbaceous species diversity. A randomized complete block design was developed to test the effect of prescribed burning, mechanical removal of understory shrubs and trees, the combination of burning and removal, and no treatment. Preliminary analysis indicates that all treatments have little effect on herbaceous species diversity, however, prescribed burning affected the composition of woody species seedlings. While fire top-killed most seedlings, regardless of shade tolerance, shade-intolerant species responded by resprouting. Combined with a reduction in the number of shade-tolerant species, burning produced greater equitability among tolerant and intolerant species seedlings. Removal treatments had no effect on the number of seedlings, but increased the level of photosynthetically active radiation (PAR) reaching the forest floor, which is essential for the growth of shade-intolerant species. The combination treatment provides both greater equitability among species, and higher levels of PAR. Further data collection and analysis are necessary to determine if growth and equitability are sustained over time.

DOREN, BOB. Florida International University, Miami, FL, USA. **Invasive Exotic Plants, Florida's Dilemma and Florida's Opportunity.**

No abstract available.

DRAY, F. ALLEN*^{1,2}, G.S. WHEELER², AND T.D. CENTER². 1-Florida International University, Miami, FL, USA, fadray@eemail.com; 2-US Dept of Agriculture, Agricultural Research Service, Invasive Plant Research Lab, Fort Lauderdale, FL. **Genetic variation within *Melaleuca quinquenervia* in Florida, and its effect on performance of biological control insects.**

Melaleuca quinquenervia was first imported (as *M. leucadendron*) into the United States during the 1880s by horticulturists in Sarasota, Florida, and San Diego, California. During the subsequent 40 years, 10 more introductions occurred in Florida from 5 different sources: botanical gardens in France (3x), Italy (1x), and Australia (4x), and plantations in Australia (1x) and Madagascar (1x). By the mid-1920s, melaleuca was naturalized in southern Florida, invading diverse habitats within the Everglades ecosystem including freshwater and brackish wetlands as well as pine flatwoods. Chromatographic profiles of leaf essential oils show genetic differences among Florida's melaleuca trees partially resulting from the presence of two chemical varieties (called chemotypes). Chemotype I plants contain the terpenoid *trans*-nerolidol as their principle constituent, whereas 1,8-cineole and viridiflorol predominate chemotype II plants. Laboratory bioassays with the biological control agent *Oxyops vitiosa* suggest that the insects currently in Florida may be better adapted to type I than type II plants. For instance, survivorship of *O. vitiosa* larvae fed type I plants was threefold greater than larvae fed type II plants. Also, adults reared on the type I plants weighed 40% more than those reared on type II plants. Similar decreases in fecundity have been noted. Studies are underway to determine the impact of these chemotype differences on *O. vitiosa* population dynamics at field sites in Florida.

DUNCAN, BREAN W. ^{*1}, VICKIE L. LARSON², AND PAUL A. SCHMALZER¹, 1-Dynamac Corporation, Mailcode DYN-2, Kennedy Space Center, FL, USA, duncabw@ksce.ms.ksc.nasa.gov; 2- Dynamac Corporation, Orlando, FL, USA, vlarson@dynamac.com. **Land Cover Alterations and Biocomplexity of the Indian River Lagoon.**

The Indian River Lagoon (IRL) is an estuary of national significance extending 248 km along the east coast of central Florida through Volusia, Brevard, Indian River, St. Lucie, and Martin counties. The lagoon and watershed have high biological diversity, principally due to its geographic position between temperate and sub-tropical regions. Rapid urban development is threatening the lagoon's natural resources. We mapped 1920, 1943 and 1990 landcover within the northern two-thirds of the watershed. These data provide baseline reference conditions quantifying profound landcover alteration within the IRL watershed. All natural landcover types decreased with exception of hammocks, while all anthropogenic types increased. The greatest losses by area within the 251,190 ha studied were from flatwoods (41,650 ha), scrub (19,000 ha), and freshwater marsh (12,110 ha) types, while the largest losses by percent were coastal scrub (71%), scrub (66%), and freshwater marsh (64%). Many of the observed changes are the direct result of urbanization, but many of them are the result of indirect anthropogenic effects such as fragmentation, hydrologic and fire regime alterations. These influences have created a relatively new set of complex interactions on the landscape that must be understood, so land management resources can effectively be applied to protect native biodiversity within the watershed.

EHRHART, L. M.^{*1}, D.A. BAGLEY¹ and S.A. ECKERT², 1-University of Central Florida; Orlando, FL, USA. 2-Hubbs-Sea World Research Institute San Diego, CA, USA. **Marine Turtles of the Indian River Coast: High and Low Technologies Reveal Links Throughout the Greater Atlantic Basin.**

Three species of marine turtles regularly use the lagoons and beaches of the Indian River Coast as foraging and nesting habitats. Long-term studies involving recoveries of "low-tech" flipper tags have clarified some aspects of the ecological geography of loggerheads, green turtles and leatherbacks. More recently, mtDNA analysis and satellite telemetry are providing additional insight into the origins, movement patterns and migratory destinations of juvenile and adult turtles from this region. Genetic studies and tag recoveries of three aggregations of juvenile green turtles indicate multiple origins and migratory destinations in the western Caribbean. Increases in green turtle and leatherback nesting on the Indian River Coast in the last decade have prompted the use of satellite telemetry to study migratory patterns of adult females of both species. Tracks of the first six leatherbacks from this area have demonstrated new components in the overall pattern of Dermochelys movements in the Atlantic Basin.

ESHEE, JR., WILLIAM D.* AND P. LIDDELL, JR. Mississippi State University, Mississippi State, MS, USA, weshee@cobilan.msstate.edu; pliddell@cobilan.msstate.edu. **Legal Trends and Implications of Using Prescribed Fire.**

Legal liability for prescribed fire has been and will continue to be of significant concern for individuals, companies and governmental agencies involved in this type of activity. The State of Florida has led the nation with legislation that defines when and under what circumstances a prescribed burner may be held legally liable. Other states have followed the Florida law with similar legislation. Is the Florida law an appropriate model for other states? Has the Florida law worked as predicted? Have new laws worked in other states? Should another model be developed? If so, what changes to existing law should be made? If not, what are the strengths of the present law? Will simple negligence continue to be the standard for measuring liability?

Should simple negligence be replaced with another standard, such as strict liability? The laws of various states will be compared and discussed in relation to the present legal climate. The legal standard of the reasonable prudent person will be evaluated in relation to the present laws. Civil and criminal liability will be examined. Future trends in legal liability will be discussed by interpreting and drawing upon past legislative enactments and court cases.

GAULT, ELIZABETH M.¹ AND R. WIEDENMANN². 1-University of Illinois Champaign, IL, USA, egault@uiuc.edu; 2- Illinois Natural History Survey, Champaign, IL, r-wiede@uiuc.edu.
The association of *Alliaria petiolata* with native vegetation.

This research is to determine the association of *Alliaria petiolata* with native vegetation in an Illinois woodland by measuring vegetation composition, plant density effects, removal manipulation, and utilization of *A. petiolata* by insects. The project will study *A. petiolata* in its native environment in Germany and Switzerland and then compare those plants to the population in Illinois. Illinois field site, Funk Forest, McLean has two main components: 1) response of natives due to the removal of *A. petiolata* and 2) comparison of native species in non-removal plots. The study is a complete block design with two treatments (removal and non-removal) and a control plot. Each treatment has 3, 0.5m x 0.5m, plots with different densities of *A. petiolata*: low (1 plant/.25m²), medium (2-4 plants/.25m²), and high (≥ 5 plants/.25m²). Three densities for the removal experiment were chosen to see if native plants have different responses depending on original *A. petiolata* density. If *A. petiolata* density changes the native vegetation composition, then native plant species diversity will decrease as original *A. petiolata* densities increases. Two field sites were established in Europe to compare *A. petiolata* plant associations between the native environment (Europe) and an invaded area (Funk). Morphological comparisons were made between Neuenberg, Germany and Illinois. The collected data will be analyzed using SAS statistical package.

GILMORE, JR, R. GRANT¹ AND ANSON H. HINES JR². 1-Dynamac Corporation, Kennedy Space Center, FL, USA, rggilmorej@aol.com; 2-Smithsonian Environmental Research Center, Edgewater, MD, hines@serc.si.edu. **Evolution of regional biocomplexity: Aquatic diversity "hot spots", community patchiness along physical gradients.**

The Indian River Lagoon (IRL) system of east central Florida has been recognized as containing the richest aquatic biota within the United States. To date 289 aquatic plant species, 555 protists, 1,785 animal species have been recorded from the Lagoon and its oligohaline tributaries. The 2,629 species of aquatic organisms are not distributed evenly throughout the entire ecosystem. There are broad biogeographical transitions along the 233 km axis of the Lagoon with distinct changes from numerical dominance of tropical species to dominance of warm temperate species. Within the tropical - subtropical species zones there are also major biota changes along salinity and tidal gradients associated with ocean inlets. Species trophic and phyletic guilds associated with specific habitats remain constant and well defined, yet species composition within these guilds change significantly along physical gradients. The most pronounced biota change occurs along tidal, salinity and winter temperature gradients associated with ocean inlets. These changes take place even though the predominate habitat types and habitat species composition does not change. For instance, there are significant seagrass meadow faunal changes on this gradient even though the meadow always consists of manatee grass, *Syringodium filiforme*. This process creates locations where species diversity is particularly high. Unfortunately, the locations of highest aquatic species diversity have received some of the greatest recurrent human impact and often receive no protection from environmental insults relative to locations of the IRL which have

far lower biocomplexity. Consequently, a number of locations supporting the highest aquatic biocomplexity within the Indian River Lagoon ecosystem have been destroyed during the past decade.

GLITZENSTEIN, JEFF S.*¹, DONNA R. STRENG¹, DALE D. WADE². 1-Tall Timbers Research Station, Tallahassee, FL, USA, Bluestem@istal.com. 2-USDA Forest Service, Southern Research Station, Athens, GA, rxfire@ix.netcom.com. **Effects of fire return interval on species composition and richness of South Carolina/east Florida longleaf pine flatwoods /savannas.**

Fire frequency is recognized as perhaps the most critical variable in longleaf pine habitat-plant community management. However, understanding of effects of varying fire frequencies on vegetation composition and richness in longleaf pine savannas and woodlands is still rudimentary and to some extent controversial. With respect to species richness, two hypotheses can be found in the literature: (a) Burn-baby-burn hypothesis (BBBH), which suggests that the more fire the better, with essentially no upper limit. (b) Saturation Hypothesis (SH), which suggests that decreases in fire return interval promote increases in species richness, but only to some threshold level. Beyond that threshold species richness asymptotes and further increases in fire frequency have no effect. We present results from two long-term experiments, in SC and east Florida, that strongly support the BBBH. In both studies species richness increased linearly with decreasing fire return interval with highest species richness found with annual burning. This effect was, moreover, evident at all spatial scales in both studies. Compositional data from both studies suggests that this pattern is due to competitive exclusion of small shrubs and perennial herbs by large shrubs and tree sprouts at longer fire return intervals. "Weedy" species (perhaps more appropriately termed "fire followers") represent an interesting exception to this general pattern. These species take advantage of temporarily open conditions following hot fires in long-interval burns. With more frequent fires perennial herbs dominate and open spaces are not created after fires, leaving fewer opportunities for "weeds".

GORDON, DORIA R.*¹, A. C. COX¹, G. S. SEAMON², AND L. PROVENCHER³. 1-The Nature Conservancy, University of Florida Gainesville, FL, USA, dgordon@botany.ufl.edu; 2-The Nature Conservancy, Bristol, FL, 3-The Nature Conservancy, Kissimmee, FL. **Understory restoration in longleaf pine sandhills.**

Loss of over 98% of the original extent of longleaf pine (*Pinus palustris*) systems has resulted in the need for development of understory restoration techniques. In natural longleaf pine systems recruitment of understory dominant species like wiregrass (*Aristida beyrichiana*) likely occurs following opening of the canopy by prescribed fire or other localized disturbances. We investigated site preparation and sowing methods for reestablishing dominant understory species in heavily disturbed xeric sandhills. Wiregrass establishment was significantly higher in burned and irrigated plots than in plots that were only burned or were burned and had soil disturbance. However, without irrigation, burned and disturbed sites showed greater establishment than did either treatment alone. Overall species richness and cover showed the same patterns when irrigation was present, but were higher in disturbed soils without fire when un-irrigated. When similarity between the restoration sites and high quality reference sites was compared, we found fairly low similarity in species frequency but high similarity in cover classes. Wiregrass contributed significantly and disproportionately relative to other species to the frequency similarity index values.

GREEN, DEBORAH. Sabal Press, Longwood, FL, USA. **Paradise Preserved: Natural History of Canaveral National Seashore and Merritt Island National Wildlife Refuge.**

Canaveral National Seashore contains 24 miles of pristine beach, the only such tract on the east coast of Florida. The National Seashore also contains the Mosquito Lagoon, part of the Indian River Lagoon system, which is the most diverse estuary in North America. Adjacent Merritt Island National Wildlife Refuge preserves an even greater diversity of habitats and many endangered and threatened species. Ownership of these properties by NASA as buffers to space activities has preserved these properties from the fate of the rest of the Florida coast. Central Florida environmental educator and natural history writer Deborah Green (www.sabalpress.com) worked five years on a recently published natural history guidebook to these two areas. In a slide presentation, based on research for the book, habitats of the area will be introduced. Habitats range from the harsh ever-changing beach and hurricane-pounded beach dune, to salt-trimmed coastal strand, to the shallow estuary, lined with salt marsh and mangrove. The northernmost maritime tropical hammock, tallest aboriginal midden in Florida, and efforts to restore integrity of a formerly diked salt marsh area will also be presented, along with the calendar of movements of migratory birds within the area. This presentation is of an interpretive and public educational, not technical nature.

GREENBERG, CATHRYN H. ^{*1}, **D. J. LEVEY**², **C. KWIT**², **S.F. PEARSON**³, **J.P. MCCARTY**⁴, **S. SARGENT**⁵, **AND R. MUMME**⁵. 1- U.S. Forest Service, Asheville, NC, USA, kgreenberg@fs.fed.us. 2-University of Florida, Gainesville, FL, USA, 3-Department of Natural Resources, Olympia, WA, 4-University of Nebraska, Omaha, NE, 5-Allegheny College, Meadville, PA. **Assessing the Importance of Fleshy Fruit to Vertebrate Biodiversity: A Long-Term Study.**

Many species of birds and mammals consume fleshy fruit. Yet, managers know little of how important fruit is to maintaining biological diversity or how to manage fruit production. Since 1994 we have monitored fleshy fruit and hard mast production monthly in 56 plots in five habitat types (upland and bottomland hardwood, loblolly and longleaf pine plantation, and clear cuts) at the Savannah River Site in South Carolina. Annual fruit and hard mast biomass was similar. Fruit biomass varies dramatically among years (16000 g/ha dry biomass in 1995 to < 1000 g/ha in 1998). Ripe fruit first appears in May, peaks in fall, and decreases throughout the winter. A few species contribute most biomass: *Cornus florida* (36%), *Rhus copallina* (20%), *Ilex opaca* (11%), *Nyssa biflora* (9%), *Vaccinium arboreum* (5%). Fruit production is highest in hardwood sites and lowest in pine plantations. Most (70%) fruit is eaten, but removal rates, proportions, and patterns differ among species. Most consumption occurs in late fall and early winter, indicating that winter residents, not migrating birds, rely most heavily on ~~n~~-fruit resources.

GREMLEY, KURT G. ^{*1} **AND EUGENE HENRY**². 1-Hillsborough County, Tampa, FL, USA, gremleyk@hillsboroughcounty.org, 2-Hillsborough County, Tampa, FL, USA, henrye@hillsboroughcounty.org. **Prospectus for using a portion of flood insurance premiums for the management of preservation lands.**

Local governments that participate in Federal Flood Insurance in implementing the National Flood Insurance Community Rating System Program can have flood insurance premiums for all flood insured property owners reduced through various initiatives. One of these initiatives includes preservation land acquisition, since these acquisitions typically contain flood prone areas and preservation removes them from exposure to future loss by prohibiting development. Within these local governments all of the citizens typically pay for the cost of the land acquisition and management. Only the citizens who pay flood insurance receive a financial benefit from these purchases through these premium reductions. Local governments typically do not have sufficient

funds to properly manage these areas in order to restore or retain their natural flood characteristics. A permanent funding source would help assure that these lands are properly maintained. By maintaining some portion of the insurance premium associated with approved reductions and directing that portion to the management of preservation lands there is a more equitable balance of the associated economic, community, and social benefits. There are several options and recommendations for establishing the mechanism to accomplish the allocation of these premiums to funding management of preservation lands.

GUO, JIAN*, YONGHONG CHEN AND JINCHU HU. Institute of Rare Animals & Plants of Sichuan Normal College, Nanchong, P.R.China. **Population Viability Analysis of Giant Panda in Yele Nature Reserve.**

Small populations are subject to large fluctuations arising from random processes at a variety of levels (genetic drift, demographic variation and environmental catastrophes), and such variation can place a population at high risk of extinction. The giant panda (*Ailuropoda melanoleuca*) is a long-term studied animal. Population trends can be estimated by population viability analysis (PVA) in computer simulation models. We used a Vortex computer model (Vortex 7.3, R. Lacy) with four possible scenarios to project the likely outcome of population change of the current Yele panda population. The results show that the number of pandas will slowly increase with no inbreeding and no environmental catastrophes (floods, fires, disease, etc.). However, when model includes inbreeding rate or a 1.76% probability of an environmental catastrophe, the population becomes extinct in 90 years and 60 years, respectively.

HARDIN, DENNIS*¹, DAVID W. CRUMPACKER², AND ELGENE O. BOX³. 1-Florida Division of Forestry, FL; 2- University of Colorado, CO; 3- University of Georgia, GA. **Predicted effects of climatic change on trees and forest communities by the Florida plant species—climatic envelope model.**

A climatic-envelope model for 125 woody native Florida species was built using site floristic lists, species range maps, and long-term climatic records for 106 meteorological stations. Using a subset of 28 ecologically important species and six climate change scenarios, the model predicts large decreases in the Florida range of many temperate species if 1 C warming occurs predominantly in winter or with a 20% decrease in annual precipitation. The model applied to 13 major natural plant communities in Florida predicts that an increase in only 1 degree C and a decrease to 80% of precipitation will result in a 61% to 100% loss of at least one dominant species envelope in 11 of the communities and a loss of at least two dominant species envelopes in seven communities. For scenarios that maintain the baseline balance between temperature and precipitation, the northward component of movement for the major temperate-subtropical transition zone is predicted to be 100 km per degree C increase. Monitoring for early indications of impact and proactive mitigation is suggested.

HERKERT, JAMES R.*¹ AND WILLIAM D. GLASS². 1-The Nature Conservancy, Peoria, IL, USA, jherkert@tnc.org, 2-Illinois Department of Natural Resources, Wilmington, IL. **The effects of prescribed fire on grassland birds: an analysis and comparison of long- and short-term responses.**

Fire is a commonly employed means of managing grassland systems. Yet despite the widespread use of fire, there are surprisingly few data available regarding how fire influences birds or other species of wildlife. We have been studying the effects of prescribed fire on breeding birds in a variety of grassland habitats within Illinois for the last decade. We have found that burn responses of grassland bird species are varied. Some species increase in abundance immediately following

spring fires, others decrease in abundance immediately following fires, and still others are largely unaffected (in the short term) by prescribed fires. Analyses of longer-term burn responses, however, show that some species that decline in abundance immediately following fires, ultimately peak in abundance two to four years post-fire and then decline in abundance in subsequent years. We will also present evidence that some bird species respond differently to prescribed fire in different habitats. For example some species that are strongly influenced by fire in some habitats, are little affected in other habitats. Our analyses show that evaluations of the effects of prescribed fire on grassland birds should be based on long-term data sets and must consider both short- and longer-term responses to fire. Additionally, managers should be cautious when using data from one habitat to predict how particular species may respond to fire

HINES, MARTINA AND MARC EVANS*. Kentucky State Nature Preserves Commission, Frankfort, KY, USA, marc.evans@mail.state.ky.us. **Current status of natural areas inventory and natural terrestrial communities in Kentucky.**

The identification and description of remnants of natural community occurrences provides important insights regarding pre-European settlement vegetation in Kentucky, and is critical for determining protection priorities and management goals. The goals of this project were to identify and describe high quality remnants of natural terrestrial plant communities and to develop a classification system that represents all major community types and is best suitable for tracking community data. This information, in connection with historical land use and GAP vegetation data, was used to determine the status and predict possible future trends for various community types. Most occurrences were identified during 25 years of natural area inventories. These followed standard methodology, involving aerial photo interpretation, aerial surveys and ground truthing of all potential natural areas. Three hundred ninety-one natural community occurrences of 47 community types were identified totaling circa 20,700 acres (0.08 % of Kentucky). Of these circa 13% have received some kind of protection. No high quality remnant of 20 community types has been identified so far, and only 55 of all known occurrences exceed 100 acres. Without prompt and aggressive protection and restoration measures, most community occurrences in Kentucky are predicted to degrade due to their small size, geographic isolation, invasion by exotic species, and land uses that are incompatible with community persistence.

HINKLE, C. ROSS, Dynamac Corporation, Mail Code: DYN-1, Kennedy Space Center, FL, USA, hinkler@kscems.ksc.nasa.gov. **Understanding the Biocomplexity of the Indian River Lagoon System – Bridging the Gap to Sustainability.**

Knowledge of the biological diversity of the IRL system has emerged from studies conducted by numerous researchers from many organizations over many years. However, understanding its biocomplexity (i.e., the complex interactions and interdependencies among living organisms and the environments that affect, sustain and are modified by them) and the sustainability of its high biological diversity remains a significant challenge. Natural ecological dynamics on the scale of days to thousands of years and cumulative human cultural dynamics, particularly over the past 400-500 years, have shaped the system we see today. Understanding the biocomplexity of the IRL requires interdisciplinary efforts that include scientists from biological, physical and social sciences. Research activities span many temporal and spatial scales, represent multiple levels of biological organization, and cross conceptual boundaries. Clear and effective links between research findings and environmental decision-making are paramount. The sustainability of the system is heavily tied to the predictive information regarding the forcing functions that drive the system and the level of understanding of biocomplexity that goes into management and regulatory decisions designed to sustain this system.

HOCTOR, T.* , C. GOODISON*, M. CARR, P. ZWICK, K. WHITNEY, AND W. ROBINSON RIETH. University of Florida, Gainesville, FL, USA, tomh@geoplan.ufl.edu. **Application of a GIS model to identify an ecological network for conservation planning in the southeastern United States.**

An interdisciplinary research team at the University of Florida has conducted a comprehensive analysis of ecological infrastructure and connectivity in eight states in the southeastern United States. Population growth and urban sprawl are major problems in the region and current trends in conversion of landscapes in the southeastern United States show high losses of many ecosystem types. The objectives of this analysis are to identify remaining areas of primary ecological significance and an ecological network connecting and buffering larger existing conservation lands and other primary ecological areas utilizing major riparian ecosystems and other suitable landscape features. The initial ecological network has been identified using a variety of region-wide and state GIS data layers in an Arc-Info GRID-based modeling process. The ecological network will be used as a planning framework for prioritizing conservation programs in the EPA, and work to prioritize features within the network are ongoing. In addition, all of the distributable GIS data and other information are being organized into a digital workbook that can be used by state and local governments and NGOs to assist natural resource conservation planning at various scales.

HOFSTETTER, STEPHEN.* Miami-Dade County DERM, Miami, FL, USA. **At the crossroads between property acquisition and wildlife management of the south Dade wetlands basin.**

Miami-Dade County and the South Florida Water Management District have been purchasing land since 1995 in the 43,000-acre South Dade Wetland Basin between Everglades National Park and Biscayne National Park. During this period of acquisition, staff completed a study to determine the importance of the basin for waterbirds and other wildlife species. This study confirmed that the basin provides critical habitat to a large diversity of waterbirds as well as other threatened or endangered wildlife like the white-crowned pigeon, peregrine falcon, and American crocodile. Unfortunately the total acquisition of this area may take as long as 10 years, meanwhile this checkerboard of ownership makes proper management of the area for wildlife difficult. Another dilemma is that many species require specific management practices, and these practices may negatively impact other species of interest. One management plan is to rehydrate the wetlands to historical levels. To accomplish this task, canals and levees may need to be removed to improve freshwater levels in the basin and improve waterbird habitat. These levees contain poisonwoods, the main food source for the white-crowned pigeon. These canals also provide year round habitat for the crocodile and alligator and are the feeding areas for the least tern. Due to the complexity in managing the basin, we recommend that future studies focus on strategies that coordinate multiple management practices for several species and habitats.

HUEGEL, CRAIG N. AND ANDY STEVENS*. Department of Environmental Management, Tarpon Springs, FL, USA. **An innovative approach to prescribed fire in an urban Florida county.**

Prescribed fire is recognized as one of the most important tools for managing natural areas in Florida. Most of Florida's native communities are fire-dependent and require fire at varying intervals. Additionally, decades of fire suppression have created a great need to use fire as a restoration tool. Instituting a fire program, however, is complicated when natural areas management occurs in densely urbanized regions. Pinellas County is the most densely urbanized county in Florida yet the County manages more than 14,000 acres of wilderness habitat under the direction of the Environmental Lands Division and about 4,000 acres of parkland within the Park

Department. The development of the County's Wildland Fire Team is an innovative approach to using prescribed fire at the urban interface and a potential model for other local governments in similar situations.

&&HUFFMAN, JEAN M. Louisiana State University, Baton Rouge, LA, USA, University of Florida, Gainesville, FL, tomh@geoplan.ufl.edu. **Fire History of a Florida Barrier Island.**

I conducted a dendroecological study of fire frequency on undeveloped Little St. George Island. My goals were to date precisely the year and season of occurrence of fires and turpentine operations that have occurred on the island. Cores from 30 living trees were used to construct a site chronology, and 25 cross-sections of dead trees were collected and used to determine fire and turpentine history. Five periods with different fire return intervals were identified. Frequent fires occurred during two periods, 1866-1894 and 1920-1945, which had 2 and 3 year mean fire return intervals, respectively. Two periods, 1895-1919 and 1946-1962, were periods with no recorded fires; these periods corresponded with periods of turpentine operations. The most recent period, 1963 to the present had a mean fire return interval of 7 years. Eighty-eight percent of fires that could be dated to season were growing season fires. Although trees used in this study were not old enough to determine presettlement accurate fire frequencies, the fire history before the 1950s when turpentine operations were not active may still reflect a fairly "natural" fire regime. Anthropogenic fire during the dormant season appears not to have been common historically; high fire frequencies in the lightning season may have characterized barrier islands of this region. Future work will use this fire history information to examine slash pine dynamics in relation to fire and hurricanes.

HUSTON, MICHAEL. Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA. **In-stream large woody debris loading and forest age on the Allegheny High Plateau: implications for riparian forest management.**

The traditional approach to understanding and predicting invasions by exotic plant species has been based on assessing the properties of the potential invaders in relation to the properties of the resident species. Most predictions of this traditional ecological theory have been contradicted by observed patterns of plant invasions. An alternative approach, based on non-equilibrium dynamics rather than the competitive equilibrium of traditional theory, makes predictions that disagree with those of classical theory, but closely match observed patterns of plant invasions. The Dynamic Equilibrium Model predicts community dynamics, species diversity, susceptibility to invasion, and other ecological and ecosystem properties in terms of the effects of environmental conditions on the interaction of plant growth rates (primary productivity) with disturbances that kill or damage plants. This model predicts that the probability of successful invasion (by native or exotic species) should be highest under the environmental conditions that allow high species diversity. In contrast to the pattern for the probability of successful establishment, the probability of dominance by exotic species, which is to say, serious problems caused by the invaders, is highest under productive conditions where native plant diversity is typically lower. Different "functional" types of plants are expected to have different spatial patterns and temporal dynamics of invasion. Various "case histories" of problem invaders will be discussed in relation to this theory.

JEFFORDS, MICHAEL R. Illinois Natural History Survey, Champaign, IL, USA, jeffords@uiuc.edu. **Photo-informatics, chaos theory, fractals, and the presentation of visual information.**

Documenting the natural world with photographs has been a tool of biologists for many decades. The information content in a photograph, however, varies greatly and is a function of several factors that are often overlooked when creating an image. What is also overlooked is the fact that the information content in a photograph is directly proportional to its quality. Whether portraying a botanical specimen growing in its natural habitat, documenting changes in restorations, or showing some unique aspect of animal behavior, the photograph has great potential as a scientific, educational, and aesthetic tool. The author will present some unique approaches, including looking at the way chaos theory and fractal geometry can effect image-making, to capturing the most information in our photographs.

JUBINSKY, GREG. Bureau of Invasive Plant Management, Florida Department of Environmental Protection, Tallahassee, FL, USA, greg.jubinsky@dep.state.fl.us. **Florida Department of Environmental Protection's Upland Invasive Exotic Plant Management Program.**

The program was developed and implemented by the Bureau of Invasive Plant Management with the assistance of over 500 local, state, and federal public conservation land managers, non-government organization representatives, and private citizens. These cooperators, organized into eleven regional working groups, provide direction for available funding for upland weed control. The program incorporates the concept of placed-based management, which allows for regional concerns, while maintaining statewide consistency and accountability. To date the program has expended approximately \$7 million to control nearly 16,000 infested acres of public conservation land.

KENNEDY, SUZANNE M. AND MARK D. EHLE. Brevard County Natural Resources Management Office, Melbourne, FL, USA, suzanne.kennedy@countygovt.brevard.fl.us. **A method for mapping and prioritizing natural community for conservation planning using GIS.**

Past efforts to delineate and prioritize natural communities typically have focused on single-species or single-resource conservation approaches. Brevard County has been mapping its plant communities since 1999 to inventory the distribution and quantity of natural areas remaining in the county. Natural areas one acre or larger receive quaternary-level codes derived from Florida Natural Areas Inventory (FNAI) and Florida Land Use Cover and Forms Classification (FLUCC) systems to better represent the diverse habitats in Brevard County. Almost every extant natural acre in the county outside of federally owned properties was visited by foot, helicopter, or plane, in addition to being photo-interpreted. These baseline data have many applications, including change detection, future planning, and environmental impact regulation. Polygons were digitized and quality assured to form a GIS coverage. Patches of natural communities were analyzed for area, spatial distribution, and neighboring land use. Weighting these polygon attributes in GIS identified priority conservation areas. We propose to protect priority conservation areas through non-acquisition means. These priority areas have multiple conservation values, including critical habitat for listed species.

KNIGHT, AMY*, JON OETTING, AND GARY KNIGHT. Florida Natural Areas Inventory, Tallahassee, FL, USA, aknight@fnai.org. **FNAI Habitat Conservation Priorities: a new analysis to determine priorities for biodiversity protection in Florida.**

In order to help inform land acquisition decisions for Florida Forever, the state's new ten-year land acquisition program, the Florida Natural Areas Inventory developed a habitat model that prioritizes places on the landscape that would protect both the greatest number of rare species and those individual species with the greatest conservation need. We developed occurrence-based habitat maps using GIS for 248 species with the greatest conservation need, including 141 plants, 50 invertebrates and 57 vertebrates. Each species was assigned a conservation needs weight based on its degree of rarity and protection status on public lands. The weighted habitat maps were overlaid to create a prioritized map of the most important places to protect Florida's rarest species. In addition to showing protection needs for the 248 species in the model, we can also report on how well the model protects over 700 other species that the Inventory tracks. Our analysis shows that the most important biodiversity areas are concentrated along the Lake Wales Ridge, Apalachicola River, Waccasassa Bay, the Florida Keys, and areas north of Big Cypress and the Florida Panther Refuge. The data are currently being used to inform conservation land acquisition decisions but it is also a useful tool for other conservation and land-use planning efforts.

KNIGHT, GARY. Florida Natural Areas Inventory, Tallahassee, FL, USA, gknight@fnai.org. **Discovering Nature: a scientific foundation for natural areas programs.**

Each of the fifty states have a Natural Heritage Program of some form that is charged with identifying and monitoring biological diversity. In Florida, the Natural Areas Inventory (FNAI) has provided such information to support the development and implementation of the state's \$3 billion Preservation 2000 Program and its successor, the \$3 billion Florida Forever Program. For the Florida Forever Program, the FNAI created a comprehensive "conservation needs assessment" to address future priorities for land, water, and endangered species protection. The assessment establishes baselines to measure progress toward specific goals that were set by the Florida Legislature. The result of this process is a model for establishing scientific baselines upon which a natural areas program can be established.

KOPTUR, SUZANNE¹, J. R. SNYDER², M.S. ROSS³, C. BORG³, AND H. LIU¹. 1 – Florida International University, Miami, FL, USA, kopturs@fiu.edu; 2 – USGS Biological Resources Division, Ochopee, FL; 3-Southeast Environmental Research Center, Miami, FL. **Key Deer herbivory following fire in Lower Keys Pine Rockland.**

Key deer numbers may be higher than historic numbers on Big Pine Key. We have investigated effects of their grazing on newly sprouting and resprouting vegetation after fires within the framework of our five-year study to develop ecological criteria for prescribed fire in Lower Keys pine rockland. Many plants are consumed by Key deer, and we hypothesized that Key deer shape the pine rockland plant community via selective herbivory. Taking advantage of the experimental design of the fire project, we erected deer exclosures around circular 1m² plots in summer burn, winter burn, and control units. Deer herbivory in open (non-exclosure) plots was substantially greater in burned than control units, so differences between plots with exclosures and controls were most dramatic in the burned units. Most forbs with erect flowering stems are clipped by Key deer; over 60% of the endemic *Chamaecrista keyensis* are eaten to several inches from the ground if plants are not protected. Stem length was substantially greater for several twining leguminous species inside exclosures (*Galactia parvifolia*, *Rhynchosia parviflora*, and *Stylosanthes hamata*) than for counterparts in the open, as well as for other vining species

(*Mikania scandens*, *Morinda royoc*, *Jacquemontia pentantha*). Within the first year abundances of most herbaceous plants preferred by Key deer increase in exclosures. Over time, coverage of preferred perennial woody species increases.

LARIMORE, RICHARD L.*, D. T. BUSEMEYER*, AND J. E. EBINGER - Illinois Natural History Survey, Champaign, IL, USA, busemeye@inhs.uiuc.edu *Asimina triloba* (L.) Dunal (pawpaw, Annonaceae) in the prairie peninsula of Illinois.

Along with a decrease in fire frequency over the last century, fire-sensitive, shade-tolerant species, such as pawpaw and sugar maple, have increased in importance and the upland forests of central Illinois have become more mesic. When invading new areas, pawpaw commonly has a clumped distribution, reproduction being mostly vegetative by root suckers following initial establishment by seed. In these clonal colonies pawpaw distribution is mostly concentric, the largest individual stems toward the middle with increasingly smaller plants occurring at greater distances from the population center. Within the past 30 years pawpaw has increased significantly in Baber Woods Nature Preserve. In 1966 only a few pawpaw colonies were observed and these had no tree sized individuals. During that survey pawpaw seedlings averaged 161 stems/ha, saplings 668 stems/ha. In 1998 pawpaw seedlings averaged 1170 stems/ha, saplings 897 stems/ha, and a few pawpaw trees greater than 9.9 cm (diameter at breast height) were present. Survey results varied in other central Illinois woodlots where pawpaw was better established.

LINARES, FLAVIO*. Peace Corps/Guatemala. 8a. Calle 6-55, Zona 9 - 01009 - Guatemala City, Guatemala, flinares@gtpeacecorps. **Contribution to the Natural Reserves Protection and Conservation by the Community Environmental Management Project-Peace Corps/G.**

Guatemala is a small and beautiful country with high biological diversity and ancestral cultural but its population has the lowest human development index in Latin-American region. This controversy was the worst during 36 years of civil war. The situation causes a lot of impact into the environment with high degradation on the natural resources especially in natural reserves and protected areas represented in 28% of the national territory. The challenge to manage protected areas and natural reserves has required design innovative strategies focused on integrated sustainable development and conservation. Peace Corps Volunteers of the Community Environmental Management Project and counterparts of the host national agencies (NGOs and municipalities) have achieved excellent results from the implementation of annual operational plans in 12 protected areas of Guatemala. Active and participatory techniques used in projects of Environmental Education, Community Based Eco-tourism, Trash Management, Youth Ecological Clubs, Park Guards Training and Biological Research have proved to be good avenues to get more harmony between humans interacting with the nature. Our work during 15 years has been highly appreciated by Guatemalan government and agencies in charged of the management and administration of the main natural reserves of the country. Peace Volunteers have made a difference living and interacting with poor people who live near or surroundings natural reserves. Municipalities are demanding support from Peace Corps to declare new areas as biosphere reserve or reserve for special protection. These experiences and results will be summarized and discussed with the audience.

LIU, HONG. Florida International University, Miami, FL, USA, hliu01@fiu.edu. **Breeding system and pollination of *Chamaecrista keyensis*, a narrowly endemic herb of the Lower Florida Keys and implications for conservation.**

I examined the breeding system and pollination of Big Pine Partridge Pea, *Chamaecrista keyensis*, a rare endemic herb of the Lower Florida Keys. Four experimental pollination treatments were applied: self-pollination, cross-pollination, bagged without manipulation (autogamy), and open pollination. Preliminary results indicated that although *C. keyensis* flowers were self-compatible, they were not capable of automatic selfing. Buzz pollinations by bees tentatively identified as *Bombus* sp. and *Melissodes* sp. were observed during the peak flowering season (June to July). These observations, combined with the floral character of poricidal anthers, indicate that fairly specialized pollinator services by certain species of bees are essential for this rare herb to set fruit. Land managers must include pollinators in their plans to perpetuate this rare species. The effects of prescribed fire and mosquito control program on bees should be further studied and considered.

LOWERY, LAURA C.*¹, KATHY BRONSON², RONALD LOWERY³, AND CAROLYN SEKERAK³. 1-Ocala National Forest, Lake George District, FL, USA, llowery@fs.fed.us; 2-Ocala National Forest, Seminole District, FL, kbronson@fs.fed.us; 3-Ocala National Forest, Lake George District, FL, rlowery@fs.fed.us; 4-Ocala National Forest, Seminole District, FL, csekerak@fs.fed.us. **Use of a Geographic Information System to plan habitat management activities for Florida scrub-jay (*Aphelocoma coerulescens*) in Ocala National Forest, Florida.**

Ocala National Forest supports one of the largest populations (763 groups) of the threatened Florida scrub-jay (*Aphelocoma coerulescens*). In Ocala National Forest, scrub-jays occupy regenerating sand pine - scrub oak stands from about 3 years after disturbance until a closed canopy of sand pine develops at about 12 years. Sand pine clearcutting through commercial timber harvest is the primary scrub-jay habitat management practice. Scrub-jay habitat needs are the primary consideration in planning sand pine timber harvests. Objectives are to expand the scrub-jay population and to maximize colonization opportunities by planning sand pine harvests adjacent or close to occupied sites. A sand pine timber harvest > 25 acres needs to be planned as replacement habitat for each scrub-jay group before the occupied site is 6 years old. A GIS product displays occupied scrub-jay stands, unoccupied suitable scrub habitat age 3 - 12 years, recent and prescribed sand pine timber harvests which will be suitable in 1 - 4 years, and areas of merchantable sand pine > 35 years from which to prescribe future timber harvests. This GIS product is an important tool in managing the rapidly changing mosaic of scrub-jay habitat in Ocala National Forest.

MAGEE, TERESA K.*¹, P.L. RINGOLD², AND M.BOLLMAN¹. 1-Dynamac Corporation, Corvallis, OR, magee.teresa@epa.gov; 2- U.S. Environmental Protection Agency, NHEEL-WED, Corvallis, OR, USA. **An approach to assessing the condition of riparian plant communities in the John Day and Deschutes River Basins of eastern Oregon.**

Riparian vegetation represents unique plant communities and provides a variety of ecosystem services that influence in-stream condition. This research develops methods and indicators for evaluating vegetation condition. A key indicator of riparian vegetation condition is the degree of invasion by alien plant species. We sampled vegetation along 15 low order streams in eastern Oregon. Data collected at each stream included presence of all species occurring in a 900 m long transect paralleling the stream course, and the abundance of dominant species in several 20 x 30 m plots perpendicular to the stream. Using cluster analysis, indicator-species analysis, ordination, and aerial photo interpretation, we identified and characterized species assemblages. Alien

species invasion along each stream reach and within each assemblage was evaluated using: 1) percentage of alien vs. native species, 2) overall abundance of alien compared to native species, 3) perturbations of vegetation structure or composition associated with the influx of alien species, and 4) a preliminary index of invasion integrating frequency and abundance of alien species weighted by rankings for invasiveness of individual alien species. Potential applications of this approach for restoration, assessment, and monitoring in natural areas management are evaluated.

MARTIN, TRICIA A.* AND CAROL TAYLOR. The Nature Conservancy, Lake Wales, FL, USA, tmartintnc@ithink.net, carolt@ithink.net. **Volunteers in monitoring and management of nongame species on the Lake Wales Ridge.**

In 1994, the Florida Fish and Wildlife Conservation Commission, US Fish and Wildlife Service and The Nature Conservancy created an innovative partnership designed to actively engage citizens in the conservation of scrub habitat on the Lake Wales Ridge. The major objective of the Ridge Rangers program is to recruit and train a corps of volunteers to help manage and monitor conservation lands along the Lake Wales Ridge. This well trained volunteer work force will become more knowledgeable about the Lake Wales Ridge ecosystem, bring expertise, and help to reduce costs to land managing agencies. The Conservancy manages the volunteer program. Volunteers are recruited by word-of-mouth; talks to service clubs and homeowners associations; flyers; newsletters, direct mail; and media coverage. Managers of public and private conservation lands request volunteer assistance from The Nature Conservancy. The Conservancy develops a job description, recruits volunteers, conducts interviews, and places the volunteers. The manager or someone he or she designates supervises these volunteers. Projects are advertised in the quarterly newsletter, *Ridge Rangers* and at ridgerangers.org. The Conservancy conducts general orientation quarterly, and provides project-related training. Managers provide specific training for volunteers, as well. In 2000, 220 volunteers participated in more than 100 projects. Volunteers donated a total of 5,932 hours. During the seventh year of this project the volunteer work force will be increased to 300 volunteers capable of undertaking 125 projects. The volunteer recruitment campaign will continue to focus on targeting subdivisions adjacent to newly purchased scrub sites.

MARYNOWSKI, SUSAN*¹ AND JAMES BRENNER*². 1-Pandion Systems, Gainesville, FL, USA, sumar@pandionsystems.com; 2-Florida Division of Forestry, Tallahassee, FL, brennej@doacs.state.fl.us. **Focus on fire - raising awareness and improving support for prescribed burning through the Fire in Florida's Ecosystems program.**

Land managers say that a lack of public support for prescribed burning has contributed to the fuel buildup that is feeding recent Florida wildfires. The Fire in Florida's Ecosystems program seeks to raise awareness of the ecological and historic role of fire while building support for prescribed burning among Florida's young people by reaching 1200 educators. Funded by the Florida Division of Forestry, the training and materials include hands-on activities, field trips, videos, posters, and the interactive Burning Issues CD-ROM. A preliminary needs assessment identified factors that lead to successful teacher training programs. Over 900 educators have been trained since September 2000 and surveys show statistically significant improvements in knowledge about fire. Follow-up surveys indicate that educators are incorporating fire ecology activities into lesson plans and field trips.

MATIUKAS, GINTARAS. Cornell University/ Lithuanian Ministry of Environment. Ithaca, NY, USA, gmatiukas@hotmail.com. **Nature Protection Areas System in Lithuania - Vision and Reality.**

Lithuania is a transit country in Central Europe. Its system of Nature Protection Areas (NPA) still has some older Soviet features and encounters with requirements for rapid changes mostly because of the European Union's requirements. Taking into account assumption that developed countries have developed nature protection systems and using their experience and achievements, it is important for Lithuania to find the cheapest, fastest, and simplest way for modernizing. There are at least three different patterns of nature protection in the developed countries: Liberal model, based on active public participation; Social-democratic model, based on centralized governmental administration; and Christian-democratic model, based on combination of state authorities and local communities collaboration. This presentation is focused on reasons and sources for these different NPA systems and on the necessity for Lithuania find the most appropriate solution for the organizing and managing of the NPA in this transit period. Some possible solutions are presented, based on existing reality, traditions, experience of different countries, official strategy and vision, and on the principles and recommendations of the NPA management and administration in the European Union.

MAZZOTTI, FRANK J.*¹, LEONARD G. PEARLSTINE¹, AND LAURA A. BRANDT². 1-Port Lauderdale Research and Education Center, University of Florida, Davie, FL, USA, fjma@gnv.ifas.ufl.edu. 2-USFWS, A.R.M. Loxahatchee NWR, Boynton Beach, FL, laura_brandt@fws.gov. **A Multi-Species/Habitat Ecological Evaluation of Alternative Everglades Restoration Plans.**

This project is the only study to evaluate the effects of restoration alternatives on biological diversity and ecological integrity over the entire Greater Everglades/South Florida landscape. Major goals of the South Florida Everglades Restoration Initiative are to restore and maintain the native biological diversity of south Florida, and to recover threatened and endangered species. This project provides direct integration of south Florida wide data layers on species richness and potential habitats developed through the USGS gap analysis project with questions on how to protect and conserve threatened and endangered species and the biological diversity of south Florida. It provides a scientifically based ecological evaluation procedure for assessing the potential effects of alternative restoration plans. It can be used to examine how restoration plans for one species may impact available potential habitat for other species and for developing habitat management plans that optimize the benefits to the greatest number of species on a regional scale. The objectives of this project are to provide a comprehensive assessment of the effects of restoration alternatives on the amount and configuration of ecosystem types and potential habitats of endangered and threatened vertebrates and to evaluate the effectiveness of threatened and endangered species habitat protection for protection of overall south Florida biological diversity.

McRAE, CATHERINE A.¹ AND LAWRENCE S. BARDEN*². 1- Law Engineering and Environmental Services, Inc., Charlotte, NC, USA, cmcrae@lawco.com, 2- Department of Biology, University of North Carolina at Charlotte, Charlotte, NC, USA, LSBarden@email.uncc.edu. **Herbiciding and Girdling Trees: Two Techniques for Restoring a Piedmont Prairie.**

Fire suppression has allowed woody succession to occur in Piedmont prairies, the former habitat for endangered plants such as the federally listed *Helianthus schweinitzii* Torrey and Gray. Mineral Springs Barrens, a North Carolina Nature Conservancy preserve that is a prairie remnant supporting *Helianthus schweinitzii*, has experienced slower succession in the absence of fire than

similar sites, probably because of its impermeable Zion soil. Herbiciding and girdling of trees were compared as methods to supplement controlled burning for restoring Mineral Springs Barrens. Three treatments, herbicide, girdle, and control, were compared over two growing seasons for changes in tree basal area and ground vegetation in the presence of fire. Two and a half years after treatments were applied, basal area decreases in herbicide and girdle plots were significantly greater than in control plots. Both herbicide and girdle plots had significantly greater increases in early colonizing, non-prairie species such as *Erechtites hieracifolia* (L.) Raf. and *Phytolacca americana* L., two species that were unknown from the site until after the prescribed burn, than control plots. Additionally, herbicide plots showed significantly greater increases in prairie species such as *Andropogon gerardii* Vitman, *Silphium compositum* var. *compositum* Michaux, and *Solidago odora* Aiton than either control or girdle plots. The herbicide treatment appears to be the best method to stimulate prairie species without resulting in disproportionate levels of non-prairie species invasion.

NAVARRETE-TINDALL, N.E.^{1*}, J.W. VAN SAMBEEK², AND R.L. MCGRAW¹. 1-University of Missouri-Columbia, MO, USA, navarreten@missouri.edu; 2-USDA Forest Service, North Central Station, Columbia, MO. ***Amorpha canescens*, *A. fruticosa*, and *A. nitens* adaptation to different light levels.**

Native legumes are important in savanna and prairie restoration because they fix atmospheric nitrogen and provide forage and refuge for wildlife. Little is known about the nodulation and growth of shrubby legumes in low-light environments. The North American genus *Amorpha* is comprised of 15 or more species. All species are perennial; however, shoot may die back in cold climate. Some are found in dry to wet prairies and others grow in bottomlands near streams. A greenhouse experiment was conducted measuring growth and nodulation of *A. canescens* Pursh, *A. nitens* Boynton, and *A. fruticosa* L plants grown in sterile vermiculite at three light levels (20, 45, and 100% full sunlight). Plants were inoculated with *A. nitens* rhizobia strains. Data were taken on dry weight of whole plants and nodule number and weight. Only *A. nitens* showed significant differences for dry matter. Dry matter was higher at 100% compared to 45 and 20% sunlight. No significant differences were found for nodulation for all species. Another experiment was conducted outside under shade cloth with the same species grown in Metro Mix®. Data were taken on shoot dry matter. No significant variation for dry matter was found for all species. The results of these studies suggest that all three species grow and nodulate under low light or full sunlight.

NILON, CHARLES H.*¹, AND R. NEIL MOISEY ². 1-University of Missouri-Columbia, Columbia, MO, USA, nilonc@missouri.edu; 2-University of Montana, Missoula, MT. **Local residents' use and perception of greenspaces and natural areas in inner city St. Louis, Missouri.**

Residents of the North City Neighborhoods of St. Louis, Missouri live in the inner city. The predominately Black residents of North City live in some of the poorest neighborhoods in St. Louis, but these same neighborhoods that have the greatest amount of greenspace and natural areas, and some of the best access to the Mississippi River in the city. As part of the EPA funded North City Sustainable Communities Project we surveyed the residents of North City to determine their use and perception of nearby open spaces and natural areas. We found that North City residents were frequent users of greenspaces that provided opportunities for a range of recreational activities. Some of the heavily used greenspaces included important natural areas. North City residents placed a high value on the vegetation of greenspaces preferring open, park-

like sites, and disliking sites that were not maintained. Concerns about safety and the belief that land managers are neglecting greenspaces in inner city neighborhoods are linked to preferences for how natural areas should be managed.

NOSS, REED F. Conservation Science, Inc., 7310 NW Acorn Ridge, Corvallis, OR, USA, reed_noss@conservationscience.com. **Considering connectivity in conservation planning.**

We would not need to concern ourselves with connectivity were it not for the imposition of artificial barriers on the landscape. Four main functions of connectivity are 1) providing for daily and seasonal movements, 2) facilitating dispersal, gene flow, and rescue effects, 3) allowing for range shifts of species, as in response to climate change, and 4) maintaining flows of ecological processes and materials (e.g., fire, wind, sediments, water). Corridors have become such a fad in conservation that often these functions are not considered rigorously. Connectivity is determined fundamentally by the intersection of an organism's life history and the structure of the landscape. Hence, connectivity is a very species-specific and landscape-specific issue. Empirical generalizations can help guide planning in the absence of case-specific data, but planners must be prepared for exceptions to the rules. Cases exist where protecting isolated habitat patches is a better conservation investment than protecting corridors. Moreover, although studies of habitat corridors designed for native species generally show positive effects, other studies document negative effects of artificial corridors (especially roads) on native biodiversity, for example increased invasion rates of exotic species. Linkage designs should be based on the species most sensitive to fragmentation and at a spatial scale appropriate for those species. For such species, paths of least resistance should be provided through the landscape. When in doubt, natural connections should be maintained (or restored) and artificial connections minimized.

NYBERG, DENNIS*¹, J.M. MARZALIK¹, AND S. BULBULKA². 1-University of Illinois at Chicago, Chicago, IL, USA, csnp@uic.edu; 2-Burbank, IL, USA. **Volunteer prescribed burning: seven years in the Palos Forest Preserves of Cook County Illinois.**

It is widely recognized that fire frequencies in Midwestern ecosystems have been greatly reduced in the last 200 years. While the importance of different fire frequencies in enhancing biodiversity has been increasingly appreciated since Curtis (1959) published The Vegetation of Wisconsin, return to historical fire frequencies has been slow. Encouraged by the Illinois Nature Preserves Commission, volunteer stewards organized a prescribed burning program on eight Forest Preserve District of Cook County, IL, natural areas. From the fall of 1989 through the spring of 1996, volunteers conducted 88 prescribed burns totaling 1989 acres (805 ha). From maps of the 88 prescribed burns and eight wildfires we describe the communities burned and the seasonality of the burns for each of 7 years. No injuries or property loss resulted from the volunteer prescribed burning program. Nevertheless, volunteer help was halted by a general moratorium on ecological restoration in Cook County, IL.

O'REILLY-DOYLE, KATHY. Partners for Fish and Wildlife Program, U.S. Fish and Wildlife Service, Naples, FL, kathy_o'reilly-doyle@fws.gov. **Partners for Fish and Wildlife.**

Partners for Fish and Wildlife is a voluntary program administered by the United States Department of the Interior's U.S. Fish and Wildlife Service. Nationally, the program was initiated in 1987 to help protect, enhance and restore wildlife habitat. The program is designed for use on privately owned (non-federal) lands, providing landowners with technical and financial assistance to restore fish and wildlife habitats. Partnerships are the keystone of the program. The list of partners is varied, but in general they include other federal agencies, state and local governments, educational institutions, businesses, conservation organizations and private landowners.

Generally speaking, anyone can become a partner providing the work will be done on non-federal lands, and eligibility requirements of the program are met.

ODDY, DONNA M.*¹, AND I.J. STOUT². 1-Dynamac Corp., Mailcode DYN-2, Kennedy Space Center, FL., oddydm@ksce.ms.ksc.nasa.gov; 2-University of Central Florida, Orlando, FL, USA, jstout@pegasus.cc.ucf.edu. **Demography of the threatened Southeastern beach mouse (*Peromyscus polionotus niveiventris*) at its last stronghold.**

Population estimates of the southeastern beach mouse (*Peromyscus polionotus niveiventris*) have not been determined in nearly two decades, and current population measures were needed to facilitate conservation and management of the remaining populations. For this purpose, demographic data were collected on four grids at Cape Canaveral Air Force Station (CCAFS), FL, the southeastern beach mouse's last stronghold. Six hundred and thirty-nine individual beach mice were recaptured on 1,069 occasions. Sex ratios were close to unity on grids LC2529 and LC17 but showed more deviation at grids AQ and JETTY, significantly so at grid JETTY. Adults dominated the captures on the grids, followed by sub-adults and juveniles. Reproductively active males and females were observed in all seasons on the grids but were most prevalent in fall. JETTY and AQ, the two southernmost, grids showed similar patterns of increases and declines in population size over the course of the study. LC2529, the largest grid, exhibited continued increases in population size until Summer 1997 when a decline occurred only to be followed by a peak in Fall 1997. LC17, the northernmost grid, showed less variation in beach mouse abundance and resembled JETTY and AQ more than LC2529 in this regard.

OETTING, JON*, AMY KNIGHT, AND GARY KNIGHT. Florida Natural Areas Inventory, Tallahassee, FL, USA, joetting@fnai.org. **The Florida Forever Conservation Needs Assessment: A statewide review of significant ecological resources that informs Florida's environmental land acquisition for the next ten years.**

In 1999, the Florida Legislature passed the Florida Forever Act, a land and water conservation program created to extend the success of Preservation 2000. While Preservation 2000 was considered a success, the Legislature wanted more accountability from Florida Forever, including better ways of identifying land acquisition priorities, tracking the progress and evaluating the overall success of the program. The Florida Natural Areas Inventory was contracted by the Florida Department of Environmental Protection to develop a Conservation Needs Assessment, which would help address the requirements of the Legislature. This Assessment is an analysis of the geographic distribution of natural resources that have been identified by the Legislature as priorities for increased conservation attention, including ecological, hydrological, coastal, archaeological, recreational, and sustainable forestry resources. The Assessment is an objective, science-based analysis using the best statewide data currently available. It is the result of a collaborative effort involving many of Florida's natural resource experts. The Conservation Needs Assessment informs the Florida Forever program and the needs of the Legislature by: 1) providing baselines that help prioritize program goals and are a starting point to measure future progress, 2) identifying the best lands to meet current conservation needs, 3) identifying lands that meet multiple conservation goals, 4) providing a continuous monitoring mechanism for re-evaluating conservation needs, and 5) clearly and continuously tracking and documenting the progress of the Florida Forever program.

PANZER, RON. Northeastern Illinois University, Chicago, IL, USA, rpanzer@earthlink.net. **Compatibility of management burning with the conservation of insects within small, isolated prairie reserves.**

I used an experimental approach to examine post-fire insect population response and recovery within small, isolated tallgrass prairie remnants in northern Illinois, northwest Indiana, and southeast Wisconsin. I used a comparative approach to examine species composition and the distribution of species richness within fire-managed and fire-excluded reserve systems. Unlike most previous studies, this study was conducted over seven seasons, focused on responses at the species level, distinguished between remnant-dependent and remnant-independent species, and included multiple fire events and sites. Most species (93%) were found to respond consistently to prescribed fires. Post-fire responses ranged from fire-positive (26%) to fire-negative (40%) for 151 species representing 33 families and seven orders. Three attributes, remnant-dependence, upland inhabitance and nonvagility were found to be significant predictors of negative post-fire species response. Among negatively impacted populations, 68% were found to recover within one year, all 163 populations tracked to recovery did so in two years or less. The fire attrition hypothesis predicts that fire-excluded sites will support greater species richness, greater mean population densities, and an inordinately large number of species that are absent from fire-managed sites. Comparative studies of remnant-dependent leafhoppers and butterflies among fire-managed and fire-excluded systems failed to support these predictions. I conclude that the judicious use of rotational cool season burning is compatible with the conservation of insect biodiversity within highly fragmented systems.

PERGAMS, OLIVER* AND DENNIS NYBERG. University of Illinois at Chicago, IL, USA, operga1@uic.edu. **Museum collections of mammals corroborate the exceptional decline of prairie habitat in the Chicago region.**

The prairie deer mouse (*Peromyscus maniculatus bairdii*) was more common than the white-footed mouse (*P. leucopus*) in museum collections from the 6 Illinois counties of the Chicago region before 1920 but constitutes only 5% of specimens deposited since 1970. Because the white-footed mouse prefers woody vegetation and the prairie deer mouse is limited to prairie or large open habitats, the change in proportion is likely driven by a disproportionate loss of prairie among remaining natural habitat and increases in woody vegetation within grasslands. The decline of the prairie vole (*Microtus ochrogaster*) relative to the meadow vole (*M. pennsylvanicus*) and the lack of recent specimens of Franklin's ground squirrel (*Spermophilus franklinii*) corroborate the hypothesis that prairie habitats have declined much more so than wooded habitats in the Chicago region. Based on extinction models using museum records, it is probable that *S. franklinii* is already locally extirpated. Regression analysis suggests the white-footed mouse will be the only local *Peromyscus* in 0-140 years.

PERGAMS, OLIVER* AND DENNIS NYBERG. University of Illinois at Chicago, IL, USA, operga1@uic.edu. **Live-trapping survey confirms analysis of museum data and the decline of prairie mammals in the Chicago region.**

We live trapped 1861 trap-nights during 1999-2000 in Cook and Lake Counties, IL to test the hypothesis that prairie mammals, particularly the prairie deer mouse (*Peromyscus maniculatus bairdii*) and the prairie vole (*Microtus ochrogaster*), had declined exceptionally in the Chicago region. Our 1999 trapping was at sites of known prairie deer mouse occurrence as indicated by museum records. Since the time the museum specimens were collected, however, most of the prairies in which they had lived have either been consumed by human development or lost to encroachment by woody vegetation. Our 2000 trapping was at large, high-quality open

grasslands. We had a catch rate of 17% with five species in primarily wooded areas (woodlands and savannas), and a catch rate of 32% with eight species in prairies (prairies, restored prairies, and open grasslands). The white-footed mouse (*P. leucopus*) was predominant in woodlands (70% of catches) and the meadow vole (*M. pennsylvanicus*) was predominant in prairies (53%). The prairie vole comprised app. 6% of both prairie and woodland catches. The single prairie deer mouse we caught comprised app. 1/10 of 1% of prairie catches. These values confirm trends shown by museum data and corroborate the exceptional decline of prairie habitat in the Chicago region.

PERGAMS, OLIVER* AND DENNIS NYBERG. University of Illinois at Chicago, IL, USA, opergal@uic.edu. **Global conservation status of Franklin's ground squirrel (*Spermophilus franklinii*)**.

Our interest in the status of Franklin's ground squirrel (FGS) in Illinois led us to an overall concern for the conservation of this species. We were then asked by the World Conservation Union (IUCN) to prepare a Species Plan for inclusion in the North American Rodents Status Survey and Conservation Action Plan. We collected data on the declines in area of occupancy and extent of occurrence of FGS, especially over the past ten years. This data consists of two types: 1) four published censuses of FGS at locations of known historical occurrence, and 2) a telephone/email survey. In this survey we contacted the government mammalogist in each state and province of FGS range most knowledgeable concerning FGS. The published censuses showed 90-98% reductions, over varying time periods, of FGS occurrence at locations of known historical occurrence. The telephone/email survey showed that 64% of states or provinces thought FGS populations were declining, 22% thought they were stable, 0% thought they were increasing, and 14% were unsure. Populations of FGS in the US were found to be largely restricted to railroad right-of-ways and prairie fragments. Populations of FGS in Canada were faring better, and were found principally in aspen parklands. We listed potential causes of FGS decline as loss of prairie habitat; lack of availability of suitable cover and soil; systematic extermination; abandonment, mowing, and herbiciding of railroad right-of-ways; pocket gopher "poison peanut" control; fragmentation causing male juveniles to disperse into sinks; and fragmentation causing lack of genetic variability. We assigned FGS an IUCN Red List Category of "Vulnerable," and made specific conservation action recommendations.

PLATT, WILLIAM J. Louisiana State University, Baton Rouge, LA, USA. **Experimental fire ecology: general concepts and prescribed fire management of pine savanna landscapes.**

Over the past two decades, experimental approaches have demonstrated that fire is an integral component of the environment in pine savannas. Variation in fire characteristics directly and indirectly affects plant populations, suggesting an evolutionary paradigm of recurrent, frequent fire as a selection pressure influencing persistent populations. Knowledge of fire effects on vegetation appears crucial to understanding the structure and dynamics of natural systems and management of ecosystems. One emergent concept is that changing characteristics of fires influences relationships between woody and herbaceous species in pine savannas, but produces no equilibrium. Each fire appears to change relationships between woody and herbaceous species, and woody species increase at the expense of herbaceous species under a number of fire regimes. Only cumulative, long-term effects of repeated fires with certain characteristics are likely to structure the vegetation in ways that maintain landscapes containing savannas. Frequent lightning season fires, in particular, appear necessary for maintenance of dominance by pines and herbaceous species, but variation in fire characteristics also appears critical for maintenance of biodiversity. Landscape-level prescribed fire management might be designed to generate within community differences in fire characteristics, while also burning different plant communities in

ways that maintain fire-generated transitions evident in pre-compartmentalized landscapes. Such aggressive, ongoing landscape-level prescribed fire management would likely involve recurrent fires during potentially dangerous synoptic weather conditions. An integrated approach to scientific study and prescribed fire management will be needed to develop effective prescribed fire practices capable of restoring and maintaining such fire-frequented landscapes.

POST, SUSAN L.*, ROBERT WIEDENMANN, MICHAEL JEFFORDS, AND DAVID VOEGTLIN. Illinois Natural History Survey, Champaign, IL, USA, spost@mail.inhs.uiuc.edu. **The color purple—a story about integrating a biological control program into education outreach.**

The purple loosestrife biological control program at the Illinois Natural History Survey (INHS) has taken on a life of its own. While we have raised and distributed over two million *Galerucella* beetles around the state, we also have developed strong partnerships with public and municipal land managers and private homeowner associations. We work with our partners throughout the year to support their participation in the project—from training and supplying them with materials for beetle rearing, holding field-demonstration days and collecting trips to gather beetles for redistribution, to developing and distributing outreach materials to make the Survey's project visible, easy to remember, and fun for the partners.

Our partners are not all adults. INHS developed educational materials entitled Biodiversity, Wetlands, and Biological Control: Purple Loosestrife a Case Study. These materials focus on biodiversity, the importance of wetlands and wetland restoration, the process of biological control, and utilize the biological control of purple loosestrife as a common theme throughout. Students raise *Galerucella* beetles in their classrooms, then make releases into nearby wetlands in partnership with the Survey's Biological Control Program, thus multiplying our efforts. An unanticipated benefit has been that students tell their parents about the project and the parents' homeowner associations have become involved in raising their own insects—bubble-up education by the students.

PRUSAK, ZACHARY A.¹ AND BRIAN TOLAND². 1-Brevard County Parks and Recreational Department, Environmentally Endangered Lands (EEL) Program, Melbourne, FL, USA, zprusak@brevardparks.com; 2-Brevard County Office of Natural Resources Management, Viera, FL. **Brevard County's Valkaria Airport and Scrub-jays: Partners in Fire Management.**

Most of the sand pine and oak scrub in Brevard County has been fire suppressed for the past 50 years, resulting in a predominance of mature scrub communities throughout the County. Land managers are therefore faced with the difficult challenges of preserving suites of scrub-inhabiting species that require the low vegetation characteristics of young scrub. Prescribed fire is one of the tools utilized to alter scrub habitat, but the drastic fire behavior of mature scrub communities often prohibits use of this tool without some form of mechanical preparation beforehand. Unfortunately, mechanical preparation can be prohibitively expensive. One solution is to seek partners who can bring both management skills and funding dollars to the table in order to achieve the desired results. An example of this cooperation is ongoing at the Valkaria Airport, in south Brevard County. This airport has considerable amounts of mature sand pine/oak scrub on-site, as well as Florida Scrub-jays. It is also located between two conservation areas that contain scrub-jay territories, which makes proper management of the airport's scrub integral to preventing habitat and population fragmentation. The scrub habitat within the Valkaria Airport also poses a line-of-sight problem for airplanes that utilize the runways. In order to reduce the vegetation height the Airport received funding from the Florida Department of Transportation (FDOT) to mechanically cut the scrub. Since the airport's needed management would also serve to benefit the scrub-jays, the Brevard County's Office of Natural Resources was asked to write a

scrub management plan for the airport. This plan outlined specific actions and procedures that would guide the scrub management. Once the mechanical treatment was completed, a prescribed fire was successfully performed. A combination of cooperative management actions has successfully satisfied both the Airport's safety regulations and scrub-jay habitat requirements. Additional scrub management is scheduled for this year.

RANDALL, JOHN M. The Nature Conservancy, Wildland Invasive Species Program, University of California, Davis, CA, USA. **Mapping and assessing invasive plants at the landscape scale: can remote sensing, GIS and spatially explicit models help us?**

Now that many conservation organizations and agencies are devoting more resources and thought to conserving landscape-scale sites (tens of thousands of acres and up) comprehensive strategies for invasive plant management at this larger scale are needed. Accurate information about the spatial distribution and spread of invaders across these large sites will be required for this. A variety of remote sensing techniques, GIS [digital maps] and spatially explicit computer models are being employed by land managers for this purpose at sites scattered across North America. Results thus far have been mixed but each of these tools has provided some notable successes which have translated to better management and prevention of invaders on the ground. I will review examples of successful and unsuccessful uses of these tools for invasive plant assessment at the landscape scale and discuss some ongoing experiments and promising new techniques.

RAYACHHETRY, MIN*¹, THAI VAN², TED CENTER², AND PAUL PRATT². 1-Fort Lauderdale Research and Education Center, University of Florida, Fort Lauderdale, FL, USA, 2-USDA-ARS, Invasive Plant Research Laboratory, Fort Lauderdale, FL. **Regenerative potential of *Melaleuca quinquenervia* canopy seed reservoir in south Florida and Australia.**

Melaleuca quinquenervia (melaleuca), an invasive tree of Australian origin, is competitively superior to many native plant species in south Florida. It aggressively invades wetlands in Florida, yet it also thrives at dry sites. In contrast, these invasive characteristics aren't apparent in Australia, where it is restricted to wetland habitats. We hypothesized that this difference was attributable to differential regenerative capacities, particularly in terms of reproduction, in the two areas. We compared attributes associated with seed production between south Florida and Australia. Overall, the regenerative potential of melaleuca proved to be greater in Florida. The infructescence lengths, capsule numbers, and seeds/capsule were similar in both areas, but capsule densities within infructescences were three times greater in Florida due to capsule abortion in Australia. Viability of embryonic seeds was greater in Florida than in Australia, but germination percentages were similar both places. Low regenerative potential in Australia related to flower bud and capsule abortion, which was rare in Florida. Damage by plant-feeding arthropods contributed up to 40% of the aborted immature seed capsules in Australia, compared to 0% in Florida. Thus, herbivory may have played a significant role in the regulation of *M. quinquenervia*'s regenerative potential in Australia, but not in Florida. This lends credence to the idea that biological control might be effective at lowering the regenerative capacity of melaleuca in Florida's Everglades.

REILLY, BRIAN* AND T. HICKMAN. Illinois Department of Natural Resources, Springfield, IL, USA, breilly@dnrmail.state.il.us. **Changing competitors into partners for natural area protection.**

As budgets grow tighter we must look for new allies and new ways to fund natural area protection. In Illinois we have turned to the more traditional wildlife organizations. These groups support the acquisition of grasslands, forests and wetlands because of the recreational

opportunities they provide. Each group employs a specific fund to finance acquisition and management of wildlife habitat. In Illinois the Natural Areas Acquisition Fund annually outspends all Wildlife Special Funds for land acquisition by nearly tenfold. By creating a partnership allowing wildlife funds to participate in acquisitions already planned by the Natural Areas Acquisition Fund, we have been able to acquire more land and educate other user groups about natural areas. First, the natural areas acquisition list is created. Then the list is reviewed to identify which sites are compatible with public hunting. Once these sites are identified, local wildlife organizations are asked to contribute. These monies are then matched one-to-one by the appropriate State habitat fund. The result is Natural Areas Acquisition Funds are conserved and Wildlife Special Funds are more than doubled. Lands purchased through this partnership will be registered into one of the State's nature preserve programs and management priorities will be based on the natural area's needs.

RICKARD, JAMES K.*¹, DALE WADE². 1- U.S. Fish and Wildlife Service, Jimmy_Rickard@fws.gov 2-U.S. Forest Service, Athens GA, rxfire@ix.netcom.com.
Herbaceous plant response to 2-year burning cycles applied at different calendar dates during the growing season.

This study is being conducted on the Piedmont National Wildlife Refuge located in the lower piedmont of Georgia in Jones County. Many southern resource managers are incorporating growing-season burns into their prescribed fire programs. The study objective is to determine the response of herbaceous and woody plants to eight separate burning windows during the growing-season to provide managers information on varying the application date of growing-season fires. The study is not designed to compare growing-season burns with dormant-season burns or unburned areas. The study area had been managed with a 4-year winter-burning cycle and is dominated by a pine overstory. Biennial burns are conducted at the first opportunity during each 3-week treatment period starting April first and running consecutively into September. Each plot will be burned four times during the same treatment window to help capture cumulative responses emerging with repeat burns and to help accommodate yearly variability in burning conditions. Two permanent 100' line transects along the slope contour on each plot are inventoried during the spring, summer and fall each year to assess species composition and frequency. Along each transect there are three milacre 0.001 (3.7' radius) plots on which we estimated percent cover of life form groups less than 4.5' tall. This paper presents preliminary groundlayer species composition trends after two burns and discusses ramifications of the current 3-year drought on their results.

ROSS, MICHAEL S.*¹, J. F. MEEDER¹, P. L. RUIZ¹, D. L. REED¹, E. GAISER¹, R. ALLEMAN², AND SARAH BELLMUND³. 1-Florida International University, Miami, FL, USA, 2-South Florida Water Management District, West Palm Beach, FL. **The L-31E Pilot Project: Coastal Restoration in Biscayne National Park.**

The coastal wetlands of Biscayne National Park have been cut off from sheet flow for decades. During that time, the tall fringe forest adjacent to the coast has broadened, and the mixed graminoid-mangrove zone further inland has been replaced by a dense monoculture of dwarf mangroves extending to the base of the L-31E levee—a structure built in the mid 1960's to minimize the impact of storm tidal waters. In an attempt to reestablish the pre-development coastal gradient while mitigating canal point discharge into Biscayne Bay, the L-31E Pilot Project was initiated in 1993. Treatment consisted of the redirection of fresh water from the L-31E Canal into a ~25 ha section of mangroves via a passive delivery system. Since August 1997 we have observed the extension of *Cladium jamaicense* (sawgrass) and *Eleocharis cellulosa* (spikerush) in the Treatment Block, but no treatment-related increase in dwarf mangrove productivity.

Vegetation recovery from two freeze events have complicated interpretation of treatment effects. The modest effects observed so far suggest that reestablishment of historical coastal plant communities is possible, but will be a slow process, dependent on the quality, quantity, and timing of fresh water delivery.

RUIZ, GIL RODRIGUEZ. Osa Conservation Area, Costa Rica. **The Osa conservation area: biodiversity and problem about relationship and sustainable use of the biodiversity.**

For the geographic position, ACOSA (Osa Conservation Area, of Costa Rica) includes a sample of the most representative natural resources of the country, with great scientific value. The biodiversity is abundant in terrestrial and marine species, endemics and species at risk of extinction (Birds and felines). The area is important for Indians (specially the Caño Island) and has considerable archeological value. The largest wild protected areas are about 145,492 hectares (without marine extensions or mangroves representing 34.5 % of the territorial extension of the total area). Within exist 3 national Parks, 1 Biology reserve, 10 wild lodge, one forestry reserve and two wetlands. One of the most importance national park of Costa Rica is located on the Osa Conservation Area. Corcovado National Park is the only Costa Rican example of the park with a complete border for the forestry reserve, Golfo Dulce. Corcovado protects the reserve for 45 kilometers. Because forest cover has been lost in the reserve, the need for forestry resource protection of the park will be great. The park protects one of the last remaining tropical rain forest in the Pacific. Because of biogeography and climate in the zone and because deforestation has been lower than in other areas, a great diversity of species still exists. Wildlife is abundant. In the very humid forest of Costa Rica, there are all the large mammals of the neotropics, like the Pecari (*Tajassu pecari*), Tapir (*Tapirus bairdii*), Mazama (*Mazama americana*), Jaguar (*Panthera onca*) and Puma (*Puma concolor*).

RUIZ, PABLO L.* AND MICHAEL S. ROSS. Southeast Environmental Research Center, Florida International University, Miami, FL, USA. **Population Dynamics of *Pinus elliottii* var. *densa* in Everglades National Park: A Case for Less Frequent Prescribed Fires.**

During a six-year period (1995-2000), the survival and cone production of adults, and the establishment, development, and survival of *Pinus elliottii* var. *densa* seedlings were monitored in a one-hectare plot of south Florida pine rockland in Everglades National Park. Adult mortality ranged from 7 trees ha⁻¹ yr⁻¹ (1994-95) to 1 tree ha⁻¹ yr⁻¹ (1999-2000). Trees \geq 25 cm DBH, approximately half of the stand's basal area, accounted for 70% of the total cone production per year. Cone production ranged from a low of 945 cones ha⁻¹ in 1999 to a maximum of 3,207 cones ha⁻¹ in 1996. Seedling density ranged from a low of 177 stems ha⁻¹ in the fall of 1995, following a prescribed fire, to a high of 29,205 stems ha⁻¹ in the winter of 1996. Seedling mortality as a result of three prescribed fires ranged between 86% and 97%, while mortality in non-prescribed fire years did not exceed 8%. Furthermore, as a result of these high fire mortality rates, only two out of the 1,581 seedlings that became established in our plots remain alive. However, several seedlings that were already present in 1995 have survived and are emerging into the tree stratum. Fire management plans should call for extended fire return intervals during stand development stages when recruitment into the tree stratum is necessary.

SAH, JAY P. Department of Biological Sciences, Florida International University, University Park, Miami, FL, USA. **Effects of fire and grazing on structure, diversity and biomass production in seasonally flooded grasslands, Nepal.**

Grazing and burning are common in seasonally flooded grasslands of Nepal. Grasslands in the study area within the Royal Shuklaphanta Wildlife Reserve were dominated by *Vetiveria zizanioides* and *Imperata cylindrica*. The objective of the study was to determine the effect of grazing and burning on structure, species richness and biomass production. A randomized split-block experiment with 9 treatments, each with replicate plots of 20mx20m, resulted from combinations of burning (unburned, early-burned, and late-burned) and grazing (ungrazed, lightly-grazed and heavily-grazed) treatments was performed. I hypothesized that species richness and biomass production would be greater in lightly grazed early-burned plots. After two annual treatments, community structure was different across the treatments. Species richness was highest in lightly grazed early-burned plots. Relative abundance of *I. cylindrica* was higher in burning/grazing than in grazing or burning treatments. Above ground biomass production in ungrazed early-burned plots was highest, indicating that early spring burning enhanced production. Proportion of biomass of *I. cylindrica* in total live biomass showed an increasing trend with the disturbance intensity, while *V. zizanioides* showed an opposite trend. I concluded that species richness and biomass production were highest at moderate disturbance level represented by the lightly grazed and ungrazed early-burned plots.

SCHAUB, RON. Dynamac Corporation, Kennedy Space Center, FL, Ronald.Schaub-1@ksc.nasa.gov. **The Fire Weather Information Machine (FWIM) – A Sub-System of the Fire Management and Analysis Network (FireMAN).**

To increase opportunity and effectiveness of controlled burn efforts and to better respond to wildfire events Dynamac Corp. and Matrix Information Systems, Inc., have developed an electronic, information based system describing the potential for occurrence and impact of wildland fire referred to as the Fire Weather Information Machine (FWIM). FWIM, a sub-system of the Fire Management and Analysis Network (FireMAN), is based on source data from the Kennedy Space Center (KSC) - Cape Canaveral Air Force Station (CCAFS) meteorological grid. Daily, FWIM processes more than 100,000 weather observations and generates an additional 70,000 unique fire weather values. Spatial analysis and map production is performed with ESRI Arc Info. Fire weather indices are calculated with WeatherPro 3 by Remsoft Inc. Hourly and daily indices are presented using the Canadian Fire Weather Information System and the National Fire Danger Rating System. Fire weather information presented in FireMAN are used by the US Fish and Wildlife Service Fire Management Office to plan controlled burns and to support space program operations response to fire events at KSC and CCAFS. The FireMAN application provides decision support for the maintenance and protection of natural, cultural, and industrial resources in a pyrogenic landscape.

SCHMALZER, PAUL A. Dynamac Corporation, Kennedy Space Center, FL, schmapa@ksce.ms.ksc.nasa.gov. **Growth of oak-saw palmetto scrub through 10 years after fire.**

Oak-saw palmetto scrub is a shrub community of acid, sandy, well-drained soils in Florida maintained by periodic, intense fire. In this study, we followed changes in vegetation along 15 m line-intercept transects, established in 1983. Two stands (8 transects) burned in a prescribed fire in December 1986; the stands were 11 yr (N=4) and 7 yr (N=4) from the previous fire when burned. We sampled transects 6, 12, 18, and 24 months and then annually through 10 years postburn. We measured cover in two height classes, > 0.5 m and < 0.5 m; we measured height at four points (0, 5, 10, and 15 m) along each transect. Saw palmetto cover equaled preburn values by 1 yr postburn and changed little after that. Cover of oaks > 0.5 m (*Quercus myrtifolia*, *Q. geminata*, *Q. chapmanii*) equaled preburn values by 5 yr postburn and changed little by 10 yr

postburn. Height growth continued, increasing from 84.0 cm at 5 yr to 125.9 cm at 10 yr postburn. Bare ground declined to < 2% by 3 yr postburn. Plant species richness increased slightly after fire and gradually declined. These vegetation changes alter habitat conditions for threatened and endangered animals and plants.

SCOTT, J. MICHAEL¹ AND FRANK W. DAVIS². 1-U.S. Geological Survey, Department of Fish and Wildlife, University of Idaho, Moscow, ID, USA, 2-Donald Bren School of Environmental Science and Management, University of California, Santa Barbara, CA, USA. **Nature reserves: Do they capture the full range of America's biological diversity?**

Less than 6% of the coterminous United States is in nature reserves. Assessment of the occurrence of nature reserves across ranges of elevation and soil productivity classes indicates that nature reserves are most frequently found at higher elevations and on less productive soils. The distribution of plants and animals suggests that the greatest number of species is found at lower elevations. A preliminary assessment of the occurrence of mapped land cover types indicates that ~60% of mapped cover types have <10% of their area in nature reserves. Land ownership patterns show that areas of lower elevation and more productive soils are most often privately owned and already extensively converted to urban and agricultural uses. Thus any effort to establish a system of nature reserves that captures the full geographical and ecological range of cover types and species must fully engage the private sector.

SHARMA, JYOTSNA*, T. P. HOLTSFORD, AND C. J. STARBUCK. University of Missouri, Columbia, MO, USA, jsb68@mizzou.edu. **Genetic Diversity in the Federally Threatened *Platanthera praeclara* (Orchidaceae).**

Platanthera praeclara (Sheviak and Bowles) is a threatened terrestrial orchid of prairies that occurs in 7 midwestern states in USA. Bimodal distribution of population sizes in the species' range raises concern for its conservation. Information on its patterns of genetic variation is needed to develop efficient conservation strategies. Protein electrophoresis was employed to survey genetic diversity within and among 8 populations of *P. praeclara* from Minnesota. Variation in molecular markers such as isozymes and allozymes was examined by resolving 13 loci, of which, 3 were monomorphic across all populations. Number of alleles per polymorphic locus (Ap) ranged from 2.00 to 2.25 and percentage of polymorphic loci (P) ranged from 15% in the smallest population to 69% in a medium sized population. In general, number of alleles was higher in larger populations. A significant positive correlation was observed between expected heterozygosity and population size ($R_s = 0.78313$; $P = 0.02150$). The G_{st} value of 0.102 indicates that 90% of variation resides within populations. Geographic distance and genetic distance were not positively correlated suggesting gene flow maintained by seed and pollen movement.

SIMBERLOFF, DAN. University of Tennessee, Knoxville, TN, USA. dsimberloff@utk.edu **We can win the war against introduced species.**

Introduced species, the second greatest cause of species endangerment, threaten more species than pollution, harvest, and disease combined. Their numbers increase steadily. Facing globalization, many conservationists see us as doomed to an accelerating tide of invaders that will homogenize the earth and extinguish multitudes of species locally, regionally, and globally. In fact, even though we have only recently recognized the magnitude and complexity of the problem, there have been successes in the war against introduced species. Many species that might have been introduced have been excluded, many that have gotten in have been eradicated, and many that have persisted have been managed at tolerable levels. Further, many techniques

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that have achieved these victories are not complicated, and the technologies can become far more effective. The biggest impediment to far more substantial progress is political rather than scientific or technological. The legal framework of multilateral trade treaties must be reorganized or reinterpreted to account for increased understanding of how invasions occur and what impacts they cause, while commercial interests must be convinced to incorporate the costs of a more comprehensive effort to exclude invaders. The entire effort has to be more integrated. Invasions will still occur, but their number and impact could be reduced to a small fraction of current figures.

SLEISTER, RANDALL K. Volusia County Land Management Department, Daytona Beach, FL, USA, sleister@totcon.com. **Florida Scrub Jay Restoration and Protection in Volusia County, Florida.**

In 1994, Volusia County initiated a project to restore and provide suitable habitat for the threatened Florida Scrub Jay on 400 acres of overgrown sand pine scrub, now known as the Lyonia Preserve in Deltona, Florida. Among the restoration techniques used during Phase I were sand pine harvesting, roller chopping, controlled burning, and root raking. Prior to 1994, no jays were found on site. Today jays occupy the site and have successfully bred for 5 years. The success of this project has encouraged Volusia County to embark on an ambitious project on nearly 4,000 acres known as the Volusia County Scrub Reserve.

SNYDER, KENNETH L.*, K. J. PONZIO, M. A. LEE, S. J. MILLER, AND M. C. MINNO. St. Johns River Water Management District, Palatka, FL, USA, ken_snyder@district.sjrwmd.state.fl.us. **Restoring pasture to floodplain marsh: the process.**

Florida's past practices of draining and converting marshes to agricultural use have resulted in both the loss of flood protection for surrounding and downstream urban areas and the destruction of highly unique and productive habitat. The Sixmile Creek Marsh Restoration Project represents one attempt to restore a 2,800 acre formerly diked and drained portion of floodplain marsh to its original function and value. The concept and logistical considerations of actually returning a working pasture to an ecologically functioning marsh requires the coordination of efforts among a diverse group of people and government agencies. Necessary physical improvements require the removal of the agricultural infrastructure (fences, culverts, and artesian wells). Ecological manipulations include re-establishment of natural hydrologic conditions via pumping and negating the effects of existing drainage patterns and the isolating effects of levees. Water levels, vegetation changes, and wildlife usage were monitored. We will describe lessons learned and results achieved in the process of completing a large-scale wetland restoration project in Florida.

SOEHN, DANA A.* AND K.D. JOHNSON. Great Smoky Mountains National Park, Gatlinburg, TN, USA. **Exotic Plant Field Species at Backcountry Horse Campsites in Great Smoky Mountains National Park.**

Managers of natural areas have become increasingly concerned about the impacts of recreational horse use on natural communities. The spread of exotic plant field species (EPFS) through hay and manure into the backcountry is a concern at Great Smoky Mountains National Park, which has 61 backcountry horse camps and 517 miles of maintained horse trails. In the summer of 1999, we collected data at 85 backcountry campsites and 5 auto-access sites. The objective of this project was to document the occurrence and amount of area covered by EPFS. A total of 42 exotic plant species were recorded. Of these, 36 species are EPFS likely to be found in hayfields or pastures and are the only species considered in our analyses. Backcountry campsites with horse use (n=60) and those campsites closed to horse use within the last 30 years (n=13) have a

significantly ($p=.004$) larger area covered by exotic species likely to be found in hayfields and pastures than those sites with no history of horse use ($n=11$). Auto-access front country horse camps ($n=5$) have a significantly ($p>.0001$) larger area covered by EPFS than backcountry horse use sites. This survey can help us estimate the area infested with exotic plant field species in the backcountry and evaluate the invasive threats of those species. In addition, this information will help park managers better assess backcountry guidelines for horse use.

STALMANS, MARC*¹, E. T.F. WITKOWSKI, AND K. BALKWILL. School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg, Republic of South Africa; 1- present address: Mpumalanga Parks Board, Nelspruit, South Africa. **Landscape management using a *laissez-faire* approach to fire in the Songimvelo Game Reserve, Mpumalanga, South Africa (1987-2000).**

The mountainous landscape and the diverse vegetation of the 48,000 ha Songimvelo Game Reserve (Mpumalanga Province, South Africa) have been shaped by fire since time immemorial. In contrast to the tightly regulated fire management generally applied in Protected Areas in southern Africa, a *laissez-faire* approach to fire has been permitted over the last 13 years. More than 1,300 individual fires have been documented. Most fires were induced by pastoralists still resident in the reserve or living on its periphery. The fire return period was 2.9 years in the game-fenced section, whereas a lesser-grazed 14,000 ha section with a higher annual rainfall burned on average every 1.5 years. These fire return periods are in line with generally accepted management prescriptions for similar grasslands and savannas. The broader frequency distribution around the mean probably conforms more to a 'natural' fire regime than the fixed or mechanistically-determined fire return period prescribed under traditional management systems. The annual number of fires and number of individual patches were consistently higher for the documented fire pattern compared to two theoretical fixed fire regimes. The observed fine-scale, dynamic fire pattern and high value of landscape indices suggest the current *laissez-faire* approach is appropriate for the maintenance of biodiversity.

STOCKER, RANDALL K.* AND A. FOX. Center for Aquatic and Invasive Plants, IFAS, University of Florida, Gainesville, FL, USA, aqplants@mail.ifas.ufl.edu. **Assessing the Assessments – Regional Efforts Lead to National Program?**

In January 2001, the National Invasive Species Council approved the first edition of the National Invasive Species Management Plan (www.invasivespecies.gov), which focuses federal activities on several priority areas:

- federal agency coordination and international cooperation
- prevention
- risk assessment protocols
- early detection and rapid response
- control and management
- restoration of natural areas degraded by invasive species
- research and monitoring
- information sharing, education and public awareness
- resources and funding

Almost all priority areas will benefit from scientifically defensible methods to assess the relative risk and impact (economic and ecological) of invasive species, present and potential. The University of Florida Invasive Plants Working Group has developed the Assessment of Non-Native Plants in Florida's Natural Areas to summarize, for species currently in the State,

information in four areas: Ecological Impacts, Potential for Expansion, Difficulty of Management, and Commercial Value. Debate continues over the relative merits of this and many other assessment protocols that have been developed, and over the need for a national protocol to unify state and regional efforts.

SYMSTAD, AMY J. Illinois Natural History Survey, Savanna, IL, USA, asymstad@inhs.uiuc.edu. **Establishing restoration goals for a degraded sand prairie.**

Detailed information on the vegetation of a site before restoration begins will help determine which methods will be most effective for achieving the end goals. Similar information from protected remnants can be used to establish those goals. I used such information to establish vegetation restoration goals for a degraded sand prairie at Lost Mound, a former military installation in northwestern Illinois. Although this site has not been plowed for at least 80 years, and perhaps never, fire suppression and heavy grazing have affected the native vegetation. Current vegetation at this site differs from nearby nature preserve remnants in composition and total plant cover. Higher total plant cover at the restoration site is due to its higher graminoid cover, much of which is non-native. Native species comprise 29-60% of total cover at the restoration site, compared to an average of 95% in the remnants, but native species richness among sites is similar. The composition of this diversity differs, however, in that it is comprised of more disturbance-resistant species at the restoration site. Thus, restoration techniques at this site should focus on increasing the diversity and abundance of more conservative native species while decreasing non-native species abundance.

TAYLOR, D. SCOTT. Brevard Mosquito Control District, Valkaria, FL, USA, dstaylor@digital.net **Saltmarsh mosquito impoundment management in east central Florida.**

The Indian River Lagoon (IRL) spans much of the east coast of Florida, and the marshes bordering the IRL were historically highly productive breeding sites for saltmarsh mosquitoes (*Ochlerotatus* spp.). Saltmarsh mosquitoes lay eggs in damp marsh substrates, and tidal flooding and/or rainfall can hatch tremendous numbers of eggs simultaneously, leading to the emergence of mass "broods" of adults which can swamp entire coastal communities. In addition, the adults can migrate long distances, so development of coastal sections of Florida was greatly inhibited by this problem. This presentation addresses the historical aspects of saltmarsh mosquito control in east central Florida, which included extensive pesticide usage and marsh destruction followed by construction of over 16,000 ha of impoundments. Current methods of mosquito impoundment management are outlined. Modern water management techniques have allowed effective mosquito control through source reduction, while some natural marsh functions are retained, thus enhancing ecological links with the IRL.

THAXTON, JARROD M.* AND W. J. PLATT. Louisiana State University, Baton Rouge, LA, USA. **Effects of small-scale fuel load variation on fire and shrubs in pine savanna.**

Heterogeneous fuel loads and fuel types are expected to produce spatial variation in fire intensity within single fires. This variability may in turn affect patterns of survival and resprouting of established vegetation. We tested these hypotheses in relation to the groundcover shrub community of a longleaf pine (*Pinus palustris*) savanna by experimentally manipulating pre-fire fuel loads in 1m² plots. Prior to growing season fires in 1999, each plot was randomly assigned one of four fuel load treatments: fine fuel removal, pine needle addition, wood addition or control. These treatments were designed to mimic the range of natural fuel load variation occurring in these savannas. Addition of fuels (pine needle addition and wood addition plots) increased pre-fire fuel loads, percent fuel consumption as well as maximum fire temperatures

relative to control plots. In contrast, fine fuel removal decreased pre-fire fuel loads, percent fuel consumption and maximum fire temperatures relative to controls. Shrubs were top-killed in all plots, but damage to stems of established shrubs was increased in fuel addition plots. Similarly, shrub mortality was increased and resprouting decreased in fuel addition plots relative to controls. These results suggest that fuel load variation at a scale as small as 1m² can have significant effects on patterns of fire intensity and shrub resprouting.

THOM, RICHARD H. Missouri Department of Conservation, Jefferson City, MO, USA, thomr@mail.conservations.state.mo.us. **Establishing a comprehensive, statewide natural areas system: some thoughts on getting started.**

Since the 1960s many states have established strong, comprehensive natural areas programs. But many other states fall short of comprehensive systems, and some have no natural area programs. Although excellent models exist for state programs, each state's situation is different. States with weak or nonexistent programs will not spontaneously generate a model program complete with strong legislation, staff and funding. So how does a state begin to improve its natural areas program? First steps include evaluating why the state does not have a strong program; taking inventory of potential natural area resources and partners; and charting a realistic course to move toward a comprehensive natural areas system. For this to happen requires interest and leadership from agencies, organizations, lawmakers, and others within the state to network, organize, create a vision, and market that vision. It may not be a quick process, but it may be unrealistic to immediately create a model system before a critical mass of support and understanding exists. Something as simple as forming an "natural areas council" of interested partners could be an effective first step toward improving a state's natural areas program.

VLASHIN, MOJMIR. Ecological Institute Veronica of the Czech Union for Nature Conservation, Panská str.9, CZ-60200 Brno, The Czech Republic. **Logging Destroys Šumava National Park**

Šumava National Park is the largest National Park in the Czech Republic. Forests covering 80 percent of the Park's area. The ridges of the Šumava mountains reach heights of 1300 meters and create the border between the Czech Republic, Germany and Austria. Bayerischer Wald National Park is protected on the German side of the border. Šumava National Park is divided into three zones. The core (natural) zone- only 13 percent of the park's area - is made up of the most precious natural ecosystems (natural and virgin forest, peat bogs, glacial lakes). The second zone - 82 percent of the park's area - is comprised of human-interfered ecosystems, where the aim of management is their renaturalization and joining to the first zone. The third zone - 5 percent of the park's area - is comprised of human seats. The forests of the second zone of the Park have already been liquidated by logging during the last four years under the pretext of an overpopulation of European spruce bark beetle (*Ips typographus*). But the consequences of the logging (clearings of many hectares, erosion rills, etc.) are much worse than the consequences of the bark beetle infestation (i.e. dead spruce trees). In big contradiction is a non-touch management in NP Bayerischer wald. The crux of the problem is that the administration of the NP Šumava is wholly controlled by technocratic-minded foresters, who believe they are able to rule the development of ecosystems better than nature.

WALK, J.W.¹, T.L. ESKER², A.J. YOUNG², AND MARK PHIPPS³. 1-University of Illinois, Urbana, IL, USA, j-walk@uiuc.edu, 2-Illinois Department of Natural Resources, Newton, IL, 3-Illinois Department of Natural Resources, Alton, IL. **Range Expansion of the Exotic Eurasian Collared-Dove into Illinois.**

The first accepted record of the Eurasian Collared-Dove (*Streptopelia decaocto*) in Illinois was in Clinton County in 1997. Since, this exotic species has been reported from 36 counties, particularly in northeastern and south-central Illinois. During the 20th century, the Eurasian Collared-Dove has undergone a worldwide range expansion, invading Europe from its historic range in the Indian subcontinent in the 1930s. By the 1950s, Eurasian Collared-Doves had colonized the United Kingdom and now occur as far north as Iceland. Eurasian Collared-Doves were introduced into the Bahamas in 1975 and were first confirmed in Florida in 1986. The species is spreading rapidly across North America, and by 2001 had been reported in 36 states and 3 Canadian provinces. This species feeds on agricultural grains, fruits and seeds. In Illinois, Eurasian Collared-Doves have primarily been associated with urban areas, particularly grain elevators and bird feeders. The effect of this species on Illinois ecosystem has yet to be determined. At a minimum, Eurasian Collared-Doves will occupy a niche in urban areas, but it is unknown if this will be at the expense of Mourning Doves (*Zenaida macroura*) or other native bird species. Additional information is needed on the distribution, abundance, range expansion and interactions of Eurasian Collared-Doves with other species in Illinois.

WALTERS, LINDA*¹, LISA WALL¹, AND R. GRIZZLE². 1- Dept. of Biology, Univ. of Central Florida, Orlando, FL, USA, ljwalter@pegasus.cc.ucf.edu; 2- Jackson Estuarine Laboratory, Univ. of New Hampshire, Durham, NH, USA. **Recruitment of the oyster *Crassostrea virginica* on intertidal reefs in areas with intense boating activity.**

Productivity, diversity and survival of estuaries are threatened by explosive coastal population growth and associated recreational activities. One major area of recreational growth has been the number of people zooming around in small pleasure craft. In counties bordering Mosquito Lagoon (northernmost section of the Indian River Lagoon system, east coast of central Florida), there were 51,000 registered boaters in 1998. Numbers have increased 10% annually since 1986 and continue to grow. In areas of Mosquito Lagoon with intense boating activity, intertidal reefs of *Crassostrea virginica* with dead margins commonly occur. The dead margins consist of mounds of disarticulated shells. The cause(s) of the reef die-offs is unclear. However, the disarticulated shells may be reducing reef sustainability if these surfaces are unavailable for oyster recruitment. Recruitment trials were run on eight reefs (4 impacted, 4 healthy) in the summers of 2000 and 2001. All settled individuals were mapped and followed for one month. Sediment loads, temperature and water motion were also monitored. To determine if shells remained in the reef area or were lost to the system, 600 individual shells were tracked. Data of this type is needed to identify causes of reef declines, habitat-specific management protocols and appropriate restoration protocols.

WEISHAMPEL, JOHN F., Department of Biology, University of Central Florida, Orlando, FL, USA, jweisham@mail.ucf.edu. **A Spatial Modeling Framework for Studying Biocomplexity of the Indian River Lagoon.**

Dozens of models (e.g., tidal hydrodynamic, salinity, pollution load reduction, 1D and 3D water quality circulation, bathymetric, light availability, land-use transition, seagrass growth, sediment transport, etc.) have been developed for the Indian River Lagoon System (IRL) and its surrounding watershed. New or existing models (e.g., ecological economic, mangrove gap, exotic species spread, microbial decomposition, larval transport, manatee movement, recreational usage, water management, sea-level rise, etc.) will continue to be developed or adapted for the IRL. However to address biocomplexity issues requires that such multidisciplinary efforts be integrated. Landscape ecological theory and spatial modeling using GIS will play critical roles in understanding and predicting the effects of the interactions among natural systems and humans across a variety of spatio-temporal and organizational scales. Landscape ecology is the body of

knowledge that focuses on questions about ecological space, spatial heterogeneity, and scaling. This paper will draw from existing integrative landscape modeling examples for wetland and estuarine systems (e.g., Across Trophic Level System Simulation, Coastal Ecological Landscape Spatial Simulation, Everglades Landscape Model, Patuxent Landscape Model) and put them into the context of the IRL.

WENNY, DAN. Illinois Natural History Survey, Savanna, IL, USA. **Seed predation of two native tree species that invade grasslands.**

Prairies are defined as open grasslands lacking trees yet woody plant species often invade tallgrass prairies, even those undergoing prescribed burns. Because an abundance of trees and shrubs in prairie can lead to declines of prairie-dependent species, understanding the causes of woody encroachment may be useful to land managers. Lack of predators is one factor that can facilitate the success of invasive species. I tested the hypothesis that low rates of seed predation can promote woody invasion of grasslands in northwest Illinois. I examined seed removal of black cherry (*Prunus serotina*) and roughleaf dogwood (*Cornus drummondii*) as an estimate of seed predation in forest and adjacent prairie. Seeds were placed at 5 m intervals along transects and monitored for 30 days. 200 seeds were used in each habitat. Both the rate and total amount of seed removal was significantly higher in prairie than in forest and differed more among habitats than among seed species. However, all seeds were not removed in either habitat. Thus, the lack-of-predators hypothesis was not supported for these two species. Instead, even modest levels of seed dispersal into grasslands may saturate predators and taking steps to limit seed input (i.e. removing perches) may help limit woody encroachment.

WEST, PAUL¹, M. REUTER², S.L. HORN*², R.L. SPARKS³, AND A. BESHARA⁴. 1 – The Nature Conservancy, Wisconsin Chapter, Madison, WI, USA, pwest@tnc.org; 2 – The Nature Conservancy, Illinois Chapter, Peoria, IL, mreuter@tnc.org, shorn@tnc.org; 3 – Illinois Water Resources Center, University of Illinois, Urbana, IL, rsparks@uiuc.edu; 4 – The Nature Conservancy, Global Resources Center, Arlington, VA, abeshara@tnc.org. **An Action Plan for Landscape-scale Conservation in the Upper Mississippi River Ecosystem.**

The Upper Mississippi River (UMR) ecosystem supports hundreds of ecoregional priority areas in the Superior Mixed Forest, Prairie-Forest Border, Northern Till Plain, Central Tallgrass Prairie, Interior Low Plateau, and Ozarks ecoregions. Representatives from Minnesota, Wisconsin, Iowa, Illinois, and Missouri met in June 2001 to draft an action plan for landscape-scale conservation in the UMR ecosystem. This process resulted in a clear, compelling vision to guide the Conservancy's conservation actions in the UMR for the next several years. More than a dozen active partners were solicited in the Fall/Winter 2000 to provide input into planning in order to enrich our information and to ensure that the Conservancy would be adding to existing efforts rather than duplicating them. The Conservancy plans to invest significant resources within the next two years at 29 landscape projects in the UMR, most of which have aquatic and terrestrial conservation targets, and all sites contribute to the recovery of the UMR. This presentation will provide an overview of the significance of the UMR from a broad multi-ecoregional perspective, identify primary threats to the ecosystem, and highlight the major strategies identified as important for the Conservancy to pursue as a partner in the conservation of the UMR ecosystem: 1) strengthen conservation science; 2) restore bluff – floodplain landscapes (model projects); 3) work with partners to promote more natural flow regimes in the UMR; and 4) improve policy framework.

WIEDENMANN, ROBERT N., SUSAN POST, MICHAEL JEFFORDS, AND DAVID VOEGTLIN. Illinois Natural History Survey, Champaign, IL, USA, r-wiede@uiuc.edu. **Loosestrife on the run.**

Purple loosestrife is an exotic weed that severely threatens the natural composition of wetlands in Northern Illinois. The most promising method to restore the natural state of these wetlands is using biological control to reduce weed populations to levels low enough to allow native vegetation to flourish. Beginning in 1994 the State of Illinois began a purple loosestrife biological control program. With the Illinois Natural History Survey taking the lead in 1995, purple loosestrife in Illinois would no longer be on the loose. The Illinois program includes partnership with land managers, administrators, and scientists from a wide variety of organizations; mass rearing of *Galericucella* beetles for statewide releases; and developing and supporting on-site rearing and educational materials for middle school and high school students. With over 2 million beetles released at over 210 sites, and over 200 educators trained, purple loosestrife is truly on the "run" in Illinois.

WILLIAMS, CHARLES E.*¹, B. BROKAW¹, AND W.J. MORIARTY². 1-Clarion University, Clarion, PA, USA, cwilliams@clarion.edu; 2-USDA Forest Service, Allegheny National Forest, Warren, PA. **In-stream large woody debris loading and forest age on the Allegheny High Plateau: implications for riparian forest management.**

Large woody debris (LWD) is an important structural and functional component of streams in forested landscapes and the quality and quantity of LWD recruited into streams is closely linked to forest management. We compared LWD loadings in headwater streams within second growth (60 to 80 years in age) and old growth (> 300 years in age) riparian forests of the Allegheny High Plateau Ecoregion, Pennsylvania. Volume (m³/100 m of stream) and density (no.stems/100 m of stream) of LWD were significantly greater for streams within old-growth forests than for those within second-growth. In-stream LWD volume ranged from 1.8 to 19.0 m³/100 m (mean = 6.0 ± 2.8 SE m³/100 m) at second-growth sites and from 9.3 to 25 m³/100 at old-growth sites (mean = 18.0 ± 2.7 SE m³/100 m); LWD density ranged from 6.0 to 18.0 stems/100 m (mean 10.8 ± 1.7 SE stems/100 m) at second-growth sites and 8 to 28 stems/100 m at old growth-sites (mean 18.3 ± 3.1 SE stems/100 m). Yellow birch (*Betula alleghaniensis* Britt.), northern red oak (*Quercus rubra* L.), black cherry (*Prunus serotina* Ehrh.), eastern hemlock (*Tsuga canadensis* Carr.), and red maple (*Acer rubrum* L.) were important contributors to in-stream LWD loading at second growth sites; eastern hemlock dominated old growth LWD. Managing riparian forests for old-growth features would be a desirable option for increasing LWD loadings in streams.

YANOSKY, ALBERTO, JOSE L. CARTES, AND ANA M. MACEDO. Prócer Argüello 208 c/Quesada, Asunción, Paraguay, ayanosky@mbertoni.org.py. **Private Efforts for the Conservation of Paraguayan Natural Areas.**

In 1989, the first experience in private land conservation began with the development of the Program of Private Nature Reserves within an NGO in Paraguay. Several properties have been recruited and a history about the Program and the properties is presented together with a short reference to the legal aspects concerning the private conservation initiatives in the country. Paraguay is characterised mainly for strong backgrounds of poverty forcing to almost sell the entirety fiscal lands and from the speculative value of the lands obtained a high rate and the trend stayed in time and nowadays these values are very high mainly due to the lack of fiscal lands (5 to 3% of the national territory). Based on result from the analysis in this work presented several points deserve mention: (a) it is of strategic priority the incorporation and the conservation development deprived in SINASIP, (b) the landowners need derived tangible legal, tributary and

economic benefits urgently on behalf of their land's conservation efforts, and (c) it is of high priority the preparation of strategies for future conflict dealing with the legal rigidity which does not allow development of sustainable economic activities (for example, nature tourism, photographic safaris, orchids and orchards of plants of economic importance, etc.) as part of the incentives.

YANOSKY, ALBERTO, RENE PALACIOS, AND CLAUDIA MERCOLLI. Prócer Argüello 208 c/Quesada, Asunción, Paraguay, ayanosky@mbertoni.org.py. **Ten years of Mbaracayu conservation and development: a successful model in eastern Paraguay.**

An international agreement, the "Agreement to Establish and Conserve the Mbaracayu Forest Nature Reserve and Surrounding Basin", was signed on June 27 1991 to give legal backing to the protection of the Mbaracayu Reserve. The signers of the agreement were the Government of Paraguay through the Ministry of External Relations, the Ministry of Agricultural and Livestock and the Ministry of Economy, the United Nations' representative in Paraguay, The Nature Conservancy, and Fundacion Moises Bertoni. The agreement was subsequently ratified in 1991 by Paraguayan Law 112, which created the protected area of the hydrographic basin as well as a reserve of multiple use within it. The Upper Jejui River Watershed encompasses roughly 300,000 hectares was declared a Biosphere Reserve by UNESCO in the year 2000, the first of its kind in Paraguay. This presentation will outline the role of this reserve in the society and will address issues on society involvement, the beneficiaries (native and local people), and will describe cuali, a quantitative indicator for sustainable development for the one of the first GHG Investment, which has shown to be a catalyst for conservation and development. General aspects of management, environmental education, outreach work and working and empowering local people and authorities will be discussed.

