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**and Disciplines”**  
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**Abstracts**  
(As of September 30, 2010)

This document includes all abstracts confirmed or being confirmed as of the above date. Oral Presentations are listed on Pages 1-29, and Poster Presentations are on Pages 29-53. Check the conference website for abstract updates and the schedule of concurrent sessions (<http://www.naturalarea.org/10Conference/>).

**Oral Presentation Abstracts**

**Alphabetical by Primary Presenter's Last Name**

**AN AQUATIC GAP ANALYSIS OF RIVERINE ECOSYSTEMS THROUGHOUT THE MISSOURI RIVER BASIN.** [Gust M. Annis](mailto:Gust.M.Annis@missouri.edu)<sup>1</sup>, [Scott Sowa](mailto:Scott.Sowa@tnc.org)<sup>2</sup>, [David Diamond](mailto:David.Diamond@missouri.edu)<sup>1</sup>, [Aaron Garringer](mailto:Aaron.Garringer@missouri.edu)<sup>1</sup>, [Phillip Hanberry](mailto:Phillip.Hanberry@missouri.edu)<sup>1</sup>, [Michael Morey](mailto:Michael.Morey@missouri.edu)<sup>1</sup>. <sup>1</sup>Missouri Resource Assessment Partnership (MoRAP), University of Missouri. [annisg@missouri.edu](mailto:annisg@missouri.edu); [diamondd@missouri.edu](mailto:diamondd@missouri.edu); [garringera@missouri.edu](mailto:garringera@missouri.edu); [hanberryp@missouri.edu](mailto:hanberryp@missouri.edu); [moreyme@missouri.edu](mailto:moreyme@missouri.edu). <sup>2</sup>The Nature Conservancy. [ssowa@tnc.org](mailto:ssowa@tnc.org).

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The Missouri River Basin encompasses portions of ten states and two Canadian provinces. It is the second largest river basin in the United States, is ecologically diverse, and drains approximately 17% of the country. The Gap Analysis Program's goal is to keep common species common by assessing representation within the existing matrix of conservation lands. To help achieve this goal within the Missouri River Basin the Missouri Resource Assessment Partnership (MoRAP) recently completed an aquatic gap analysis of the entire basin. This effort brought together Gap Analysis Program data developed by several organizations covering varying portions of the basin. The project objectives were to assemble seamless basinwide datasets consisting of a hierarchical classification of riverine ecosystems, predicted fish distribution models/maps, riverine stewardship characterizations, and indices of human threats to ultimately assess habitats and species not adequately represented within existing conservation lands (gap analysis). This presentation will 1) highlight each component of the

hierarchical classification including aquatic subregions, ecological drainage units, aquatic ecological system types, and stream valley segment types; 2) describe the development of both probability of occurrence and presence/absence models for 178 fish species in the basin; 3) show how these data were used to assess gaps in the conservation of riverine ecosystems and species at multiple spatial scales and; 4) present the results of the Missouri River Basin aquatic gap analysis.

**KEY WORDS:** AQUATIC GAP ANALYSIS, MISSOURI RIVER BASIN, ECOLOGICAL CLASSIFICATION, FISH PREDICTIVE DISTRIBUTION MODELS

**IVEGOT1.ORG: INTEGRATED INVASIVE SPECIES REPORTING AND TRAINING PROGRAM FOR FLORIDA.** Charles T. Barger<sup>1</sup>, Karan A. Rawlins<sup>1</sup>, Kristina Serbesoff-King<sup>2</sup> and David J. Moorhead<sup>1</sup> <sup>1</sup>Center for Invasive Species and Ecosystem Health, The University of Georgia, Tifton, GA, [bugwood@uga.edu](mailto:bugwood@uga.edu) <sup>2</sup>The Nature Conservancy, Hobe Sound, FL, [kserbesoffking@tnc.org](mailto:kserbesoffking@tnc.org)

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**IveGot1.org** is the portal to EDDMapS in Florida for reporting and tracking invasive species in the Everglades. EDDMapS, the **E**arly **D**etection and **D**istribution **M**apping **S**ystem, was developed to provide a more accurate picture of the distribution of invasive species. It is a tool to develop more complete local, state and regional level distribution data of invasive species, identify “leading edge” ranges of new invasive threats, provide a means of implementing EDRR, and help corroborate threats and refine invasive species lists and management priorities. EDDMapS allows land managers, agencies and others to set priorities for early detection and rapid response (EDRR), and formulate overall invasive plant management action plans.

**IveGot1.org** was developed through the partnership between the Florida Invasive Species Partnership and the Florida Exotic Pest Plant Council with support from U.S. Fish and Wildlife Service, National Park Service and the Nature Conservancy in cooperation with Florida Fish and Wildlife Conservation Commission and Florida Natural Areas Inventory.

**KEY WORDS:** invasive species, mapping, management plans, species lists, EDRR

**HOW MANY VISITORS DO I HAVE AND WHAT DO THEY THINK? CREATING AND TESTING A SIMPLE, STANDARDIZED VISITOR SURVEY YOU CAN USE ABOUT ANYWHERE...EVEN ON A NATURAL AREA.** Michele Baumer, Julie Fleming, Robin Grumm, Joel Sartwell, Colleen Scott and Tom Treiman. Missouri Department of Conservation. [Michele.Baumer@mdc.mo.gov](mailto:Michele.Baumer@mdc.mo.gov); [Julie.Fleming@mdc.mo.gov](mailto:Julie.Fleming@mdc.mo.gov); [Robin.Grumm@mdc.mo.gov](mailto:Robin.Grumm@mdc.mo.gov); [Joel.Sartwell@mdc.mo.gov](mailto:Joel.Sartwell@mdc.mo.gov); [Colleen.Scott@mdc.mo.gov](mailto:Colleen.Scott@mdc.mo.gov) and [Tom.Treiman@mdc.mo.gov](mailto:Tom.Treiman@mdc.mo.gov).

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The Missouri Department of Conservation (MDC) just completed a pilot project to develop a simplified visitor survey that conservation areas can apply on their own schedule and minimize the cost by using volunteers. MDC does not have current information on visitor numbers or their attitudes and opinions. This information helps area managers to develop programs, assign staff and volunteer time and market themselves to future visitors. We present the results of the

visitor survey from two areas, the Runge Conservation Nature Center (RCNC) in Jefferson City, MO and the Columbia Bottom Conservation Area in St. Louis, MO at the confluence of the Missouri and Mississippi Rivers. These survey results include visitor numbers and demographics, their activities and rating of activities, how they heard about the area, economic value and more. We will also present a survey template, which includes the rules, protocols, training methods and computer programs that were developed. These methods are easily adaptable to other locations.

**KEY WORDS:** VISITOR USE, SURVEYS, HANDHELD DATA RECORDERS and HUMAN DIMENSIONS

**LANDSCAPES OF PROPERTY, POLITICS AND PLACE: UNDERSTANDING 'REGIONS' FOR CONSERVATION ACTIONS.** David J. Brunckhorst, Phillip Morley, and Ian Reeve. Institute for Rural Futures and UNESCO Centre for Bioregional Resource Management, University of New England, Armidale 2351, Australia. [dbrunckh@une.edu.au](mailto:dbrunckh@une.edu.au) and [www.ruralfutures.une.edu.au](http://www.ruralfutures.une.edu.au) Ph. +61 267-733-001

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What's in a region? Governments, policy makers, scientists and planners struggle to provide strategies and implementation programs to integrate systems linkages of protected natural areas and other biodiversity conservation actions, with sustainable natural resources management, agriculture and other human activity. We contend that local government, ecoregional and catchment spatial contexts provide only part of the picture. In order to understand and apply a more integrated landscape regional approach to conservation actions, we suggest and operationalise a social-ecological 'systems' approach. In contemporary times, human activity of social systems and institutions such as property, politics and local citizens, 'place' identity and attachment shape patterns of landscapes and biodiversity as much as ecosystems do. Integrated ecosystem management must reflect local to landscape to regional scales of human institutions and activity to be effective and efficient, and to engage meaningfully with people and place – local to regional communities. Using an interdisciplinary approach based in landscape ecology, institutional economics and sociology theory to delineate such local to regional contexts, three key elements are required. Firstly, understanding scale and pattern of similar ecosystem or biophysical characteristics are important for resource management and conservation. Secondly, understanding the spatial patterns and scales of resident citizens 'place' identity and communities of interest are important for harnessing support and collective action. Thirdly that multiple scales or spatial nesting of regional social-ecological contexts is necessary in order to deal with externalities. An example of application of eco-civic regionalisation method in Australia will be provided, and suggestions for application in the USA.

**KEY WORDS:** REGION, ECOREGION, BIOREGION, ECOCIVIC REGION, LANDSCAPE PLACE IDENTITY, COLLECTIVE ACTION, INSTITUTIONS

**A CASE STUDY IN ECOSYSTEM RESTORATION IN FOREST PARK, ST LOUIS, MISSOURI.** Steven Buback, Chris Ferree, Forest Park Forever. [sbuback@forestparkforever.org](mailto:sbuback@forestparkforever.org); [cferree@forestparkforever.org](mailto:cferree@forestparkforever.org).

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Findings and results from ecosystem management and creation within Forest Park, the largest urban park in St Louis Missouri. Forest Park contains 150 acres of natural areas including 68 acres of old growth forest as well as prairie, savanna, and wetland restorations. 16 years of invasive species control, ecosystem restoration, and monitoring have resulted in nearly 600 plant species, over 200 bird species, and numerous invertebrates, including several of conservation concern. These ecosystems represent a unique urban habitat that provides environmental education opportunities for 12,000,000 Park visitors a year, as well as a laboratory for assessing the long-term impacts of fragmentation and urbanization.

**KEYWORDS:** URBAN ECOSYSTEMS, RESTORATION, INVASIVE SPECIES

**CREATING AN INTEGRATED VEGETATION MANAGEMENT PLAN FOR GEORGE WASHINGTON CARVER NATIONAL MONUMENT** [Michael P. Burfield](mailto:michaelburfield@mail.mizzou.edu)<sup>1</sup>, Charles H. Nilon<sup>1</sup>, and Lana Henry<sup>2</sup>. <sup>1</sup>Department of Fisheries and Wildlife Sciences, University of Missouri. [michaelburfield@mail.mizzou.edu](mailto:michaelburfield@mail.mizzou.edu); [nilonc@missouri.edu](mailto:nilonc@missouri.edu). <sup>2</sup>George Washington Carver National Monument; [lane\\_henry@nps.gov](mailto:lane_henry@nps.gov).

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George Washington Carver National Monument (GWCA) is a 97 ha historic site in southwest Missouri. Park managers are responsible for management of more than 90 ha of grassland and woodland. There have been several efforts to develop a long-term monitoring program to support management efforts at GWCA. We are working on a cooperative project to develop an Integrated Vegetation Management Plan for GWCA that includes input from multiple agencies and stakeholders. Park staff will use the plan as a guide for monitoring and management. A key aspect of the plan is the use of Habitat Suitability Index (HSI) models and presence/absence surveys for four prairie indicator species (Henslow's sparrow, ornate box turtle, northern bobwhite quail, and prairie vole) to evaluate 53 314-m<sup>2</sup> circular plots for existing prairie structure. In 2009 we found that there are areas of mixed quality across the prairie units, and management recommendations were provided to GWCA to address limiting habitat characteristics (scores <0.50) from HSI data. We used logistic regression to determine if HSI scores predict the presence of a species in a unit. A guidebook for using HSI models at GWCA is being created and includes a management matrix for each HSI model, allowing park staff to prescribe applicable management techniques based on ranges of HSI scores. Also, maps illustrating habitat quality for each indicator species will be developed using GIS. GWCA staff will be trained to implement an adaptive approach to management based on this project's habitat evaluation procedures.

**KEY WORDS:** GEORGE WASHINGTON CARVER NATIONAL MONUMENT, INTEGRATED VEGETATION MANAGEMENT, HABITAT SUITABILITY, ADAPTIVE MANAGEMENT

**EFFECTS OF SHADING ON THE REPRODUCTIVE ECOLOGY OF *SYNTHRIS BULLII* (PLANTAGINACEAE), A RARE SPECIES.** Katherine Chi<sup>1</sup> and Brenda Molano-Flores<sup>2</sup>.

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*Syntheris bullii* (Plantaginaceae) is a perennial prairie-savanna plant endemic to the Midwestern U.S. Threatened by habitat degradation (e.g., woody encroachment), this species was a candidate for federal protection in the 1980s because of range-wide decline. Further research is required to determine potential biological factors that might contribute to its rarity. The objectives of this study were to: (1) account for percentage of flowering individuals in 10 Illinois populations, (2) measure reproductive (e.g., fruit and seed set) and fitness (i.e., seed germination) differences among populations, and (3) determine if habitat characteristics (e.g., shading) account for observed reproductive differences. In 2008 and 2009, 10 populations of *S. bullii* were surveyed for total number of individuals, comparing numbers of flowering and sterile individuals. Additionally, each site was assigned a particular category according to community structure, with special attention on shading. Inflorescences were randomly selected from each population to measure fruit/seed set and seed germination. When examining the number of flowering plants in each population, there was no relationship between shading and percentage of flowering individuals. For both 2008 and 2009, higher fruit and seed set were observed in sites with more open canopies (e.g., dry-mesic prairies) compared to closed-canopy sites (e.g., cedar forests). No differences were observed in seed germination among the different habitats types, though there were differences among sites. From this data, we conclude that certain reproductive factors (i.e., fruit and seed set) are potentially related to shading conditions, though seed quality and overall recruitment do not appear to be affected.

**KEY WORDS:** *SYNTHRIS*, REPRODUCTION, GERMINATION, SHADING EFFECTS

**LIFE AFTER PHRAGMITES CONTROL: NATIVE SPECIES RESPONSE TO IMAZAPYR APPLICATIONS FOR CONTROLLING *PHRAGMITES AUSTRALIS* IN VIRGINIA.**

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Common reed, *Phragmites australis* (Cavanilles) Trinius ex Steudel *ssp. australis*, continues to expand into previously unoccupied wetland habitats throughout coastal Virginia. This invasion by a non-native haplotype of *Phragmites* is of major concern due to the loss of floral and faunal diversity, and changes in ecosystem structure. Each year, coastal resource managers in Virginia treat hundreds of acres with broad spectrum herbicides to control *Phragmites* in an attempt to restore and/or protect wetlands. A research project on Virginia's Eastern Shore provided an opportunity to study the response of both *Phragmites* and non-target native species to imazapyr-based herbicide. One year after treatment, *Phragmites* abundance was reduced by 87%. However, during the second growing season, the remaining *Phragmites* more than doubled, for a two-year overall reduction of only 54% compared to pre-treatment. Eleven plant

species including *Phragmites* occurred in the study area prior to treatment. One growing season after treatment, nine species occurred, with only two species common to pre- and post-treatment. By the second growing season, all 11 species occurring pre-treatment also occurred post-treatment, plus another 14 species not found previously. These results support the need for follow-up treatments to effectively control *Phragmites* while also demonstrating the resilience and high potential of invaded wetlands to recover following herbicide application.

**KEYWORDS:** IMAZAPYR, INVASIVE, NON-NATIVE, *PHRAGMITES*, RESTORATION

**Michigan's Biodiversity Conservation Planning Process.** [Joshua Cohen](#)<sup>1</sup> and Michael Donovan<sup>2</sup>. <sup>1</sup>Michigan Natural Features Inventory, Michigan State University Extension. [cohenj@michigan.gov](mailto:cohenj@michigan.gov); <sup>2</sup>Wildlife Division, Michigan Department of Natural Resource and Environment, [Donovanm@michigan.gov](mailto:Donovanm@michigan.gov).

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Michigan's Department of Natural Resources and Environment (DNRE) is currently working with a wide range of partners through its Biodiversity Conservation Planning Process to develop a network of functional representative ecosystems on DNRE administered lands. These Biodiversity Stewardship Areas (BSAs) will be managed with conservation of biological diversity as a high priority goal. The selection of these BSAs is based on three primary elements: ecosystem representation, functionality, and condition. This talk will discuss the following: the methodology utilized to develop the initial network of proposed BSAs; the potential of this methodology to also function as a gap analysis and survey and conservation prioritization tool; and preliminary survey results.

**KEY WORDS:** BIODIVERSITY, CONSERVATION PLANNING, FUNCTIONAL LANDSCAPE, ECOSYSTEM REPRESENTATION, GAP ANALYSIS, SURVEY PRIORITIZATION

**VEGETATION DYNAMICS OF A SUGAR MAPLE-OAK NATURAL AREA IN THE MISSOURI RIVER HILLS.** [C. Mark Cowell](#)<sup>1</sup> and Rose-Marie Muzika<sup>2</sup>. <sup>1</sup>Department of Geography, University of Missouri, Columbia. [mcowell@missouri.edu](mailto:mcowell@missouri.edu). <sup>2</sup>Department of Forestry, University of Missouri, Columbia. [muzika@missouri.edu](mailto:muzika@missouri.edu).

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Schnabel Woods is a protected natural area within the loess bluffs adjacent to the Missouri River floodplain in the outer Ozark Border ecological subsection. Species composition in Schnabel Woods reflects relatively mesophytic conditions relative to the broader region's native matrix of oak-hickory/prairie. A set of permanent plots was established in this 80-acre (32.4 ha) forest in 1982; these were subsequently re-sampled in 1992 and 2009. This study examines tree-by-tree changes in composition and structure of this forest over 27 years, as well as dendrochronology data, to analyze demographic patterns of recruitment, growth and mortality that characterize the successional processes in this forest.

Overall stand density has decreased, while basal area has increased over the past 27 years. As a group, oaks dominate the site, but have an aging unimodal population structure with very

limited regeneration. Only sugar maple has increased in density. These patterns, together with land history data and dendroecological analyses indicate that the stand does not likely have the “old-growth” status previously attributed to it, but rather shares characteristics with many human-modified forests throughout the eastern U.S. Given the mesic site, sugar maple established as an important constituent of Schnabel Woods earlier in the stand’s successional history than typically seen in many other eastern oak forests. The successional behavior of this stand offers some insights into the possible dynamics of sugar maple as it becomes increasingly dominant throughout the eastern deciduous forest, and presents implications for oak success.

**KEY WORDS:** FOREST DYNAMICS, MISSOURI, OAKS, SUGAR MAPLE

**A CASE STUDY FOR CONDUCTING NATURAL RESOURCE CONDITION ASSESSMENTS FROM EFFIGY MOUNDS NATIONAL MONUMENT, IOWA.**

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Assessment tools are essential for land managers to prioritize and justify management actions, and to help identify areas where additional funding is needed to adequately manage the resource. The National Park Service has initiated a service-wide program of Natural Resource Condition Assessments (NRCA). Here we discuss the NRCA at Effigy Mounds National Monument, Iowa, with an emphasis on the assessment framework and process employed. Specifically, we discuss: a heuristic tool for designing an assessment’s breadth, rigor and focus; a process for identifying resources, attributes, and indicators; and reference condition types and sources. We conclude with the results of an integrated, hierarchical evaluation using a logical framework.

**KEYWORDS:** CONDITION ASSESSMENT, LOGICAL FRAMEWORK

**THE EFFECTS OF LAND USE ON THE AQUATIC AND TERRESTRIAL STAGES OF AMERICAN TOADS AND WOOD FROGS.** Julia E. Earl<sup>1</sup> and Raymond D. Semlitsch<sup>2</sup>.

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Land use changes associated with forestry practices may affect multiple life stages of amphibians. Thus, multiple life stages must be examined within the same study to determine the true impacts of forestry practices. American toads and wood frogs were studied in experimental forestry plots at Daniel Boone CA, Warren County, Missouri. Hatchlings were placed in artificial ponds in clearcuts and forest. At metamorphosis, juvenile frogs from each aquatic treatment were placed in terrestrial enclosures in each of four forestry treatments: control forest, partial cut, clearcut with coarse woody debris removed, and clearcut with coarse woody debris

retained. After two and 10 months, the terrestrial pens were searched thoroughly to determine the survival and growth of the frogs. Toads had low survival as aquatic larvae in all forestry treatments, but wood frog tadpoles had higher survival in forest when compared to clearcuts. For both species, forestry treatment was a strong predictor of terrestrial survival in the first two months with the highest survival in the partial cut, but after 10 months in enclosures, the treatments were no longer significant. Wood frogs additionally had decreased survival in the clearcuts with coarse woody debris removed. Larval history was also important for juvenile survival, more so for toads than wood frogs. Juvenile toads that spent their larval period in the forest had higher terrestrial juvenile survival than those from clear cuts. These results indicate that partial harvest forestry practices are positive for amphibians, likely due to increased amounts of downed wood providing cover and increasing amounts of herbaceous vegetation creating favorable microclimate.

**KEYWORDS:** CLEARCUTTING, FORESTRY, AMPHIBIANS, TADPOLES

**IMPACTS, MANAGEMENT, AND RECOVERY OF A SHALLOW LAKE SYSTEM INFESTED WITH CURLY PONDWEED (POTAMOGETON CRISPUS).** [Chris Evans](#)<sup>1</sup> and [Chris Bickers](#)<sup>2</sup>,  
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Mermet lake, in Southern Illinois, is a shallow reservoir with little flow and diverse aquatic and wetland plant communities. Mermet also serves as an important recreational opportunity and tourism draw, significantly adding to the local community. In 1999, curly pondweed (*Potamogeton crispus* L.) was first discovered in the lake. This aquatic invasive plant rapidly spread throughout the entire lake. Infestations lead to oxygen depletion and fish kills, particularly in shallow and low-flow waters. Over the next decade, Mermet experienced a series of major fish kills that greatly reduced the populations of many sport fish and well as drastically impacted recreational use. The Illinois DNR, with assistance from the River to River Cooperative Weed Management Area, has initiated an aggressive eradication plan to remove curly pondweed from the system. Currently we are in year three of the eradication plan. The aerial extent and severity of pondweed infestations have been reduced, the amount of turions (reproductive structures of pondweed) in the sediment has been reduced, the populations of sport fish are increasing, and public use is on the increase. This case study serves as a great example of cooperative efforts and directed control efforts against an aquatic invasive species.

**KEYWORDS:** AQUATIC INVASIVE PLANTS, CURLY PONDWEED, POTAMOGETON CRISPUS, ERADICATION PLAN

**WOODLAND GROUND FLORA RESPONSE TO TIMBER MANAGEMENT: FINDINGS FROM THE MISSOURI OZARK FOREST ECOSYSTEM PROJECT 1993-2009.** [Susan J. Farrington](#)<sup>1</sup>,  
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While the use of prescribed fire is considered key to open woodland natural community management, it is not possible and/or practical to use fire in all of the woodlands we manage. Can timber management introduce enough light to maintain woodland ground flora biodiversity until fire can be re-introduced? The Missouri Ozark Forest Ecosystem Project (MOFEP) is a long-term (100+ years) experiment examining the effects of even-aged and uneven-aged timber management practices on multiple components of the a mixed-oak forest ecosystem. Study sites were not managed for at least 40 years prior to the study's inception, and 85% of the 648 vegetation plots are located in woodland natural communities on upper slopes and ridges. Pre-treatment vegetation data were collected from 1993-1995, timber harvest was conducted in 1996, and post-treatment data were collected from 1999-2001 and in 2009. Species diversity is decreasing in untreated plots, while percent cover has remained constant. Diversity and percent cover increased modestly after treatment in thinned plots, but returned to pre-treatment levels 13 years post-harvest. Clearcut plots showed large increases in species richness and percent cover post-treatment, and maintained a higher species richness in 2009, including the addition of conservative woodland forbs and graminoids. Herbaceous cover, however, has greatly decreased, and is now lower than pre-treatment levels. Preliminary findings indicate that while a heavy harvest creates a strong woodland ground flora response, these gains are lost by the subsequent thick re-growth of woody sprouts. Follow-up thinning and/or burning should be implemented following a heavy harvest.

**KEY WORDS:** OAK WOODLAND, GROUND FLORA, THINNING, CLEARCUT

**FOOD FOR FLIGHT: USING NATURAL FEEDING PREFERENCES TO INCREASE MIGRATORY SONGBIRD HABITAT ON THE LOWER DELMARVA PENINSULA.** Dorothy P. Field, Paul A. Clarke, Rick K. Myers. Virginia Department of Conservation and Recreation, Division of Natural Heritage. [dot.field@dcr.virginia.gov](mailto:dot.field@dcr.virginia.gov) ; [paul.clarke@dcr.virginia.gov](mailto:paul.clarke@dcr.virginia.gov) ; [rick.myers@dcr.virginia.gov](mailto:rick.myers@dcr.virginia.gov)

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The lack of sufficient stopover habitat is recognized as one of the greatest threats to neo-tropical songbirds during migration. The presence of adequate stopover habitat is especially important on the lower Delmarva Peninsula (Accomack and Northampton Counties, VA), where the expanse of the Chesapeake Bay forms a natural migration barrier. Fragmentation of stopover habitat by agriculture and development has led to the need to implement habitat restoration projects that will provide for the needs of migrating songbirds in both the short and long-term. To meet this need, the Virginia Department of Conservation and Recreation has re-vegetated 250 acres of former agricultural fields located on three state Natural Area Preserves on the lower Delmarva Peninsula. To quickly establish songbird habitat and minimize costs, large (1-gal) container-grown southern wax myrtle, *Morella cerifera* (Linnaeus), shrubs were planted at wide (30'x30') spacing. Southern wax myrtle grows quickly and provides early cover, produces abundant berries attractive to songbirds, and establishes readily in nutrient poor soils. The shrubs provide stable perches, encouraging resting birds to eliminate seeds of preferred food species, resulting in the natural establishment of the preferred species in the restoration site. Diverse "volunteer" food species became established in just one growing season after shrub planting, indicating early bird use of the sites. Monitoring suggests increased migratory songbird use and volunteer plant recruitment over time. Planting fast-growing, berry-producing shrub species appears to be a quick and cost-effective alternative to planting bare-root tree seedlings for restoring critical migratory songbird habitat.

**KEYWORDS:** MIGRATORY SONGBIRDS, STOPOVER HABITAT, RESTORATION, WAX MYRTLE, DELMARVA PENINSULA

**TOWARD ACCELERATING WILDLIFE HABITAT CONSERVATION: A SYNTHESIS REPORT FROM THE WILDLIFE HABITAT POLICY RESEARCH PROGRAM.** Figg, Dennis E. Missouri Department of Conservation, PO Box 180, Jefferson City MO 65102 [Dennis.Figg@mdc.mo.gov](mailto:Dennis.Figg@mdc.mo.gov)

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The National Council for Science and the Environment, Wildlife Habitat Policy Research Program, was funded by the Doris Duke Charitable Foundation to improve information and tools to support accelerated habitat conservation in the United States. Research funded by the program will help the conservation community understand the obstacles to completing a habitat conservation network for the nation. The members of the committee recently completed a synthesis report which offers specific recommendations to the fish and wildlife community, including findings that can accelerate habitat conservation. Conserving habitat for future wildlife will be more successful if we are responsive to new and different conservation collaborations that have access to new funding and are innovative about using existing funding mechanisms. The synthesis report and related research program results have implications for Natural Areas Program as they are integral elements of the reserve network for future wildlife in a rapidly changing world.

Additional information can be found at <http://www.ncseonline.org/WHPRP/>

**KEY WORDS:** WILDLIFE HABITAT POLICY RESEARCH PROGRAM, STATE WILDLIFE ACTION PLANS, LANDSCAPE CONSERVATION COOPERATIVES, ACCELERATED HABITAT CONSERVATION

**A 14,000 YEAR LONG RECORD OF MIDWESTERN GROWTH AND CLIMATE.** Richard Guyette<sup>1</sup>, Michael Stambaugh<sup>2,1,2</sup> School of Natural Resources, Department of Forestry, University of Missouri, [guyetter@missouri.edu](mailto:guyetter@missouri.edu), [Stambaughm@missouri.edu](mailto:Stambaughm@missouri.edu), Columbia, Missouri.

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Natural woody debris in streams and rivers contain a record of the past in old wood buried in sediments. The Midwestern United States has one of the oldest known records of climate and growth in the world. Using this record to model the processes of the past is one of society's best hopes for envisaging the future. We present tree-ring based growth models defined by distant ocean climates. Low resolution variability in sea surface temperature (SST) is hypothesized to influence the growth of oak trees in the North American mid-continental region. SST is used to estimate climate changes recorded by the growth of bur oaks (*Quercus macrocarpa*) preserved in the alluvial plain sediments. Regression modeling indicates that Northern Hemisphere SST is the most significant predictor of growth at this mid-continental location (40 N, 93 W) during the post glacial and Holocene periods. We present photos, illustrations, and dated wood in the hidden natural areas of North Missouri streams along with estimations of past climate and growth.

**KEY WORDS:** ANCIENT OAKS, MIDWEST, WOODY DEBRIS, CLIMATE

**ESTIMATING HISTORIC FIRE FREQUENCY WHERE NONE IS KNOWN, AN INTERACTIVE PRESENTATION.** Richard Guyette<sup>1</sup>, Michael Stambaugh<sup>2</sup>, Rose Marie Muzika<sup>3</sup>, and Daniel Dey<sup>4,1,2</sup> School of Natural Resources, Department of Forestry, University of Missouri, [guyetter@missouri.edu](mailto:guyetter@missouri.edu), [Stambaugh@missouri.edu](mailto:Stambaugh@missouri.edu), [Muzika@missouri.edu](mailto:Muzika@missouri.edu) ; <sup>3</sup>Northern Research Station, Columbia, Missouri, [ddeg.fs.fed.us](http://ddeg.fs.fed.us) .

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Information about the temporal-spatial variability in fire intervals is needed for understanding the changing interactions among climate, carbon, fire regimes, and natural areas management. We used fire interval data from 166 sites in North America and data from global fires to calibrate mean fire intervals with climate and human population. A process model based on the physical chemistry of combustion reactions (the Arrhenius equation) was developed from fire scars, charcoal, fire starts, and expert estimation data for predicting mean fire intervals from temperature, precipitation, and their interactions. The model development uses data during the pre industrial period to more accurately calibrate climate and fire frequency. The historic approach reduces the effects of climate change, land use, fire suppression, and other technological factors affecting fire rates. The model and its validation will be briefly explained and then questions from the audience on historic fire intervals at specific natural area locations will be addressed.

**KEY WORDS:** FIRE HISTORY, NATURAL AREAS, PHYSICAL CHEMISTRY

### **HERBICIDE CONTROL OF SPOTTED KNAPWEED**

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*Centaurea maculosa* (spotted knapweed) is an introduced species originating from Eurasia, first reported in the late 1800's. *C. maculosa* invades agricultural land, roadsides and natural areas throughout much of North America and is listed as a noxious plant in 16 states. Herbicide is a common management tool used to control this species. This study evaluated the efficacy of selected herbicides for control of *C. maculosa* and responses of other broadleaf and grass species to treatments. Applications were completed in October 2009 and July 2010 along an infested roadside in West Lafayette, Indiana. Treatments consisted of 9 herbicide solutions and an untreated control. Study design consisted of three replicates in a randomized block design. Herbicides included both current and emerging (aminocyclopyrachlor) broadleaf control and bare ground products from the non-crop and forestry herbicides. Herbicides included aminocyclopyrachlor, chlorsulfuron, rimsulfuron, metsulfuron-methyl, aminopyralid, imazapic and topramezone. Percent cover of knapweed as well as other species were collected at time of application, 90, and 180 days after treatment when applicable. Initial mean percent cover of *C. maculosa* ranged from 19 to 72 percent cover within treatments. Mean percent cover of knapweed in control plots increased post-treatment to 31%. Four herbicide solutions resulted in

0% cover of knapweed after treatment while another four reduced knapweed to 1.5 % or less of the total cover. All herbicide solutions except topramezone significantly reduced knapweed cover.

**KEYWORDS:** SPOTTED KNAPWEED, CENTAUREA MACULOSA, HERBICIDE, CONTROL, ROADSIDE

**THE GROWTH OF COOPERATIVE WEED MANAGEMENT AREAS IN THE MIDWEST.**

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Cooperative Weed Management Areas (CWMAs) are local partnerships focused on invasive species prevention, control, and education. By bringing together government agencies, private corporations, non-profit organizations, and concerned citizens to plan and conduct invasive species programs, CWMAs have led to improved coordination, more effective outreach, and increased funding for invasive species programs at a local level. CWMAs have been around for decades in the Western United States, but in the last five years the idea has just started to catch on in the Midwest. This talk will provide an introduction to CWMAs in Indiana, Illinois, Iowa, Ohio, Michigan, Minnesota, Missouri, and Wisconsin and highlight some of their accomplishments.

**KEY WORDS:** CWMA, INVASIVE SPECIES, OUTREACH, PARTNERSHIP

**THE IMPORTANCE OF THINKING BIG: LARGE-SCALE PRAIRIE DOG CONSERVATION DRIVES BLACK-FOOTED FERRET REINTRODUCTION SUCCESS.**

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Attempts to reintroduce one of the most endangered mammals in North America, the black-footed ferret (*Mustela nigripes*), have been ongoing for 18 years with no quantitative evaluation of factors related to reintroduction success. We examined relationships between ferret reintroduction success and 11 variables representing factors associated with prairie dog distribution and abundance, disease outbreaks, and release strategies at 11 reintroduction sites. The most important factor related to ferret reintroduction success was a cumulative metric incorporating both size of the area occupied by prairie dogs (*Cynomys* sp.) and density of prairie dog burrows within that area. All four successful sites had prairie dog complex sizes of at least 4,300 ha. The overarching importance of the availability of high quality habitat suggests managers prioritize actions that maintain and enhance the availability of large areas with high prairie dog burrow density.

**KEY WORDS:** BLACK-FOOTED FERRET, CARNIVORE, PRAIRIE, PRAIRIE DOG, REINTRODUCTION

**MANAGING LANDSCAPES FOR NATURAL COMMUNITIES: SAVING BIRDS AND A WHOLE LOT MORE IN THE CENTRAL HARDWOODS.** D. Todd Jones-Farrand<sup>1,3</sup>, Jane A. Fitzgerald<sup>2,3</sup>, and Lee E. O'Brien<sup>2</sup>. <sup>1</sup>Central Hardwoods Joint Venture, Columbia, MO. [tjones-farrand@abcbirds.org](mailto:tjones-farrand@abcbirds.org). <sup>2</sup>Central Hardwoods Joint Venture, St. Louis, MO. [lee.e.obrien@gmail.com](mailto:lee.e.obrien@gmail.com); [jfitzgerald@abcbirds.org](mailto:jfitzgerald@abcbirds.org). <sup>3</sup>American Bird Conservancy, The Plains, VA.

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Conservation planning at landscape and eco-regional scales requires an assessment of current conditions, restoration opportunities, and future threats. To meet this need for the Central Hardwoods Bird Conservation Region (CHBCR), we developed a set of decision support tools that can be linked together to assess the potential impact of conservation actions across the region. Central to this approach is a model that characterizes the restoration potential of a particular site as one of 11 broadly-defined natural vegetation communities. The model identifies potential locations for community restoration efforts, as well as the maximal extent of each community within the region, based on land-type associations, landform position, and assumed historic fire regimes. Additionally, we characterized the vegetative structure of each potential community type using measured vegetation structure from reference sites and expert opinion so that we could use mapped potential as an input to Habitat Suitability Index (HSI) models previously developed for priority forest-associated bird species. Comparison of the potential landscape to current conditions based on the 2001 National Land Cover Database (NLCD) and concurrent data from the Forest Inventory and Analysis (FIA) program suggests that glade, savanna and woodland communities have the greatest potential for restoration. If undertaken, efforts to restore these communities could stabilize or reverse declines of associated bird species, but must be balanced against interior forest habitat loss. This research provides a framework for setting regional avian population and habitat objectives, as well as for identifying priority landscapes and sites for conservation efforts.

**KEYWORDS:** CONSERVATION DESIGN, DECISION SUPPORT TOOLS

**MAPPING POTENTIAL NATURAL VEGETATION ACROSS THE CENTRAL HARDWOODS BIRD CONSERVATION REGION.** D. Todd Jones-Farrand<sup>1,5</sup>, Lee E. O'Brien<sup>2</sup>, Tim A. Nigh<sup>3</sup>, C. Diane True<sup>4</sup>, and Jane A. Fitzgerald<sup>2,5</sup>. <sup>1</sup>Central Hardwoods Joint Venture, Columbia, MO. [tjones-farrand@abcbirds.org](mailto:tjones-farrand@abcbirds.org). <sup>2</sup>Central Hardwoods Joint Venture, St. Louis, MO. [lee.e.obrien@gmail.com](mailto:lee.e.obrien@gmail.com); [jfitzgerald@abcbirds.org](mailto:jfitzgerald@abcbirds.org). <sup>3</sup>Missouri Department of Conservation, Columbia, MO. [Timothy.Nigh@mdc.mo.gov](mailto:Timothy.Nigh@mdc.mo.gov). <sup>4</sup>Missouri Resource Assessment Partnership, Columbia, MO. [truecd@missouri.edu](mailto:truecd@missouri.edu). <sup>5</sup>American Bird Conservancy, The Plains, VA.

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Conservation planning at landscape and eco-regional scales requires an assessment restoration opportunities, including what natural communities can be restored where, how much land is available, and who owns it. To meet this need for the Central Hardwoods Bird

Conservation Region (CHBCR), we developed a model to predict where the best ecological potential is for restoring 11 broadly-defined natural vegetation communities. The distribution of communities was modeled using Land Type Associations (LTAs), subdivisions of (Bailey's) subsections, and the landforms within them. We delineated LTAs using topography, geology and soils to define different ecological communities. Landform types were developed by The Missouri Resource Assessment Partnership (MoRAP) using a 30m digital elevation model, derived solar insolation values and relative land positions to describe local sites. Given maps and descriptions of LTAs and landforms, local community ecologists were asked to predict the potential vegetation at each landform type within each LTA, assuming "natural" disturbance regimes. This matrix of potential vegetation types was then spatially mapped in a GIS. The result is a spatially explicit, 30 m grid of the distribution of potential natural vegetation, or with assumptions about historic disturbance regimes; historic vegetation distribution. The model can be used to help guide management actions by comparing current site and landscape conditions to predicted "historic" conditions.

**KEYWORDS:** EXPERT OPINION MODEL, LAND TYPE ASSOCIATION, LANDFORM, NATURAL COMMUNITIES

**USE OF FOLIAR HERBICIDES TO CONTROL A PROBLEMATIC NATIVE SPECIES: ACER NEGUNDO (BOXELDER).** Matthew S. Kraushar, Zachary E. Lowe, Harmon P. Weeks Jr. Department of Forestry and Natural Resources, Purdue University. [mkrausha@purdue.edu](mailto:mkrausha@purdue.edu); [lowez@purdue.edu](mailto:lowez@purdue.edu); [weeks@purdue.edu](mailto:weeks@purdue.edu)

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Aggressive native woody species often pose management problems in natural areas. Persistent species such as boxelder (*Acer negundo*) can be problematic in prairies, savannas, and lowland hardwood restoration sites which require more than just mechanical reduction for complete control. Foliar herbicides containing imazapyr are effective alternatives to cutting difficult-to-control woody species, but they have not been thoroughly tested on boxelder. We tested 16 foliar herbicide tank mixes that are commonly used by managers to control undesirable vegetation in natural areas and utility rights-of-ways to determine the most effective treatments for boxelder control. Individual trees were sprayed to wet, not to runoff, to minimize off-target damage and the amount of herbicide used. Visual ratings of percent defoliation and re-sprouting were taken at 30 and 365 days after treatment to evaluate effectiveness. Foliar applied herbicides containing imazapyr, such as Arsenal and Arsenal Powerline, resulted in greater than 95% mortality of boxelder.

**KEY WORDS:** IMAZAPYR, RE-SPROUTING, CONTROL, RIGHT-OF-WAY, VEGETATION MANAGEMENT

**CREATING "CLIMATE SMART" CONSERVATION PRACTICES: BRIDGING THE GAP BETWEEN SCIENCE AND BIODIVERSITY ADAPTATION STRATEGIES IN THE CHICAGO WILDERNESS REGION.** Abigail Derby Lewis<sup>1</sup>, Laurel Ross<sup>1</sup>, Doug Stotz<sup>1</sup>, Robert Moseley<sup>2</sup>, and Melinda Pruett-Jones<sup>3</sup>. <sup>1</sup>Division of Environment, Culture and Conservation, The Field Museum. [aderby@fieldmuseum.org](mailto:aderby@fieldmuseum.org); [lross@fieldmuseum.org](mailto:lross@fieldmuseum.org); [dstotz@fieldmuseum.org](mailto:dstotz@fieldmuseum.org). <sup>2</sup>The Nature Conservancy. [rmoseley@tnc.org](mailto:rmoseley@tnc.org). <sup>3</sup>Chicago Wilderness. [melinda.pruett\\_jones@chicagowilderness.org](mailto:melinda.pruett_jones@chicagowilderness.org)

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Chicago Wilderness (CW) is a 15-year old consortium of over 250 conservation players in the Chicago metro area that includes parts of three Great Lakes states. The mission of CW is biodiversity conservation in the significant natural areas of the region. CW recognizes there is overwhelming scientific evidence that climate change is real, already underway, and has the potential to jeopardize decades of conservation investment. In response to this threat, CW has recently completed the first climate action plan that addresses issues of biodiversity conservation in the Chicago region. The Climate Action Plan for Nature (CAPN) focuses on the 370,000 acres of natural areas in the CW region and the specific actions that the consortium can take to adapt to climate change and mitigate future impacts.

A main goal of the CAPN is to update current conservation strategies to be climate smart by bridging the gap between science and biodiversity adaptation practices. Communication and outreach have begun with both local and regional partners to help increase their capacity to understand and benefit from this powerful new tool. We will present information on the CAPN framework, along with specific tools designed for communication and education with land managers. Responses and outcomes from a 2010 workshop with CW natural resource managers focusing on adaptation strategies for natural communities, and the role these efforts play in a regional context of green infrastructure, will be discussed.

**KEY WORDS:** BIODIVERSITY, ADAPTATION, CLIMATE CHANGE

**INTERSEEDING AND HETEROGENEOUS DISTURBANCES INCREASE NATIVE SPECIES RECRUITMENT AND DIVERSITY IN PRAIRIE RESTORATIONS.** [Quinn Long](#), Kelly Kindscher, and Bryan Foster. Kansas Biological Survey, University of Kansas. [gugalo@ku.edu](mailto:gugalo@ku.edu); [kindscher@ku.edu](mailto:kindscher@ku.edu); [bfoster@ku.edu](mailto:bfoster@ku.edu).

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The need for restoration of the tallgrass prairie biome is marked by critical declines of characteristic flora and fauna. Though restorations rarely approximate the diverse flora of remnant prairies due to poor native forb establishment, methods of enhancing forb diversity in existing restorations have been poorly investigated. We examine effects of multiple disturbance regimes on recruitment of native forbs sown into species-poor native grassland restorations at three Midwestern research areas and evaluate the potential of mosaic disturbance management to increase floral and structural heterogeneity. Native forbs were sown into plots that were either undisturbed, summer burned, or subjected to one of the following disturbances in addition to summer burning: broad-spectrum herbicide, shallow disking, mowing, or annual spring burning. Native richness increased in response to sowing without disturbance, though disturbances further enhanced recruitment. Light availability was a strong predictor of recruitment, and the benefit of increased disturbance intensity was contingent upon the extent to which productivity limited light availability at each location. Initial application of herbicide had the adverse effect of promoting colonization by exotic species when abundant in the surrounding landscape. We found significant differences in native forb community composition among treatments, but no singular treatment resulted in decisively superior establishment of sown species. These findings, together with the variable structural requirements of grassland fauna, indicate that

heterogeneous disturbance regimes within a single restoration site can benefit native forb establishment and enhance wildlife habitat value.

**KEYWORDS:** RESTORATION, TALLGRASS PRAIRIE MANAGEMENT, FORB ENRICHMENT, SPECIES RICHNESS, DISTURBANCE.

**4 X 4: A TEN YEAR APPRAISAL OF IPANE'S EARLY DETECTION EFFORTS.** Leslie J. Mehrhoff. Invasive Plant Atlas of New England & Invasive Plant Control, Inc. [ipcnortheast@mindspring.com](mailto:ipcnortheast@mindspring.com)

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The detection of new or incipient populations of nonindigenous plant species is one of the best tools for combating long-lasting effects of invasive species on natural communities. While the Invasive Plant Atlas of New England (IPANE) was designed to serve many needs, the establishment of a multifaceted Early Detection (ED) program for the six state New England region was the overarching goal of the initial USDA grant. The original plan, calling for one early detection list for the region, soon gave way to 6 individual state ED lists. Attempts to develop 67 different ED lists, one for each county in the six states, were not practical and methodologies for reasonably doing this are still being developed. Pros and cons of all 3 levels are presented. After 10 years the original ideas still hold, but our understanding of how to best accomplish our goals has greatly improved. Currently IPANE supports four different kinds of early ED efforts in the region. These all have utility beyond New England. Further, IPANE attempts to address different kinds of ED events. Program-trained volunteers are the basis for data gathering for IPANE supported research, some of which has applications for early detection. Untrained volunteers play an important role in many early detection efforts. IPANE's current ED efforts are presented and the importance of a clearly articulated state early detection and rapid response program is discussed. These efforts will be tied to the need for a national early detection network.

**KEY WORDS:** EARLY DETECTION, IPANE, NEW ENGLAND, LISTS, VOLUNTEERS

**LANDSCAPE CHANGE AND POPULATION MIGRATION – EXAMINING CONSERVATION FUTURES OF ALTERNATIVE LANDSCAPE DESIGNS** [Phil Morley](#) and David Brunckhorst. Institute for Rural Futures and UNESCO Centre for Bioregional Resource Management, University of New England, Armidale 2351, Australia. Ph. +61 267-735-211 [pmorley@une.edu.au](mailto:pmorley@une.edu.au), [www.ruralfutures.une.edu.au](http://www.ruralfutures.une.edu.au)

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Past policies and landscape changes influence future directions. Human society tooled with powerful machines since the industrial revolution have become the major altering force on landscapes and regions. The affluence of some recent generations in developed countries adds further social expectations for change, particularly urban development in naturally aesthetic places. Migration to many rural coastal regions in Australia is forcing rapid large scale change to remaining ecosystems of landscapes. The enormous challenge is how to accommodate these

population and social pressures while protecting ecosystems and other natural areas in the long term.

The Alternative Landscape Futures approach contributes tools, knowledge and options to guide long-term policy and planning of regions. Building on Carl Steinitz's methodology and integrating past-trend future trajectory analysis with landscape ecology and design principles, a multi-scaled hybrid approach applicable to landscapes of large regions was developed. Spatial modeling of the essential elements of a very complex debate about regional development and sustainability is used to produce a number of future scenarios that geographically represent potential and plausible changes that might occur or may be applied (through planned design) to regional landscapes in the medium to long term. The outcomes of visual and quantitative analysis and assessment provide a clear understanding of the future consequences of present day decisions for communities, planners and policy makers; and alternative conservation futures through design of future regional landscapes.

**KEYWORDS:** LANDSCAPES, BIOREGIONAL PLANNING, SCENARIOS, ALTERNATIVE LANDSCAPE FUTURES, CONSERVATION DESIGN.

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The high level of illiteracy and poverty has contributed a big challenge in biodiversity conservation efforts in Nepal as it has to fulfill both conservation and community development needs. However, since there has been local community involvement in management, many successful improvements have been noted for the protection of biodiversity. An Integrated Conservation and Development Program approach used by the Annapurna Conservation Area Project since 1986, and a buffer zone concept applied to the various national parks and wildlife reserves since 1996 have proven the importance of local community involvement for biodiversity conservation. These initiations have contributed to biodiversity conservation; feeling of ownership, exploration of alternatives for earning income, participation in conservation activities, and ecotourism development to some extent. Despite these many achievements, there are still some gaps in order to achieve conservation goals. Experiences revealed a big challenge in finding ways and means to improve governance, active and effective participation and equity and enabling activities relating to conservation of biodiversity. So, for promoting the continued conservation and stewardship of biodiversity there still requires an understanding of to which extent and how the conservation information has been communicated with the concerned stakeholders. Right information and proper advocacy on resource use is utmost important in order not to misunderstand the access to resource use and sustainable conservation. Both "rights" and "responsibilities" are to be clearly communicated to community people for true and long term involvement of community people in conservation efforts.

**KEY WORDS:** BIODIVERSITY, COMMUNITY PARTICIPATION, CONSERVATION AREAS, BUFFER ZONE

**CONTROL OF CHINESE PRIVET (*Ligustrum sinense*): THE INFLUENCE OF INDIVIDUAL PLANT SIZE ON TREATMENT EFFICACY** Error! Reference source not found., Stephen Enloe, Nancy Loewenstein, and Evaden Brantley, [seo0001@auburn.edu](mailto:seo0001@auburn.edu); [sfe0001@auburn.edu](mailto:sfe0001@auburn.edu); [loewenj@auburn.edu](mailto:loewenj@auburn.edu); [brantef@auburn.edu](mailto:brantef@auburn.edu)

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For land managers in natural areas, individual plant treatment (IPT) methods such as cut stump and basal bark herbicide treatments are commonly used. However, there has been little research done to determine optimal IPT methods for Chinese privet control. Furthermore, no studies have quantified treatment efficacy of IPT methods in relation to privet size. Therefore, our objective was to evaluate cut stump and basal bark treatments for Chinese privet control across a range of plant sizes commonly found within infestations.

Studies were conducted near Auburn, AL in both riparian and upland sites heavily infested with Chinese privet. For the cut stump studies, we compared glyphosate (Accord Concentrate at 25% vol/vol) and triclopyr (Garlon 3A at 25% vol/vol) at April and November timings across a wide range of privet sizes. Basal bark studies compared triclopyr formulations and rates (Pathfinder II at 100% vol/vol and Garlon 4 at 20, 10, and 5% vol/vol) at January and March timings. For both studies Chinese privet mortality and resprouting were quantified 6 to 18 months after treatment.

For the cut stump studies, root collar diameter had no effect on treatment efficacy. Both herbicides were effective with the fall timing providing slightly better Chinese privet control. Basal bark treatment data collected at 12 months after treatment indicate Pathfinder II and Garlon 4 at 20% vol/vol provide excellent Chinese privet control while the lower rates of Garlon 4 have yet to provide consistent control. These studies demonstrate the effectiveness of IPT techniques for Chinese privet control.

**KEY WORDS:** CHINESE PRIVET, LIGUSTRUM SINENSE, GLYPHOSATE, TRICLOPYR, INDIVIDUAL PLANT TREATMENT (IPT)

**FLORA OF JORDAN: EXOTIC AND INVASIVE SPECIES** Sawsan A. Oran Dept. of Biological Sciences, Faculty of Sciences, University of Jordan, Amman- Jordan, *E-mail:* [oransaw@ju.edu.jo](mailto:oransaw@ju.edu.jo), [oransaw@yahoo.com](mailto:oransaw@yahoo.com)

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Flora of Jordan is rich with regards to its number of plant species. A number of 2978 species belongs to 120 families and 719 genera are recorded in Jordan. 20% of the total flora are medicinal plants that are used in folk medicine and can be used in pharmaceutical industry. A total number of medicinal plants are recorded, 363 species of vascular plants, belonging to 263 genera and 86 families. A number of exotic (ornamental, medicinal and economic plants), species are among the recorded exotic species such as *Orchids*, *Tulips*, *Iris*, *Narcissus*, *Crocus* and others. A number of invasive species are also recorded as Jordan is an Eastern Mediterranean country and surrounded by Turkey and Syria from the North, Saudi Arabia from the South and Iraq from the East. The status of flora of Jordan will be discussed: the exotic plant species; medicinal plants and invasive species will also be explained. Recommendations and Conservations Strategies will be discussed.

**KEYWORDS:** FLORA OF JORDAN, EXOTIC PLANT SPECIES, MIDDLE EAST FLORA

**EVERGLADES COOPERATIVE INVASIVE SPECIES MANAGEMENT AREAS (ECISMA).**

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A Cooperative Invasive Species Management Area is a formal partnership of federal, state, and local government agencies, tribes, individuals and various interested groups that manage invasive species and is defined by a geographic boundary. Florida has a long history of invasive species organization cooperation such as the Florida Exotic Pest Plant Council, Noxious Exotic Weed Task Team, Florida Invasive Animal Task Team and Invasive Species Working Group. Everglades restoration poses new challenges for invasive species management and has created a need for a more defined commitment to cooperation among agencies and organizations at higher levels of policy and management.

**KEYWORDS:** INVASIVE SPECIES, FLORIDA, COOPERATIVE INVASIVE SPECIES MANAGEMENT AREAS

**SUCCESSFUL AND AWARD WINNING RESTORATIONS IN SUSTAINABLE DEVELOPMENTS AND OPEN SPACES – HOW TO COMMUNICATE TO THE DEVELOPMENT COMMUNITY AND TO THE BUYING PUBLIC** Jack Pizzo, President and Senior Ecologist, Pizzo & Associates, Ltd.

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Consumers as well as the regulators and municipal officials are requiring and demanding sustainable developments. How do we take a sincere desire to preserve, protect and restore our natural communities into projects that demonstrate that? Two-dimensional plans and specifications often end up far short of the goal when turned into three-dimensional projects. The problem is a lack of hindsight and linear thinking. The solution is three-fold: 1) Dissect the failures to understand what went right and wrong. Repeat the successful methods and abandon the failed methods. 2) Plan with a team that includes all stakeholders from the beginning including ecologists. 3) Plan for ongoing stewardship of these sites. Case studies will be included. This will be a highly visual presentation of suburban and rural projects.

**KEY WORDS:** NATURAL HABITAT, SUSTAINABLE DEVELOPMENT, URBAN PRESCRIBED FIRE, INVASIVE SPECIES, STEWARDSHIP

**CAN HERBICIDES BROADCASTED IN THE FALL CONTROL CANADA THISTLE AND MAINTAIN FORB COVER IN ESTABLISHING PRAIRIES?** Mark J. Renz, Department of Agronomy, University of Wisconsin-Madison.

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Public interest exists in establishing mixed forb/grass prairie systems, but establishment can be reduced by weed perennial weeds like Canada thistle (*Cirsium arvense*). Experiments were conducted at two establishing prairies with substantial Canada thistle in Wisconsin to evaluate native cover response from fall applications of herbicide targeting Canada thistle. Treatments included 2,4-D (0.532 kg ae ha<sup>-1</sup>), metsulfuron (12.6 g ai ha<sup>-1</sup>), dicamba (0.56 kg ae ha<sup>-1</sup>), glyphosate (0.28 kg ae ha<sup>-1</sup>), aminopyralid (17.4 g ae ha<sup>-1</sup> and 87.0 g ae ha<sup>-1</sup>), and an untreated control. Plots were treated in September, early October, and late October. Cover of Canada thistle was estimated the spring and fall after treatment. Cover of native plants was estimated one and two years after treatment. While reductions in Canada thistle cover were observed the spring after treatment, by fall only the high rate of aminopyralid in late October showed any reduction in Canada thistle cover. Reduced native forb cover compared to untreated areas was observed one year after treatments at the September timing for 2,4-D, metsulfuron, and dicamba at one site only, all other treatments were similar in forb cover. Differences in native grass cover one year after treatment were minimal except for a reduction in cover from glyphosate applied in September at one site. Response of cover of native forbs and grasses two years after treatments will be presented. Results demonstrate broadcasting herbicides in the fall can suppress Canada thistle in mixed forb/grass prairies and increase the cover of native species.

**KEY WORDS:** CANADA THISTLE, PRAIRIE, HERBICIDE, FALL

**WORK SMARTER, NOT HARDER—SUSTAINABLE DESIGN PRACTICES FOR WETLANDS MITIGATION BANKS IN OHIO.** David Riddell, Karen Wise, Natural Resources Consulting, Manager. Davey Resource Group, A Division of the Davey Tree Expert Company, [kwise@davey.com](mailto:kwise@davey.com)

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As regulatory guidelines and performance standards increase for wetlands mitigation banks, more emphasis is being placed on long-term stewardship and maintenance. Specifically, awareness and control of invasive species is growing in popularity, and in order to achieve performance goals set forth by state and federal agencies, a proactive plan including monitoring and aggressive treatment must be implemented. However, with smarter site selection, pre-construction treatment, and/or the proper planting plan, much time, money, and frustration can be avoided on the back-end. Two Ohio mitigation bank projects will be discussed and compared to demonstrate the point that time and money up front and during construction can result in a healthier and more sustainable ecosystem, saving money in the long run.

**KEY WORDS:** INVASIVE SPECIES, WETLANDS MITIGATION BANKS, PERFORMANCE GOALS, TREATMENT METHODOLOGY, SUSTAINABLE DESIGN PRACTICES

**CHICAGO WILDERNESS SPECIES OF CONSERVATION CONCERN: HOW REGIONAL-LEVEL RARITY LISTS CAN DRIVE CONSERVATION:** Rebecca Schillo, Douglas Stotz, Laurel Ross. The Field Museum, Department of Environment, Culture, and Conservation, [rschillo@fieldmuseum.org](mailto:rschillo@fieldmuseum.org); [dstotz@fieldmuseum.org](mailto:dstotz@fieldmuseum.org); [lross@fieldmuseum.org](mailto:lross@fieldmuseum.org)

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The Chicago Wilderness Species of Conservation Concern (SCC) Project will identify the species of greatest conservation concern within the four-state, 6- million acre region known as Chicago Wilderness (CW). This presentation will focus on the process for building regional consensus, rationale, and the practical implications of developing a regional-level Species of Conservation Concern list.

Similar lists exist for plants (Chicago Botanic Garden's Plants of Concern Program), birds (Bird Conservation Network's Birds of Concern Lists), and prairie and savanna insects (Northeastern Illinois University) in the Chicago region. This information will be incorporated, along with expert opinion and data for other species groups, to assemble a comprehensive, focused list of species that may benefit from regional-level conservation efforts. Species will be selected based on a variety of factors including: relative abundance, population trends, endemism, species range, and an estimate of how important conservation within Chicago Wilderness is to the species' survival. By providing a broader set of conservation targets the SCC Project will expand conservation thinking beyond federal and state threatened and endangered species lists. It will also help public agencies and funders effectively allocate resources towards the most important targets. Additionally, the SCC list will provide guidance for prioritizing land management and acquisition decisions for sites without obvious conservation targets, essential information for monitoring the effects of climate change on CW species, and identification of iconic species for mobilizing public interest in regional conservation.

**KEY WORDS:** THREATENED AND ENGANGERED SPECIES, CONSERVATION PLANNING, RARE SPECIES, CHICAGO WILDERNESS

**THE CONSERVATION AND LAND MANAGEMENT INTERNSHIP PROGRAM – PUTTING YOUR EDUCATION TO WORK WITH FEDERAL AGENCIES.** Krissa Skogen<sup>1</sup>, Belton Copp<sup>2</sup>, Diana DelleChiale<sup>3</sup>, Andrew Monks<sup>4</sup>, and Carley Jennings<sup>5</sup> <sup>1</sup>Chicago Botanic Garden 1000 Lake Cook Road Glencoe, IL 60022 847-835-6919, [kskogen@chicagobotanic.org](mailto:kskogen@chicagobotanic.org); <sup>2</sup>Bureau of Land Management, Nome, AK, [bacoppvi@gmail.com](mailto:bacoppvi@gmail.com); <sup>3</sup>Rancho Santa Ana Botanic Garden, Claremont, CA, [dmmonks@gmail.com](mailto:dmmonks@gmail.com); <sup>4</sup>Bureau of Land Management, Lakewood, CO, [dedellec@colby.edu](mailto:dedellec@colby.edu); <sup>5</sup>Bureau of Land Management, Arizona Strip, AZ, [carley.jennings@gmail.com](mailto:carley.jennings@gmail.com)

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The Conservation and Land Management Internship Program has placed over 525 interns with federal biologists over the last nine years. Each year, the program places 75-100 college graduates in five-month paid internships to assist professional staff at the Bureau of Land Management (BLM), National Park Service (NPS), U.S. Forest Service (USFS) and other federal agencies. These internships involve work in botany or wildlife-related fields, or combinations that may include monitoring or assessing threatened and endangered species and habitats. The CLM Internship Program has numerous benefits, which include gaining hands-on

experience putting your education to work, making connections in various government agencies and non-profit organizations, experience working in a federal agency, and the opportunity to explore your career goals and expand your resume. This session will open with an overview of the history of the CLM Program, future opportunities within the Program and details on the qualifications that make a stand out applicant. Four current CLM interns will then share their experiences as a CLM intern and how it has facilitated their professional and personal growth. These four interns represent both the internship project and geographic breadth of the CLM Program – from working with rare plant species in Colorado, collecting seeds for the Seeds of Success Program in California, to conducting rare/endorsed bird surveys in Arizona and working with local peoples to develop a caribou management plan in Alaska. The session will conclude with a discussion and question/answer session.

**KEYWORDS:** INTERNSHIP OPPORTUNITIES, CONSERVATION, LAND MANAGEMENT, BOTANY, WILDLIFE BIOLOGY

**NATIVE FORB AND SHRUB TOLERANCE TO AMINOPYRALID.** [Byron Sleugh](#)<sup>1</sup>, Mary B. Halstvedt<sup>1</sup>, and Daniel C. Cummings<sup>1</sup>, Rodney G Lym<sup>2</sup>, Fargo. K. George Beck<sup>3</sup>, Roger L. Becker<sup>4</sup>, Celestine A. Duncan<sup>5</sup>, Peter M. Rice<sup>6</sup>. <sup>1</sup>Dow AgroSciences LLC. [bbsleugh@dow.com](mailto:bbsleugh@dow.com); [mbhalstvedt@dow.com](mailto:mbhalstvedt@dow.com); [dccummings@dow.com](mailto:dccummings@dow.com). <sup>2</sup>North Dakota State University, [Rod.Lym@ndsu.edu](mailto:Rod.Lym@ndsu.edu). <sup>3</sup>Colorado State University, [george.beck@colostate.edu](mailto:george.beck@colostate.edu). University of Minnesota, [becke003@umn.edu](mailto:becke003@umn.edu). Weed Management Services, [weeds1@wildblue.net](mailto:weeds1@wildblue.net). University of Montana, [peter.rice@umontana.edu](mailto:peter.rice@umontana.edu).

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Aminopyralid is a broadleaf herbicide with reduced risk to the environment compared with other available herbicides, making it desirable for invasive weed control on rangeland and wildland sites. Effect of aminopyralid on desirable native forbs and shrubs is a consideration for land managers when making decisions about controlling invasive plants. Experiments were established at ten locations in four states to determine long-term response of native forbs and shrubs to aminopyralid applied in early summer or fall, and to develop a tolerance/susceptibility ranking for native plants. Studies were established within diverse native plant communities in western Montana; Boulder, Colorado, Theodore Roosevelt National Park, North Dakota; Glacial Ridge Preserve and restored prairies in Minnesota. Herbicide treatments were aminopyralid at 1.25 or 1.75 oz ae/A. Evaluations were based on individual species reduction in canopy cover or density compared to non-treated controls or baseline data. Four ranking categories were developed: susceptible (S - 75% or more reduction), moderately susceptible (MS - 75 to 50% reduction), moderately tolerant (MT- 49 to 16% reduction) and tolerant (T – 15% or less reduction). Of the 98 forb species categorized, 28, 16, 26, and 28 were ranked S, MS, MT, and T, respectively. Many forbs recovered by the second year following aminopyralid application with 55 of 68 native forbs ranked either MT or T. There were 19 shrub species, and 74% were either MT or T. Most native forb species and shrubs were moderately tolerant to tolerant, or quickly rebounded following treatment with aminopyralid. Thus, land managers can use aminopyralid to restore the plant community by controlling invasive plants while minimizing non-target plant injury.

**KEY WORDS:** AMINOPYRALID, MILESTONE HERBICIDE, FORB TOLERANCE, INVASIVE WEEDS

**SALT CEDAR AND RUSSIAN OLIVE CONTROL WITH AMINOPYRALID AND TRICLOPYR MIXTURES.** [Byron B. Sleugh<sup>1</sup>](mailto:Byron.B.Sleugh@Dow.com), [Mary Halstvedt](mailto:Mary.Halstvedt@Dow.com), [Robert G. Wilson<sup>2</sup>](mailto:Robert.G.Wilson@unl.edu), and [Gustavo Sbatella<sup>2</sup>](mailto:Gustavo.Sbatella@unl.edu). <sup>1</sup>Dow AgroSciences. [bbsleugh@dow.com](mailto:bbsleugh@dow.com); [mbhalstvedt@dow.com](mailto:mbhalstvedt@dow.com). <sup>2</sup>University of Nebraska Panhandle Research Center. [rwilson@unlnotes.unl.edu](mailto:rwilson@unlnotes.unl.edu); [gsbatella2@unlnotes.unl.edu](mailto:gsbatella2@unlnotes.unl.edu).

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Chemical control of salt cedar (*Tamarix spp.*) and Russian olive (*Elaeagnus angustifolia* L.) has had varying degrees of success. Some non-selective herbicides cause unacceptable injury to desirable species or do not control invasive species under the canopy. Aminopyralid (Milestone<sup>®</sup>) controls many invasive herbaceous broadleaf weeds, but control of salt cedar and Russian olive has not been fully explored. Experiments were established to assess the efficacy of various aminopyralid containing products and aminopyralid and triclopyr (Garlon 3A or Garlon 4 Ultra) mixtures on these plants. Treatments included triclopyr amine and triclopyr ester at various rates plus aminopyralid at 120 g ae/ha (0.11 lbs ae/acre) and Milestone<sup>®</sup> VM Plus at 9.6 L/ha (1 gal/acre) [triclopyr amine at 1.12 kg ae/ha (1 lb ae/acre) and aminopyralid 120 g ae/ha (0.11 lb ae/acre)]. At 326 days after application, 3.3 kg ae /ha (3 lbs ae/acre) triclopyr ester plus 120 g ae/ha aminopyralid provided excellent control (98%) of Russian olive and salt cedar (94%), similar to efficacy of imazapyr at 1.12 kg ae/ha (1 lb ae/acre). Triclopyr + aminopyralid treatments caused little to no grass injury (0 to 5%) compared to the imazapyr treatments (50 to 85%). Milestone<sup>®</sup> VM Plus at 9.6 L/ha provided 91% control of salt cedar and no grass injury. Adding aminopyralid to either the triclopyr amine or triclopyr ester was synergistic and provided increased control of Russian olive and salt cedar thus providing another option for controlling these species without significant injury to desirable understory vegetation.

**KEYWORDS:** AMINOPYRALID, TRICLOPYR, SALT CEDAR, RUSSIAN OLIVE, MILESTONE, GARLON

**ECOLOGICAL SITE DESCRIPTIONS: DEVELOPMENT AND APPLICATION IN MISSOURI.** [Kyle Steele<sup>1</sup>](mailto:Kyle.Steele@mizzou.edu), [Fred Young<sup>2</sup>](mailto:Fred.Young@usda.gov), [Tim Nigh<sup>3</sup>](mailto:Timothy.Nigh@mdc.mo.gov), [Amber Marshaus<sup>1</sup>](mailto:Amber.Marshaus@mizzou.edu). <sup>1</sup>School of Natural Resources, University of Missouri – Columbia. [Kyle.Steele@mizzou.edu](mailto:Kyle.Steele@mizzou.edu); [marshausa@missouri.edu](mailto:marshausa@missouri.edu). <sup>2</sup>USDA Natural Resources Conservation Service. [Fred.Young@mo.usda.gov](mailto:Fred.Young@mo.usda.gov). <sup>3</sup>Missouri Department of Conservation. [Timothy.Nigh@mdc.mo.gov](mailto:Timothy.Nigh@mdc.mo.gov).

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Ecological Site Descriptions (ESDs) are being completed by the Natural Resources Conservation Service (NRCS) and their collaborators across the United States. An ESD refers to an ecological site or ecological landtype, which is a community scale land management unit that has specific soil and physical characteristics (i.e., geologic parent material and landform) that drive ecosystem composition and structure, and responds similarly to natural disturbances and management actions. An ESD document describes an ecological site in terms of the landscape and site level physical characteristics, plant communities, management interpretations, and other ecological dynamics. Until recently, ESD development was largely restricted to smaller, case-by-case projects, mainly in the western range states. In the spring of 2010, a national directive was signed to accelerate ESD inventory and implementation for the

rest of the country. In Missouri, the NRCS Soil Survey has teamed with the Missouri Department of Conservation to map and describe ESDs statewide. As a result, Missouri is the among the first of the eastern forest states to do substantial work on ESDs and will likely be the first to complete ESD interpretations for an entire state. Missouri ESD documents and maps will be available via the NRCS Web Soil Survey. In addition, ten eco-regional reports will be published by the U.S. Forest Service Northern Research Station and each will contain an accompanying DVD with associated geospatial data and other related information. It is our hope that land managers will use these products to help guide their efforts in managing Missouri's native ecosystems.

**KEY WORDS:** ECOLOGICAL CLASSIFICATION, PLANT ECOLOGY, DYNAMIC SOIL PROPERTIES, GEOLOGY, ECOLOGICAL RESTORATION

**MANAGEMENT, RESTORATION AND RESEARCH – JOINING FORCES TO RECLAIM AN OZARK PINE COMMUNITY.** Carrie R. Steen, Missouri Dept. of Conservation, 551 Joe Jones Blvd., West Plains, MO 65775. 417-256-7161. [Carrie.Steen@mdc.mo.gov](mailto:Carrie.Steen@mdc.mo.gov).

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The Missouri Ozarks is known for its large tracts of oak and mixed-hardwoods forest lands. This community becomes especially diverse among a topographical mosaic of plateau , riverbreaks, ridges and hollows. The diversity and microhabitats created continues to provide ample forage and cover for many wildlife species, recreational opportunities and lumber. So what is there to restore?

Turn of the 20<sup>th</sup> century timber barons also recognized the opportunity in harvesting these areas. As mixed-oak forest stands were cut over, so were the large pineries that also existed at the time. Oak stumps re-sprouted, and quickly shaded pine seedlings which could then not advance to a dominant canopy species. At the beginning of the 21<sup>st</sup> century, managers are left with even-aged oak forest tracts that are naturally senescing and subject to oak decline. Regeneration harvest alone would simply start the cycle over. Instead, this became a prospect for restoring shortleaf pine (*Pinus echinata*), its associated structure and composition. A restoration area was designated, but also designed with distinct, replicated units to better analyze the effects of different management techniques. As the study is in the beginning stages, some preliminary results will be provided. Primarily, this presentation will discuss the process of creating the restoration project, challenges of being operational and scientific, and unexpected opportunities for “mini-studies” along the way. In addition to studying vegetation responses, this has become a case study for management and research working closely to provide applicable information for continued restoration and maintenance of the shortleaf pine community.

**KEY WORDS:** SHORTLEAF PINE; COMMUNITY RESTORATION; OZARK

**THE FUTURE OF MISSOURI'S BIODIVERSITY.** Aaron Stevenson, Resource Scientist, Missouri Department of Conservation

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The future of biodiversity management in Missouri is uncertain. Anthropogenic influences beginning with Native American settlement thousands of years ago modified Missouri's landscape. Those changes were accelerated with Euro-American settlement in the 1800s as vast swaths of prairie were plowed under and lowlands were drained. Fire suppression and ineffective management tools added to the lost resiliency of these ecological systems. Today we are faced with much uncertainty as exotic species invasions and global climate change threaten our ecological livelihoods. For Missourians we are lucky, because we have state, federal, and NGO scientists working at the leading edge of ecosystem research. Projects such as the Missouri Forest Ecosystem Project and Missouri's Ecological Classification System lead the way with dedicated scientists providing the best available information to aid natural resource professionals with land management. For natural areas and all of Missouri's native biota, a controlled burn by trained professionals is a welcome relief from the days of annual woods burning and complete fire suppression. With data from three projects in southern Missouri, I can justify fire management programs on both public and private land.

**KEY WORDS:** TNC'S CHILTON CREEK PROJECT, FOURCHE CREEK CONSERVATION AREA, ROCKY CREEK CONSERVATION AREA, PRESCRIBED FIRE, ECOSYSTEM RESILIENCY

**GOLF COURSE CONSERVATION EASEMENTS WITH NATURAL HABITATS: A NEED FOR CLARITY.** John Taggart<sup>1</sup>, Charles Roe<sup>2</sup>. <sup>1</sup>Department of Environmental Studies, University of North Carolina at Wilmington. [taggartj@uncw.edu](mailto:taggartj@uncw.edu). <sup>2</sup> Southeast Land Trust Alliance. [croe@lta.org](mailto:croe@lta.org).

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Golf course conservation easements represent a controversial type of protected area which may qualify for federal and some state tax reduction incentives under certain conditions defined by the Internal Revenue Service Tax Code and respective state departments of revenue. Tax benefits are often the primary motivation for a landowner to terminate certain rights on a property through deed restrictions under a permanent conservation easement. One easement category within the Internal Revenue Service Tax Code requires protection of one or more natural habitats; however, few golf courses offered for conservation by this criterion actually possess meaningful environmental or biodiversity values, nor serve a real public interest. A general evaluation methodology is presented for objective consideration of such golf course conservation easements to ensure that only qualified sites are accepted. Not only is there a basic responsibility to comply with the intent of the tax code, but natural habitat quality must be maintained.

**KEY WORDS:** CONSERVATION EASEMENT, GOLF COURSE, TAX BENEFIT, NATURAL HABITAT, PROTECTED AREA

**STRATEGIC MANAGEMENT OF PRIORITY INVASIVE PLANTS: COORDINATED CONTROL THROUGH THE SOUTHERN ILLINOIS INVASIVE PLANT STRIKE TEAM.** [Karen Tharp](#)<sup>1</sup>, Chris Evans<sup>2</sup>, and Jody Shimp<sup>3</sup>. <sup>1</sup>The Nature Conservancy, [ktharp@tnc.org](mailto:ktharp@tnc.org), <sup>2</sup>River to River Cooperative Weed Management Area, [rivertoriver@gmail.com](mailto:rivertoriver@gmail.com), <sup>3</sup>Natural Heritage Division, Illinois Department of Natural Resources, [jody.shimp@illinois.gov](mailto:jody.shimp@illinois.gov).

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The Nature Conservancy, in partnership with the Illinois Department of Natural Resources, the River to River Cooperative Weed Management Area, and the USDA Forest Service Northeast Area State and Private Forestry Program developed the Southern Illinois Invasive Species Strike Team (ISST). This Strike Team deploys a trained, mobile force of two plant management specialists who assist with mapping, monitoring, and controlling of exotic plants at state parks, state nature preserves and adjacent private lands that serve as pathways onto these properties. Once risk has been identified, the Strike Team also serves as a Rapid Response Team. Applying the Early Detection & Rapid Response approach to invasive species management greatly improves the likelihood that invasions will be addressed successfully while populations are still localized and containable. The Invasive Species Strike Team serves 11 counties (Alexander, Gallatin, Hardin, Jackson, Johnson, Massac, Pope, Pulaski, Saline, Williamson and Union) in southern Illinois. The strike team project is being conducted to determine if this approach is a cost-efficient method of controlling invasive plants and whether the data collected is useful for strategic planning and Early Detection Events. This presentation will review the findings from the first 18 months of the strike team project.

**KEYWORDS:** INVASIVE PLANTS, EDRR, STRATEGIC PLANNING, COOPERATION

**EXPANDING HERBICIDE PRODUCT CHOICES FOR WEED MANAGEMENT IN NATURAL AREAS.** [John Vickery](#). [jvickery@mcg.net](mailto:jvickery@mcg.net).

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There are many herbicides that are not available to managers of natural areas. We generally utilize products labeled for generalized contexts such as 'rangeland' and 'noncrop areas'. However, the bulk of the active ingredients registered for such uses fall into just two modes of action, the ALS inhibitors and the growth regulators. Many active ingredients are registered for only one or very few settings such as turf and turf farms or a single major crop such as corn. Some of these active ingredients offer a desirable combination of characteristics that are not represented among the products currently registered for noncrop areas or rangeland. There are two federal programs that are possible avenues to ameliorating the situation. The IR4 Project—funded by USDA—was designed to increase pesticide options in the production of specialty crops, both agricultural and ornamental. The purpose of the US EPA OPP Conventional Reduced Risk Pesticide Program (CRRPP) is to facilitate the introduction of active ingredients that exhibit an improvement in environmental and human health risk profiles relative to existing products. In this presentation, the modes of action and chemical families of herbicide active ingredients are reviewed vis-à-vis registration for use in natural areas. Examples of active ingredients that are good candidates for 'natural areas registration' are presented, followed by a discussion of possibilities and issues concerning IR4 and CRRPP. It is argued that to avail of the potential of the options explored will require the active and sustained support of land managers and weed control specialists.

**KEY WORDS:** HERBICIDE OPTIONS, ACTIVE INGREDIENT, IR4, CONVENTIONAL REDUCED RISK PESTICIDE PROGRAM

**VEGETATION MANAGEMENT IN COLORADO FRONT RANGE PRAIRIE DOG COLONIES: CONCEPTS, CONSIDERATIONS, AND NATIVE PLANT ‘SURVIVORS’.** John Vickery, Denver Natural Areas Program, [vickejx@denvergov.org](mailto:vickejx@denvergov.org).

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Northern Colorado Front Range prairie dog colonies comprise a significant portion of the acreage of public lands managed as open space, natural areas, and wildlife habitat. Typically, these colonies receive relatively less vegetation management attention. Ostensibly, it is difficult to justify the expenditure of quite limited resources in areas where it is judged that there will be little lasting benefit. Meanwhile, with reduced predation in a fragmented landscape, prairie dog densities are generally too high to be sustainable. The result is a loss in native plant diversity and the deterioration of remnant native plant communities. However, many of these sites have more native plants than is generally appreciated and some of these plants seem to be resistant to long-term, continuous grazing and clipping. Preliminary surveys reveal that some twenty plant families are represented by these ‘survivors’, with Asteraceae alone accounting for about forty percent of the species. Although, common annual and/or weedy plants are well-represented among them, the largest component of the species richness consists of perennial forbs. These natives may offer a clue for the successful management of active colonies and the restoration of depopulated sites. A proposed approach to vegetation management includes the following components: Increasing the level of general weed management; Enhancing the control of nonnative plants that prairie dogs prefer not to eat; Fostering extant native plants (particularly, rhizomatous or patch-forming species); Planting native species for which prairie dogs have a low preference; Maintaining some exotic plant populations for forage; and controlling prairie dog density

**KEY WORDS:** PRAIRIE DOG, VEGETATION MANAGEMENT, NATIVE PLANTS, PUBLIC LANDS, COLORADO FRONT RANGE

**ECOLOGICAL SERVICES OF WEEDS: EXAMPLES AND IMPLICATIONS FOR NATURAL AREAS MANAGEMENT.** John Vickery and Megan Bowes. Education and Outreach Committee, Colorado Native Plant Society. [jvickery@mcg.net](mailto:jvickery@mcg.net); [bowesm@bouldercolorado.gov](mailto:bowesm@bouldercolorado.gov).

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Although not co-evolved, native animals utilize non-native plants in various settings from natural areas to ornamental plantings. Although such use is typically generalist in nature, it is nonetheless an important relationship where non-native plants comprise a significant part of the available vegetation. Native invertebrates and vertebrates utilize plants directly in the form of forage, shelter, nest materials, and perches and indirectly via the food chain. Weed control activities should take these considerations into account, especially whenever nonnative weeds are a substantial component of the available resources—such as nectar or pollen—at any point in time. The number and complexity of relationships that arise from a large number of species along with the various types of uses poses a challenge to land managers who try to control

weeds or manage vegetation with wildlife in mind. However, general principles, illustrated with common scenarios and case examples provide a good starting point. Instances involving both invertebrates and vertebrates and both aquatic and terrestrial settings are presented. Weed and vegetation management scenarios, with some general categories such as chemical, mechanical, biological, and cultural control (including prescribed fire) are explored.

**KEY WORDS:** ECOLOGICAL SERVICES, WEED MANAGEMENT, POLLINATORS, INVERTEBRATES, VERTEBRATES

**USING CITIZEN SCIENCE DATA TO BETTER UNDERSTAND THE DISTRIBUTION OF SOME KEY INVASIVE SPECIES IN TEXAS.** Damon E. Waitt and Travis Gallo<sup>1</sup>. <sup>1</sup>Lady Bird Johnson Wildflower Center at the University of Texas at Austin, Austin, TX. [dwaitt@wildflower.org](mailto:dwaitt@wildflower.org)

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The ecological impacts of invasive species are becoming increasingly worrisome. Invasive plant species do not provide significant food or shelter for native wildlife and displace the native plants that do. Every invasive plant species creates its own problems and Texas habitats and wildlife are increasingly suffering as a result. The Invaders of Texas Program was developed to address this conservation need. The Invaders of Texas Program trains citizen scientists to detect and report invasive plant species throughout Texas. Citizen scientists have reported over 7,000 observations that have been validated and delivered into a statewide database. This information contains the ecological information collected at the site along with the GPS coordinates for every observation. The program dramatically and systematically increases early detection, reporting and monitoring of invasive species in critical wildlife habitats. Citizen science data from the Invaders of Texas program has allowed us to better understand the distribution of some key invasive species, in Texas, such as *Arundo donax*, *Triadica sebifera*, and *Lonicera japonica*. This study compares Texas county records from two existing data sources, USDA PLANTS Database and the Atlas of the Vascular Plants of Texas, with citizen scientist data obtained from the Invaders of Texas program. Comparing citizen science data with existing data helps better understand the current distribution and spread of these particular species, allowing for better invasive plant management plans and priority areas for management and restoration.

**KEY WORDS:** INVASIVE SPECIES, CITIZEN SCIENCE, EDRR.

**ALTERNATIVE METHODS OF CONTROLLING JAPANESE STILTGRASS.** Jeffrey S. Ward<sup>1</sup>, and Todd L. Mervosh<sup>2</sup>. <sup>1</sup>Department of Forestry and Horticulture, The Connecticut Agricultural Experiment Station. [jeffrey.ward@ct.gov](mailto:jeffrey.ward@ct.gov). <sup>2</sup>Valley Laboratory, The Connecticut Agricultural Experiment Station. [todd.mervosh@ct.gov](mailto:todd.mervosh@ct.gov).

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Japanese stiltgrass (*Microstegium vimineum*) is an annual grass species native to eastern Asia that has become a serious invasive plant problem in much of the eastern United States. It is now widely distributed throughout the Southeast, Mid-Atlantic, and southern New England. Stiltgrass threatens not only "edge" communities, but because of its ability to grow in low light levels, can spread into undisturbed forests from adjacent infestations along roads, trails, and

streams. Stiltgrass can form dense monotypic stands that dominate entire habitats by displacing native groundlayer vegetation and inhibit tree regeneration. In 2008, we began a two-year study to compare untreated controls with eighteen treatment options: hand pulling, directed heating with a propane torch (June, July), cutting w/ string trimmer (July, August), table vinegar (June, July), Scythe (June, July), Pendulum AquaCap (June), Plateau (June), Acclaim Extra (July, high and low dose), Finale (August, high and low dose), and Rodeo (August, high and low dose). At the beginning of the third growing season, and after two rounds of treatment, all treatments reduced cover relative to the untreated plots. Hand-pulling was not effective and only reduced cover by two-thirds. Foliar application of vinegar in July, Scythe, and the string trimmer were more effective, but left a large enough population that stiltgrass will probably again dominant the site within several years. Synthetic herbicides, directed heating with a propane torch and foliar application of vinegar in June were effective treatments, but will require additional follow-up treatments if control is to be maintained.

**KEY WORDS:** INVASIVE, HERBICIDE, PROPANE TORCH

## Poster Presentation Abstracts

### Alphabetical by Primary Presenter's Last Name

**EFFECTS OF CHINESE PRIVET (*LIGUSTRUM SINENSE*) ON NUTRIENT CYCLING AND GROWTH BY RECOLONIZING NATIVE HERBACIOUS PLANTS.** G. Mitchell Allen, Oliver Herbst, and Katherine Larson, Department of Biology, University of Central Arkansas, Conway, AR 72035, [gma06001@cub.uca.edu](mailto:gma06001@cub.uca.edu); [klarson@uca.edu](mailto:klarson@uca.edu)

**G. Mitchell Allen**, Department of Biology, University of Central Arkansas, Conway, AR 72035, [klarson@uca.edu](mailto:klarson@uca.edu).

Chinese privet is increasingly abundant throughout the southeastern US, especially within riparian zones and wetlands that have been disturbed. Once established, Chinese privet dominates an area and reduces biodiversity. As part of a restoration of an urban natural area, areas invaded by Chinese privet were either cut and killed with herbicides or left intact. To evaluate the potential for reestablishing native vegetation we conducted greenhouse germination and growth studies of seedlings grown in soil from three different areas: (1) an area invaded by *L. sinense* and left intact, (2) an area with *L. sinense* cut and killed the previous year, and (3) an area that contained no *L. sinense*. Two native perennial species, *Pycnanthemum virginianum* and *Hibiscus lasiocarpus*, were planted in the three types of soil and allowed to germinate and grow in a controlled environment. Although germination was similar in all soil types, early seedling growth was greatest in the soils that contained privet. We investigated the potential mechanism by using resin bags to collect soil nutrients mobilized during the growing season in the three different sites. Understanding the impacts of Chinese privet on soil nutrient cycles will be key to managing the areas after privet removal.

**KEY WORDS:** CHINESE PRIVET, SOIL NITROGEN, SEEDLING ESTABLISHMENT

**DECOMPOSITION STATION SURVEY AT TUMBLING CREEK CAVE.** David Ashley<sup>1</sup> and Thomas Aley<sup>2</sup>. <sup>1</sup>Department of Biology, Missouri Western State University. [ashley@missouriwestern.edu](mailto:ashley@missouriwestern.edu). <sup>2</sup>Ozark Underground Laboratory, Protem, MO. [taley@ozarkundergroundlab.com](mailto:taley@ozarkundergroundlab.com)

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Tumbling Creek Cave (TCC) is a registered National Natural Landmark located on the property of the Ozark Underground Laboratory in Taney Co., Missouri. This cave contains the highest biodiversity of any cave west of the Mississippi River. For decades, OUL staff have led interpretive natural history tours of the cave and have utilized a series of wood decomposition stations to allow tour participants to observe terrestrial macroinvertebrates typically associated with cave habitats. Our current project was designed to initiate a survey of the different organisms found associated with these decomposition stations located in different areas (zones) of Tumbling Creek Cave. No specimens were collected or handled, merely observed and measured. In addition, we used a Kestrel 4000 Weather Station to collect climatic data. During visits to TCC, we observed different individuals (at least 15 different species) associated with the decomposition stations. Three species of millipede, one (perhaps *Pseudopolydesmus pinetorum*) a troglophile and two troglobites (*Causeyella dendropus* and *Chaetaspis aleyorum*) were noted. Webworms (*Macrocera nobilis*), guano pseudoscorpions (*Hesperochnes occidentalis*), a troglobitic isopod (*Brackenridgia ashleyi*), and a harvestman (possibly *Erebomaster flavescens*) were observed as well. Several unidentifiable invertebrates were also noted. Our preliminary analysis indicates no significant difference in the mean number of organisms per decomposition station across season (ANOVA,  $p=0.05$ ) and no significant differences between stations in terms of overall species richness, organism abundance and Shannon Index. However, three species (*B. ashleyi*, *C. aleyorum*, and *H. occidentalis*) were not evenly distributed among the five decomposition stations.

**KEY WORDS:** TUMBLING CREEK CAVE, DECOMPOSITION COMMUNITY

**MONITORING MISSOURI POPULATIONS OF THE PRAIRIE FRINGED ORCHIDS (*PLATANThERA PRAECLARA* AND *PLATANThERA LEUCOPHAEA*).** David Ashley<sup>1</sup> and Tom Nagel<sup>2</sup>. <sup>1</sup>Department of Biology, Missouri Western State University. [ashley@missouriwestern.edu](mailto:ashley@missouriwestern.edu). <sup>2</sup>Missouri Department of Conservation. [Tom.Nagel@mdc.mo.gov](mailto:Tom.Nagel@mdc.mo.gov)

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Museum records for the western prairie fringed orchid show it was historically distributed throughout much of western and northwestern Missouri but now exists at only three locations in the state. We have been annually monitoring the three extant Missouri populations of *Platanthera praeclara* since 1996. This report summarizes morphological measurements and flower counts of 2009 orchids at Helton Prairie (Harrison County), Tarkio Prairie (Atchison County) and Little Tark Prairie (Holt County). Prairies were systematically searched for orchids during early spring and summer. Specimens observed were flagged with temporary wire stake flags and permanently marked with aluminum tags with engraved numbers. A Trimble GeoExplorer was used to determine location and to record a variety of measurements and counts: total plant height, height to inflorescence, number of leaves, and number of buds or

flowers. The number of flowering stems of *P. praeclara* on each prairie (Helton = 18, Tarkio = 11, and Little Tark = 16) was less than those (29) of *P. leucophaea*. Individuals of *P. leucophaea* did not differ significantly in total height, height to inflorescence, number of leaves, or width of leaves from individuals of *P. praeclara* (Independent Samples T-test, alpha = 0.05). Individuals of *P. leucophaea* did exhibit a significantly greater number of flowers than did individuals of *P. praeclara* (Independent Samples T-test, alpha = 0.05).

**KEY WORDS:** PLATANThERA PRAECLARA, PLATANThERA LEUCOPHAEA, MONITORING

**SHOW ME THE MISSOURI RIVER.** M. Neil Bass<sup>1</sup>, Chuck Sellmeyer<sup>1</sup> and Jason Skold<sup>2</sup>

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**M. Neil Bass**, <sup>1</sup>US Army Corps of Engineers, Kansas City, Missouri 64106

The Missouri River Mitigation Project was authorized by Congress in 1986 and reauthorized in 1999. The Mitigation Project now is a part of the larger Missouri River Recovery Program. The original intent of the project was to mitigate for the 522,000 acres of habitat lost due to the completion of the Bank Navigation and Stabilization Project along the Missouri River. The Mitigation Project is authorized to purchase 166,750 acres of land from willing sellers in the Missouri River Floodplain from Sioux City, Iowa (RM 735) to St Louis, Missouri (RM 0), making this one of the largest land acquisition projects currently underway in the Corps. The goals of the project are to create native and diverse habitats and areas that require mostly passive management, preserve and improve riverine habitats and processes, preserve and restore wetland and upland terrestrial habitats, and create opportunities to reconnect the floodplain to the river. There are currently 58,570 acres acquired in Missouri, Kansas, Nebraska, and Iowa in varying stages of development. These project sites are managed by the US Army Corps of Engineers, US Fish and Wildlife Service, Missouri Department of Conservation, Missouri Department of Natural Resources, Kansas Department of Wildlife and Parks, Nebraska Game and Parks Commission, and Iowa Department of Natural Resources. These areas are open to varying forms of outdoor use.

**KEYWORDS:** MISSOURI RIVER, BIG RIVERS ECOLOGY, FLOODPLAIN MANAGEMENT

**AQUATIC VEGETATION MONITORING AT OZARK NATIONAL SCENIC RIVERWAYS, MISSOURI.** David E. Bowles, Hope R. Dodd ([Hope\\_Dodd@nps.gov](mailto:Hope_Dodd@nps.gov)), Jan A. Hinsey ([Jan\\_Hinsey@nps.gov](mailto:Jan_Hinsey@nps.gov)), Tyler Cribbs ([Tyler\\_Cribbs@nps.gov](mailto:Tyler_Cribbs@nps.gov)). National Park Service, Heartland Inventory & Monitoring Network.

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Over 300 springs occur at Ozark National Scenic Riverways. Since 2006, we have monitored aquatic vegetation communities annually in six of the largest springs. Vegetation sampling is conducted on six equally-spaced, fixed transects with each having three equally-spaced 1 m<sup>2</sup> plots (n=18). Daubenmire cover classes (% composition) are used to evaluate plant density. Diversity of aquatic vegetation is calculated for each transect and averaged across the sample reach using three measures: species richness, Simpson's index, and the Shannon diversity index. A final metric used to evaluate community structure is the ratio of exotic to native taxa.

We found 46 species of hydrophytes, mosses and algae from among the six springs, and community composition and structure varied widely. No single species is dominant in more than one spring, and most springs share several co-dominants. Mean plot species richness among springs ranged from 4 to 5, and effective number for Simpson's and Shannon indices ranged from 1 to 2 and 1 to 3, respectively among springs. Similarity analysis of this data shows that aquatic vegetation communities are most similar for Alley and Big springs (77%) and least similar for Blue and Round springs (49%). Several hydrophyte species previously reported from the springs are now absent, but conversely we have documented several new distributional records for other species, including several non-native species. These findings reflect the broad natural habitat diversity in and among these springs. The data aid resource managers in making informed, science-based decisions about these fragile systems.

**KEY WORDS:** AQUATIC VEGETATION, OZARKS, SPRINGS

**EFFECTS OF LAND MANAGEMENT PRACTICES ON PRIMARY PRODUCTION AND SOIL NUTRIENTS IN A TEMPERATE PRAIRIE ECOSYSTEM.** David R Burge. Department of Biology, University of Central Arkansas. [dburge@gmail.com](mailto:dburge@gmail.com)

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A 20 acre college natural area surrounded by urban land use constantly requires justification for its existence. A strong justification for a campus natural area is an ecosystem offset, providing ecosystem services lost by the development of the campus. Ability to maintain nutrient cycles through carbon sequestration and providing nutrients to headwater streams are examples of ecosystem services the natural area provides. The goal of this study was to determine how land management impacts net primary production and nutrient pools. To quantify the difference between management practices, the campus natural area was examined under three different management practices: mowed field, burned good quality prairie, and degraded prairie undergoing restoration to historical conditions. In each of these areas biomass samples were collected over a four month growing period to determine net primary productivity. Additionally, soil cores were gathered from each area and analyzed to determine carbon content of the soil and nitrogen availability in the soil. Using the productivity results a biomass gradient was established and statistically compared with soil nutrient availability. The results from this study help provide justification to maintain this natural area for ecosystem function. The functioning ecosystem in the campus natural area also provides justification through an opportunity to educate the general campus population and local community on the ecosystem role of a natural area.

**KEY WORDS:** NET PRIMARY PRODUCTION, PRAIRIE, NUTRIENT POOLS, CARBON SEQUESTRATION

**NATURAL AREAS AS SCIENTIFIC LABORATORIES. EMERALDS AT THE CROSSROADS: DRAGONFLY HYBRIDIZATION IN BERINGIA.** Dr. Syd Cannings<sup>1</sup>, Dr. Erik Pilgrim<sup>2</sup>, Dr. Rob Cannings<sup>3</sup>, Tim Vogt<sup>4</sup>, and Dr. Oleg Kosterin<sup>5</sup>, <sup>1</sup>Environment Canada, Whitehorse, YT; <sup>2</sup>US Environmental Protection Agency, Cincinnati, OH; <sup>3</sup>Royal British Columbia Museum, Victoria, BC; <sup>4</sup>Missouri Department of Natural Resources, Jefferson City, MO; and <sup>5</sup>Division of the Russian Academy of Science, Novosibirsk, Russia.

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Natural Areas are defined as, "Areas of land which have scientific, educational, and esthetic value by reason of distinctive features." Frequently, basic science conducted on natural areas has led to better understanding of ecological and evolutionary processes, which in turn often have management implications. Although not formally designated as such, Blackstone Fen occurs in a remote, pristine landscape in northern Yukon. The occurrence of putative hybrids in an undisturbed natural setting raises questions regarding evolution, biogeography, paleoecology, population ecology, behavioral ecology, and population genetics. Knowledge derived from these disciplines can help land managers make better informed choices.

**KEY WORDS:** DRAGONFLY, SOMATOCHLORA, HYBRIDIZATION, BERINGIA

**NORTHERN BOBWHITE QUAIL (*COLINUS VIRGINIANUS*) RESPONSE TO HABITAT RESTORATION ON PRIVATE LANDS IN NW MISSOURI: IMPLICATIONS FOR MANAGEMENT APPLICATIONS ON NATURAL AREAS.** [Richard Cook<sup>1</sup>](#), [Cary Chevalier<sup>1</sup>](#), [Jeffrey Powelson<sup>2</sup>](#), [Kyle Reno<sup>2</sup>](#), and [Wyatt Jackson<sup>1</sup>](#). <sup>1</sup>Department of Biology, Missouri Western State University. [rcook10@missouriwestern.edu](mailto:rcook10@missouriwestern.edu); [cchev@missouriwestern.edu](mailto:cchev@missouriwestern.edu); [wjackson3@missouriwestern.edu](mailto:wjackson3@missouriwestern.edu). <sup>2</sup>Missouri Department of Conservation. [kyle.Reno@mdc.mo.gov](mailto:kyle.Reno@mdc.mo.gov); [Jeff.Powelson@mdc.mo.gov](mailto:Jeff.Powelson@mdc.mo.gov).

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Northern bobwhite quail (*Colinus virginianus*) are the dominant native quail in the prairie ecosystem in North America, and the premier upland game bird in North America. Unfortunately, over the last decade or so, quail populations in the Midwest, including Missouri have shown a steady decline, largely due to widespread habitat destruction by way of habitat conversion for urban development and agriculture practices. In 2003 Missouri Department of Conservation instituted a strategic plan for recovery of northern bobwhite quail in Missouri. The purpose of this study is to determine quail response to the habitat restoration and management practices on a farm actively involved in quail habitat restoration and management. This project is part of an on-going study so in many ways, our data are preliminary. 8 quail were fitted with radio transmitter collars and monitored at least once/week. Our data currently suggests that the quail are responding well to the management practices being applied on this farm. Specifically, the quail are found predominately in warm-season grass (34%), woody (32%), and forbs (23%), vegetation types, as research predicts they would prefer. Further, they are rarely more than 10 m, and predominately within 4-8 m of the above preferred vegetation type. Quail on this site have varied home ranges, ranging from 2.7 ha (6.6 ac) to 18.5 ha (45.8 ac), with an overall average among these quail of 7.8 ha (19.3 ac). All our sample sizes to date are small, so home range size is still highly sensitive to sample size changes. As sample size increased, estimates of home ranges increased as well. As sample size reached 12 or so, estimates of home range begin to stabilize and began to reflect home range sizes observed in the literature.

**KEY WORDS:** NORTHERN BOBWHITE, COLINUS VIRGINIANUS, QUAIL MANAGEMENT, HABITAT RESTORATION

**USING GIS/GPS TECHNOLOGY TO ASSIST IN MANAGING HABITAT FOR A FEDERALLY ENDANGERED SPECIES: COLDWATER FEN AND THE MITCHELL'S SATYR BUTTERFLY (*NEONYMPHA MITCHELLII MITCHELLII*).** Randy Counterman and Nate Fuller. The Southwest Michigan Land Conservancy. [counterman@swmlc.org](mailto:counterman@swmlc.org); [fuller@swmlc.org](mailto:fuller@swmlc.org).

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The Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*) is listed as a federally endangered species. Strictly a fen dwelling creature, its' existence has been threatened mainly through the destruction and fragmentation of suitable habitat. Recent estimates of existing viable populations range from < 8 to no more than 11 sites. Despite their imperiled status and the availability of grant money earmarked for the enhancement or creation of habitat, little literature on the specifics of management activities or the results of these activities has been published. The goal of this project is to determine if Mitchell's satyr butterflies are actually moving into areas that are being created as habitat for them. Using GPS and GIS technologies, creating a systematic grid of evenly spaced sample points and a presence/absence determination of known vegetative, soil, and hydrologic associations, we have determined baseline conditions at a site having a healthy population of Mitchell's satyrs. Meshing this information with documented historic locations of butterflies, we have created a habitat suitability index model and are currently using this model to assist in management decisions. We will be assessing the results of our management activities and will also continue to monitor butterfly movement to determine if they are actually using managed areas that we have created for them.

**KEY WORDS:** MITCHELL'S SATYR BUTTERFLY, HABITAT MANAGEMENT, BASELINE ASSESSMENT, HABITAT SUITABILITY INDEX MODEL, GPS/GIS

**ESTIMATING THE OCCUPANCY STATUS OF SEVERAL MESOPREDATORS IN THE OZARK HIGHLANDS OF MISSOURI: OVERABUNDANCE FOR SOME AND ABSENCE FOR OTHERS.** Michael V. Cove, Liisa M. Niva, and Victoria L. Jackson. Department of Biology and Earth Science, University of Central Missouri. [m.cove3@gmail.com](mailto:m.cove3@gmail.com); [nivalm@gmail.com](mailto:nivalm@gmail.com); [vjackson@ucmo.edu](mailto:vjackson@ucmo.edu).

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Eastern spotted skunk populations have declined since the early 1940s, with the assumption that this resulted from land use alterations. Land use alterations have allowed generalist mesopredators to become overabundant and potentially compete with spotted skunks. We surveyed 14 mesopredator communities in the Ozark Highlands of southern Missouri to examine landscape associations and potential interactions among sympatric mesopredators and the eastern spotted skunk. During this period, no spotted skunks were documented, but three common mesopredators were detected. We created occupancy estimations for raccoons, Virginia opossums, and striped skunks within the region. Occupancy was constant and high (>0.85) across sites for raccoons and opossums. Detection probabilities for raccoons were moderate and affected by habitat covariates and sampling covariates; while opossum detection probabilities were high and affected by habitat covariates. Striped skunk models provided little inference due to small sample size and lack of repeat detections. Detection probabilities for all three species were affected by latitude. Our findings suggest that the generalist nature of raccoons and opossums have allowed them to become overabundant in the Ozark Highlands of

Missouri. With high abundance, these species may affect spotted skunk occurrence through interference and exploitative competition. Further studies should examine mesopredator community dynamics to determine the role of interspecific competition in the decline of the eastern spotted skunk.

**KEY WORDS:** MESOPREDATORS, OZARK HIGHLANDS, RACCOON, VIRGINIA OPOSSUM, SKUNK

**DISTRIBUTION OF THE PRAIRIE MOLE CRICKET *GRYLLOTALPA MAJOR* SAUSSURE (ORTHOPTERA: GRYLLOTALPIDAE) IN AREAS THAT ARE GRAZED AND UNGRAZED BY BISON AT PRAIRIE STATE PARK IN BARTON COUNTY MISSOURI.** Nicholas A. Crownover. Department of Biology, Pittsburg State University. [nacrownover@gus.pittstate.edu](mailto:nacrownover@gus.pittstate.edu)

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This study looked at the effect of bison grazing and found that populations were significantly higher in grazed locations. Two grazed and two ungrazed plots, each approximately 320, 000 m<sup>2</sup> were used in this study at Prairie State Park in Barton County Missouri . Over two calling seasons (2008 & 2009), portions of the four plots were systematically surveyed for calling chambers for 2 hours each night until all four plots had been entirely surveyed one time. The survey took approximately 18 days to complete each season and every calling chamber was located in the grazed and un-grazed plots with two spatial replicates over two seasons. Data were analyzed with a Pearson Chi square test. There was a highly significant difference in numbers of calling chambers between the two treatments with approximately 10 times more chambers in the grazed than the ungrazed areas. While studies have shown that controlled burning has little effect on the number of prairie mole crickets, this study suggests that bison can increase prairie mole cricket populations dramatically.

**KEYWORDS:** PRAIRIE MOLE CRICKETS, GRAZING, BISON

**DEVELOPMENT AND MAINTENANCE OF NATIVE BEE HABITAT WITHIN NATURAL AREAS FOR EDUCATION.** Zane M. Dye and David M. Gordon. Department of Biology, Pittsburg State University.

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Native bees are all around us, as many as 4,000 species of native bees occur in the United States. We have become aware of the importance of native bees in pollination plants within natural areas and need to learn more about them for long-term management planning. In addition we need to educate the general public to protect native bee populations. Both of these goals can be achieved by developing demonstration habitats that establish and maintain sustainable populations of native bees. These demonstration sites would emphasize the importance of our native bee populations and how to manage habitats for maintaining native bees. A main viewing area would house specimen collections and displays as well as a large window for viewing bees in a bee garden, one that could be easily replicated for the home. Tour paths would be developed to show native bee habitat requirements and their ecological importance to the system.

There are many internet sites to help with flower selection, but the key is to have a continuance of flower blooms throughout the season. Nesting sites can be artificially provided for most native bees such as leafcutter bees and bumble bees. Water and mud are crucial so providing a pond or creek with muddy banks is vital. One aspect of altering cultural practices involves not using pesticides. Following these four rules should provide a sustainable habitat for native bees. By developing demonstration habitats in natural areas we can improve our own management practices and educate the public.

**KEY WORDS:** NATIVE BEES, ALTERNATIVE POLLINATORS

**THE BIOLOGY AND ECOLOGICAL ROLES OF A LEAFCUTTER BEE IN A NORTHERN CALIFORNIA COASTAL DUNES PRESERVE.** David M. Gordon. Department Of Biology, Pittsburg State University. [dgordon@pittstate.edu](mailto:dgordon@pittstate.edu).

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The study was conducted on the Lanphere-Christensen Dunes Preserve in Arcata, CA between 1978 and 1990. The site is the least disturbed remaining example of the Pacific Northwest coastal dunes type. The solitary leafcutter bee *Megachile wheeleri* Mitchell is one of the most abundant species in the bee fauna. There are distinct behavioral and physical differences between males and females. Each female independently constructs a nest that contains a single brood cell fashioned from leaf cuttings. After it has been provisioned with pollen and nectar, an egg is laid, the cell is sealed, and another nest is constructed. Within this brood cell, the offspring eats the stored provisions, overwinters as a prepupa, pupates in April and adults are active from June to September. The primary pollen and nectar sources for females were *Achillea borealis*, *Erigeron glaucus* and *Solidago spathulata*. *Hypochoeris radicata* is occasionally visited, and males take nectar from *Polygonum paronychia*. Nesting habitat can be recognized by characteristic vegetation and nest densities can exceed 300 nests per square meter. In addition to pollinating the flowers they visit, these bees play other underappreciated ecological roles. By incorporating organic matter in the form of leaf material and nutrients in the form of feces into sand they probably influence soil formation and plant growth where they nest. Small mammals including skunks and rodents utilize the bees as a food resource.

**KEY WORDS:** HYMENOPTERA, MEGACHILIDAE, *MEGACHILE WHEELERI*

**WILDLIFE COMMUNITIES AND HUMAN RECREATIONISTS IN BOBCAT RIDGE NATURAL AREA.** Bonnie Caldwell Greenwood and Victoria Claire Wilson. Department of Fish, Wildlife, and Conservation Biology, Colorado State University. [bccgreen9@gmail.com](mailto:bccgreen9@gmail.com); [vcwilson7@gmail.com](mailto:vcwilson7@gmail.com).

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This study explores the impact of human recreationists on wildlife in Bobcat Ridge Natural Area in Fort Collins, Colorado. Eight camera traps were located within the natural area, four on-trail and four off-trail. Photos of wildlife and humans were enumerated by camera and used as the basis of analysis. The spatial and temporal use of the natural area by wildlife is not evenly

distributed; wildlife appear to spatially and temporally avoid human recreationists in the natural area. Bobcat (*Lynx rufus*), coyote (*Canis latrans*), and cottontail rabbit (*Sylvilagus floridanus*) photos were primarily during the night and at on-trail cameras. Coyotes appeared to shift their spatial use of the natural area during the day to off-trail areas, suggesting that coyotes spatially avoid human recreationists. Black bear (*Ursus americanus*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*) photos were primarily during the day and at off-trail cameras. Mule deer, and to a lesser extent, elk, appeared to shift their spatial use of the natural area during the night to on-trail areas; this suggests that mule deer and elk avoid trails when humans are present but take advantage of trails in the absence of humans at night. These results suggest a negative correlation between human presence and wildlife presence. Recreational use of Bobcat Ridge Natural Area may be adversely impacting wildlife due to the spatial and temporal avoidance of human recreationists. This study served as a foundation for the Rocky Mountain Cat Conservancy's Communities, Cameras, and Conservation project that involves local communities in conservation.

**KEY WORDS:** NATURAL AREAS, CAMERA TRAPS, WILDLIFE, RECREATION

**SPATIO-TEMPORAL DISTRIBUTION OF EASTERN RED CEDAR (*JUNIPERUS VIRGINIANA*) IN THE WICHITA MOUNTAINS NATIONAL WILDLIFE REFUGE, OKLAHOMA, USA.** [Lyndia D. Hammer](#), [Michael C. Stambaugh](#). Missouri Tree-Ring Laboratory, Department of Forestry, University of Missouri-Columbia. [ldhp54@missouri.edu](mailto:ldhp54@missouri.edu); [stambaughm@missouri.edu](mailto:stambaughm@missouri.edu).

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The rugged peaks of the Wichita Mountains National Wildlife Refuge in southwestern Oklahoma host the western edge of Cross Timbers forest in a matrix of mixed-grass prairie. Information regarding the historic frequency of fire and the pattern and extent of eastern red cedar (ERC) is needed to guide prescribed fire management efforts to control the species. To quantify the spatial and temporal pattern of ERC, vegetation and site characteristics were measured at 400 plots distributed across the Special Use Area of the refuge. Locations and ages of ERC trees were used to quantify encroachment patterns and rates. In addition, we constructed a 600-year long ring-width chronology for the purpose of analyzing long-term cedar growth and climate response, dating fire scars and identifying age cohorts. Site and vegetation variables were used to generate a predictive map of old (>100 years) and young (<50 years) cedar locations. We hypothesize that a positive correlation exists between maximum ERC tree age and local topographic roughness. Local topographic roughness likely represents a gradient in fire disturbance and may be useful for determining the historic extent of ERC throughout the refuge.

**KEY WORDS:** CROSS TIMBERS, EASTERN RED CEDAR, WICHITA MOUNTAINS, FIRE

**REFERENCE CONDITIONS FOR THE MISSOURI OZARKS.** [Brice Hanberry](#)<sup>1</sup>, [Hong He](#)<sup>1</sup>, [John Kabrick](#)<sup>2</sup>, [Dan Dey](#)<sup>2</sup>, [Brian Palik](#)<sup>3</sup>, and [Shawn Fraver](#)<sup>3</sup>. <sup>1</sup>School of Natural Resources, University of Missouri, Columbia, MO. [hanberryb@missouri.edu](mailto:hanberryb@missouri.edu); [heh@missouri.edu](mailto:heh@missouri.edu). <sup>2</sup>USDA Forest Service, Northern Research Station, Columbia, MO. [jkabrick@fs.fed.us](mailto:jkabrick@fs.fed.us); [ddey@fs.fed.us](mailto:ddey@fs.fed.us). <sup>3</sup>USDA Forest Service, Northern Research Station, Grand Rapids, MN. [bpalik@fs.fed.us](mailto:bpalik@fs.fed.us); [sfraver@fs.fed.us](mailto:sfraver@fs.fed.us).

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Forests in Missouri changed after European settlement, due in part to timber harvest, fire suppression, and conversion to agricultural and urban land use. Reconstruction of historical landscapes can provide a reference for restoration efforts, and which furthermore may reduce intense fire risk. Therefore, we used GIS (geographic information system) and statistical inference of General Land Office Surveys from 1815-1864 to spatially predict tree species distribution of the Missouri Ozarks section. For modeling and prediction, we used Random Forest, a nonlinear method that constructs many classification trees using different samples of both the data and the predictor variables. Relevant predictors included terrain characteristics and variables from the soil survey geographic (SSURGO) dataset. Modeling and prediction rates for 20 species or species groups were above 90%. Our predictions provide a spatial representation of historical forests, as a reference for future restoration.

**KEY WORDS:** GENERAL LAND OFFICE, HISTORICAL FORESTS, RESTORATION, TREE DISTRIBUTION

**SOIL COMPOSITION USING PORTABLE X-RAY FLUORESCENCE SPECTROMETRY (PXRF) IN THE LOESS HILLS OF THE MISSOURI RIVER.** Dr. Kurt M. Hartman<sup>1</sup>, Dr. Shauna L. Hiley<sup>2</sup>, Samantha M. Schmuecker, Brian Guyer, Peter Nelson, Tyeson Geiger, Nicole Deveau, Tommy Beck, and Amanda Sullivan. <sup>1</sup>Dept. of Biology, Missouri Western State University. [khartman3@missouriwestern.edu](mailto:khartman3@missouriwestern.edu); <sup>2</sup>Dept. of Chemistry, Missouri Western State University. [hiley@missouriwestern.edu](mailto:hiley@missouriwestern.edu).

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The loess hills along the Missouri River are a unique ecosystem group encompassing forested habitats on northeast and northwest facing slopes and prairies on southeast and southwest slopes. Without disturbance of fire or grazing, prairies are encroached upon by woody plants, eventually reverting to forested environments. Because of possible slope and aspect differences, we sought to quantify the elemental composition of various locations of the loess hills. We used a Bruker Tracer III SD portable X-ray fluorescence spectrometer to identify and relatively quantify the elements in soil taken from 130 grid locations. Samples were collected from the top 10 cm of the soil profile, air dried, and homogenized before analysis. Detectable elements included the following: Al, Ca, Cr, Fe, K, Mn, Mo, Nb, P, Pb, Rb, Si, Sn, Sr, Ti, Y, and Zr. Ca and K demonstrated greater quantities in prairie versus forest habitats. Ca, Fe, and Mn demonstrated differences based on elevation. K was positively correlated with Si, and Al was positively correlated with K and Si. These data will be used as a multivariate, chemical element description of the loess hills and to associate elemental correlations with herbaceous and woody plant distributions.

**KEY WORDS:** SOIL ANALYSIS, EDAPHIC, LOESS, GRADIENT, CONSERVATION

**MIDSTORY REMOVAL WITHIN A MIXED UNEVEN AGED OAK STAND TO PROMOTE NATURAL REGENERATION OF VARIOUS OAK SEEDLINGS.** Dawn E. Henderson<sup>1</sup>, Mike Anderson<sup>2</sup>, Mike Keeley<sup>1</sup>, and Eric R. Goats<sup>3</sup>. <sup>1</sup>Missouri Department of Conservation. [Dawn.Henderson@mdc.mo.gov](mailto:Dawn.Henderson@mdc.mo.gov). [Mike.Keeley@mdc.mo.gov](mailto:Mike.Keeley@mdc.mo.gov). <sup>2</sup>Consulting Forester, Perryville, MO. [manderson010@charter.net](mailto:manderson010@charter.net). <sup>3</sup>University of Tennessee, Martin. [erigoat@ut.utm.edu](mailto:erigoat@ut.utm.edu).

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Natural regeneration of oaks can be slow and unreliable. Due to oak decline and the desire for sustainable production, an increased interest has arisen for promoting stand development through forest management practices. In a pilot project designed to determine oak seedling growth response to light availability, a midstory thinning using hack and squirt technique was performed on an uneven aged mixed oak stand. Thinning occurred on both north and south facing slopes to identify seedling growth response to midstory removal. Species such as maple, ironwood, and dogwood were treated and northern red, white, and black oak seedlings were tagged and measured for initial height and root collar diameter. Light levels, before and after the thinning, were tracked yearly on both slopes and compared to a control treatment. A positive growth response to increased light was found for the thinning treatments on both slopes while the trend in the control treatment was slightly negative. Growth response varied by species with black and red oak responses indicating a positive relationship between growth and light, while white oak response was flat to negative. In the control treatment, black oak growth response was negative while northern red and white oak showed a minor but positive growth rate. These findings indicate that increased light provided by hack and squirt technique can increase growth response in natural stands, however, these responses are species specific. Further, these findings could be used to identify optimum light level requirement for natural stands as well as afforestation and restoration efforts.

**KEY WORDS:** OAKS, NATURAL REGENERATION, LIGHT AVAILABILITY, MIDSTORY REMOVAL

**INFLUENCES OF ENVIRONMENTAL FACTORS ON AQUATIC INVERTEBRATE COMMUNITY STRUCTURE IN OZARK TRIBUTARIES AT BUFFALO NATIONAL RIVER AND OZARK NATIONAL SCENIC RIVERWAYS.** [Janice A. Hinsey](mailto:Janice.A.Hinsey@nps.gov), David E. Bowles, Hope R. Dodd, J. Tyler Cribbs. National Park Service, Heartland Inventory & Monitoring Network. [Jan\\_Hinsey@nps.gov](mailto:Jan_Hinsey@nps.gov); [David\\_Bowles@nps.gov](mailto:David_Bowles@nps.gov); [Hope\\_Dodd@nps.gov](mailto:Hope_Dodd@nps.gov); [Tyler\\_Cribbs@nps.gov](mailto:Tyler_Cribbs@nps.gov).

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In 2006, the National Park Service implemented long-term monitoring of aquatic invertebrate communities in wadeable tributaries of three Ozark rivers: Buffalo River, Buffalo National River (BUFF), Arkansas and Current and Jacks Fork rivers, Ozark National Scenic Riverways (OZAR), Missouri. Tributary watersheds are influenced by local and regional environmental factors that affect the aquatic invertebrate communities. Diversity data and environmental factors from 45 tributaries were analyzed to determine similarities among tributaries and between parks, and the influences, if any, of the environmental factors on the invertebrate communities. A total of 175 unique taxa were reported with 98 present in both parks. Metric results (taxa richness, EPT index, biotic index, Shannon's diversity index) indicated varying, but similar levels among tributaries and between rivers. Cluster analysis (Ward method, Euclidean distance) based on Sörenson's Similarity Index (taxa presence/absence) resulted in two distinct clusters of Buffalo River and Current River tributaries with Jacks Fork tributaries distributed

between groups. Spatial relationship of environmental factor PCA scores further illustrated distinct park groupings. Significant correlation results of metrics to factors showed potential influences of environmental factors on the communities.

Differences in environmental factors between these rivers do not appear to greatly influence overall integrity of the invertebrate community within each tributary even though results showed significant correlations as well as distinct taxa groupings. However, the community structure does appear to be influenced by the watershed specific environmental factors. Further analysis is underway to better understand these effects and to evaluate other possible influences such as geology.

**KEY WORDS:** AQUATIC INVERTEBRATE, TAXA SIMILARITY, ENVIRONMENTAL FACTORS, OZARKS

**HEARTLAND NETWORK I&M WEBSITE REDESIGN FOR IMPROVED VISITOR USABILITY.**

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The Heartland Network Inventory & Monitoring (HTLN) website is the public face of the program, as well as the portal for information sharing between our network parks. This thereby translates into the need for an organized web-design that efficiently and effectively conveys resource information to different audiences. To achieve this we updated and organized our website to reflect the needs of our diverse audience, providing readily accessible resources through a dynamic and simplified webpage design.

We restructured long and cluttered pages into Spry Tabbed Panels and Collapsible Panels to reduce clutter and improve organization. This change equips web surfers with control over the amount of information per page they wish to display. Additionally, the navigation panel was logically simplified into comprehensive groups with subjects expressed through tabular/fly-out menus. This streamlined design is dynamically engaging and easy to use, assisting rapid information retrieval and presenting information in a viewer-friendly format.

By implementing these structural changes to the HTLN website, we have engaged a diverse audience and enhanced their overall website experience. Our redesigned website serves as an efficient model for improving online communication between the I&M Networks, park managers, and the public.

**KEY WORDS:** WEBSITE, DATA MANAGEMENT, DYNAMIC WEBPAGE, SPRY, DESIGN.

**MONITORING A GLADE RESTORATION: AN OPPORTUNITY FOR UNDERGRADUATE EDUCATION AND RESEARCH.**

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Lindenwood University's Boone Campus includes approximately 1000 acres of natural areas available for educational purposes. South-facing slopes with rocky outcrops and invasive cedar were determined to be promising for glade restoration and cedar removal in a 1.5 acre study area began in fall 2008. Habitat alteration and monitoring activities were incorporated into the curriculum in selected classes and have served as the basis for introducing our students to scientific research. In spring 2009, students in Field Biology conducted preliminary surveys, established boundaries of the study areas (treatment and control), and placed coverboards to study reptile populations. Long-term monitoring of coverboard use is a continuing project conducted by different students each semester who register for research experience. Research students also conduct individual short-term projects. Changes in the arthropod community have been investigated by collecting and identifying organisms in leaf litter and soil samples and by trapping surface active and flying insects. A study of the effects of cedar removal on herbaceous vegetation focused on selected native glade species and invasive species colonizing the disturbed area. Students in Environmental Geology examined changes in physical parameters: air and soil temperature and soil moisture. This study was continued as a student research project with greater detail provided by the use of dataloggers. We report on both short-term and long-term projects and expect that these studies will provide insight into the progress and success of glade restoration as well as valuable educational opportunities for our students.

**KEY WORDS:** GLADE RESTORATION, UNDERGRADUATE EDUCATION, UNDERGRADUATE RESEARCH, INVASIVE SPECIES, MONITORING

**HISTORIC CANOPY DISTURBANCE AND THE ROLE OF TOPOGRAPHY IN THE MISSOURI OZARK HIGHLANDS.** Chad King, Rose-Marie Muzika, Richard Guyette. [cbkm88@mail.missouri.edu](mailto:cbkm88@mail.missouri.edu); [muzika@missouri.edu](mailto:muzika@missouri.edu); [guyetter@missouri.edu](mailto:guyetter@missouri.edu). Department of Forestry, University of Missouri.

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Disturbances vary both at a temporal as well as a spatial scale, and communities are adapted to variations in frequency, extent, magnitude, and type of disturbance. Using dendrochronological techniques and growth release detection methods, we analyzed the canopy disturbance history of a shortleaf pine-oak (*Pinus echinata*, Mill.; *Quercus* sp.) forest in the Missouri Ozark Highlands. The site consisted of opposing aspects providing an opportunity to determine the role of topography in the response of pine and oak to historic overstory disturbance. The north aspect consisted of predominately white oak (*Quercus alba*, L.) within the 4 ha Current River Natural Area, and the opposing south aspect (10 ha) consisted of shortleaf pine and oak species. We used existing dendrochronology data from the Current River Natural Area and sampled remnant pine and increment cores of dominant and co-dominant shortleaf pine and white oak on the south aspect. Tree-ring width measurements provided over a 300 year disturbance chronology for both south and north aspects. Preliminary analysis of growth release events suggests variation in the frequency of canopy disturbance events on opposing aspects which likely contributed to the differences in forest structure of the opposing aspects.

**KEY WORDS:** DENDROCHRONOLOGY, CANOPY DISTURBANCE, GROWTH RELEASE

**RESTORATION AND MANAGEMENT OF NATURAL AREAS THROUGH SCIENCE AND HISTORY.** David M. Knotts, Amanda D. Molenpah, Daniel W.J. Beliese; School of American Studies, Lindenwood University. [dknotts@lindenwood.edu](mailto:dknotts@lindenwood.edu); [adm533@lionmail.lindenwood.edu](mailto:adm533@lionmail.lindenwood.edu); [thelonghunter@earthlink.net](mailto:thelonghunter@earthlink.net)

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One of America's most noted explorer and colonizer, Daniel Boone is credited for opening up settlement opportunities east of the Alleghany Mountains into Kentucky and the Ohio River Valley, eventually settling along the Femme Osage River of eastern Missouri. Why did he choose to settle here? What are needs of man to live? Does man have the same needs as wildlife? How does the fish, forest and wildlife or the area meet those needs? What impacts has man made on the area from pre-settlement to modern times? Can the area return to pre-settlement ecology? If so, how?

At the Daniel Boone Historic Site and Science Center, K-12 students, participate in various interdisciplinary (Math, Science, History, Social Studies and language arts) investigative tasks to answer these questions and others. University students research and identify Natural Areas in need of restoration, protection and management. One of the most significant restoration projects is a glade in which over 500 cedars have been removed from approximately 1.5 acres of the site and other restoration practices implemented. Several sub-studies, such as botanical analysis, avian diversity, and reptile counts have been generated by the students.

This poster will illustrate activities designed to raise student and public awareness of eastern Missouri Natural Areas, their historical evolution and the pre-settlement to present day impacts of man and how restoration and subsequent conservation and management will ensure the future of critical Natural Areas.

**KEY WORDS:** HUMAN DIMENSIONS; EDUCATION; RESEARCH; GLADE RESTORATION; LAND MANAGEMENT

**THE RELATIVE CONTRIBUTION OF SEEDLING ESTABLISHMENT VERSUS VEGETATIVE SPREAD IN INVASIONS BY JAPANESE HONEYSUCKLE.** Katherine Larson and Michael Uffenbeck. Dept. of Biology, University of Central Arkansas. [klarson@uca.edu](mailto:klarson@uca.edu).

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Japanese honeysuckle is a well known invader of natural areas, however, our studies in Arkansas have found limited pollination by native insects, low fruit set, and low seedling recruitment, traits not typically associated with a strong invader. We have found that *Lonicera japonica* has strong morphological plasticity and rapid vegetative growth that appears to enhance its capacity to dominate an area through strong clonal growth. Here we will report on a long term study to quantify the rate of vegetative spread under different environmental conditions (early successional field and forest edge) for both *Lonicera japonica* and its native congener, *Lonicera sempervirens*. In addition we have quantified seedling establishment for each species. We find that *L. japonica* is capable of much greater colonization of space through vegetative spread than *L. sempervirens*, but that *L. sempervirens* is more successful in colonization through seedling establishment. In addition we found that different genotypes of *L.*

*japonica* spread at different rates, with some no more invasive than the native species. We also report on a molecular study to determine the number of genotypes of *L. japonica* that have invaded an Arkansas natural area and thus determine the relative importance of seeding recruitment versus clonal spread in filling space. We use the results of this study to make recommendations for how to best manage natural areas with established populations of Japanese honeysuckle and areas that are potential sites of invasion.

**KEY WORDS:** LONICERA JAPONICA, SEEDLING RECRUITMENT, RESTORATION, VEGETATIVE SPREAD

**LONGLEAF PINE RESTORATION ON STATE NATURAL AREA PRESERVES IN SOUTHEAST VIRGINIA.** Darren Loomis, Rick K. Myers, and Paul A. Clarke. Virginia Department of Conservation and Recreation, Division of Natural Heritage. [darren.loomis@dcr.virginia.gov](mailto:darren.loomis@dcr.virginia.gov); [rick.myers@dcr.virginia.gov](mailto:rick.myers@dcr.virginia.gov); [paul.clarke@dcr.virginia.gov](mailto:paul.clarke@dcr.virginia.gov).

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Longleaf pine (*Pinus palustris*) once dominated forests on over 60 million acres from eastern Texas to southeastern Virginia. Frequently-burned longleaf pine forests have high species diversity owing to the rich groundcover vegetation maintained by fire. Numerous threatened and endangered species are associated with fire-maintained longleaf pine communities. In Virginia, longleaf pine is critically imperiled (G5/S1), found only in isolated and degraded habitats. In 2005, the Virginia Department of Conservation and Recreation (DCR) and the Virginia Department of Forestry (DOF) began cooperating to restore longleaf pine forests at the northern limit of the historic range of this iconic fire-adapted species. Activities have included 1) locating, mapping, and protecting remnant mature longleaf pines; 2) improving bucket truck access; 3) collecting cones; 4) extracting and testing seed; 5) producing high-quality containerized planting stock. Seedlings have been grown under contract with a state forest tree nursery near Goldsboro, NC. In 2007 and 2008, over 120,000 longleaf pine seedlings were grown from seed collected from the largest remaining northern range longleaf pine stand located near Franklin, Virginia. In 2008, 125 acres were planted with longleaf pine at Chub Sandhill Natural Area Preserve in Sussex County. Site preparation methods included bush hogging, scalping, timber harvesting, and prescribed burning. In 2010, 120 acres of longleaf are scheduled for establishment at Antioch Pines Natural Area Preserve in Isle of Wight County. Longleaf pine restoration is planned for other state natural area preserves in southeast Virginia, with a goal of over 3,000 acres by the year 2020.

**KEY WORDS:** LONGLEAF PINE, HABITAT RESTORATION, PRESCRIBED FIRE

**SHOOT CONTROL OF RUNNING BAMBOOS USING GLYPHOSATE.** Victor Maddox<sup>1</sup> and John Byrd<sup>2</sup>. <sup>1</sup>Geosystems Research Institute, Mississippi State University. [vmaddox@gri.msstate.edu](mailto:vmaddox@gri.msstate.edu). <sup>2</sup>Department of Plant and Soil Sciences, Mississippi State University. [jbyrd@pss.msstate.edu](mailto:jbyrd@pss.msstate.edu).

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Running bamboos continue to be a problem in natural landscapes. There are herbicide options for treating running bamboos, but when tree preservation is an issue, options are diminished. Running bamboo shoot production tends to be most active in spring and young shoots may be more susceptible to herbicides during this period. This study was conducted on *Brachystachyum densiflorum* (Rendle) Keng, *Phyllostachys aurea* Carr. ex Riviere & C. Riviere, *Phyllostachys heteroclada* Oliver, *Phyllostachys nigra* (Lodd. ex Lindl.) Munro, and *Shibitaea lancifolia* C.H. Hu each spring in 2009 and 2010 while shoots were actively growing. Each species received three treatments including a control and one application each of 1% and 2% ai v/v glyphosate (445 g ae/L), selectively applied using a back-pack sprayer. Ten shoots were included in each treatment and height measurements were recorded for five weeks following treatment. Both rates were effective in controlling shoots on all species. No basal regrowth was observed during the study period, although potential translocation was observed on shoots in close proximity to treated shoots. Based upon the results of this study, glyphosate can be effective for treating actively growing bamboo shoots. However, multiple applications would be required for complete control, since rhizomes were not killed and produced shoots the following year in 2010. In addition, some damage to non-target species was observed during the study. Thus caution should be taken when using glyphosate, which is a non-selective herbicide.

**KEY WORDS:** INVASIVE SPECIES, MANAGEMENT, HERBICIDE

**BOOT BRUSH STATIONS: AN EFFECTIVE WAY TO STOP THE SPREAD OF INVASIVE SPECIES?** Misty McElyea<sup>1</sup>, David J. Gibson<sup>1</sup>, Chris Evans<sup>2</sup>. <sup>1</sup>Department of Plant Biology, Center for Ecology, Southern Illinois University Carbondale. [m.mcelyea88@gmail.com](mailto:m.mcelyea88@gmail.com); [dgibson@plant.siu.edu](mailto:dgibson@plant.siu.edu). <sup>2</sup>River to River Cooperative Weed Management Area. [rivertoriver@gmail.com](mailto:rivertoriver@gmail.com).

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Invasive species are introduced species that compete with native species for particular resources. The impact of invasive species can be damaging both environmentally and economically. In 2008, boot brush stations were constructed along 26 trail heads in southern Illinois, to limit the spread of invasive species seed by hikers. This study was conducted to determine the efficiency of these boot brush stations. A soil sample was collected from each boot brush station, and from a trail edge location 4.6 m down the trail. In addition, invasive species observed growing at the boot brush station and up to 92 m down the trail were recorded. 603mL of each soil sample was spread in a thin layer over vermiculite in 17.8 X 13.34 cm trays and placed inside a greenhouse. Seedlings of invasive species emerging from the soil samples were identified and recorded. Invasive species occurred along the trail more frequently than at the boot brush stations. The most common invasive species observed at the boot brush stations was *Trifolium repens* L. (white clover, 39% of stations), whereas the most commonly observed invasive species along the trails were *Lonicera japonica* Thunb. (Japanese honeysuckle, 58% of trails), and *Rosa multiflora* Thunb. (multiflora rose, 54%). By contrast, at one trail head, invasive species occurred at the boot brush but not down the trail. The greenhouse portion of this experiment is ongoing, and results will be available at the end of the summer.

**KEY WORDS:** BOOT BRUSH STATIONS, INVASIVE SPECIES, SHAWNEE NATIONAL FOREST, ILLINOIS

**RANGE EXPANSION OF THE NON-NATIVE ROESEL'S KATYDID (*METRIOPTERA ROESELII*) INTO NORTHERN INDIANA.** [Scott Namestnik](mailto:scottnamestnik@jfnew.com)<sup>1</sup> and Carl Strang<sup>2</sup>. <sup>1</sup>JFNew. [snamestnik@jfnew.com](mailto:snamestnik@jfnew.com). <sup>2</sup>Forest Preserve District of DuPage County, Illinois. [wildlifer@aol.com](mailto:wildlifer@aol.com).

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Roesel's Katydid (*Metrioptera roeselii*) is an Orthopteran native to central Europe that was introduced to North America in Montreal, Quebec in 1953. Since that time, this member of the shieldback group has spread throughout the northeastern United States and adjacent Canada and along the East Coast. In addition, an isolated population of this non-native insect has been documented in Illinois, spreading into Wisconsin and Iowa. In 2009 we first discovered this species in Indiana, and in 2009 and 2010 our casual surveys have documented Roesel's Katydid in 10 northern Indiana counties to date. Further research will allow us to speculate as to whether Roesel's Katydid has expanded into Indiana from the northeastern population or from the isolated population to the west. Roesel's Katydid is known to feed on nymphs of other insect species; however, the long-term impact of this predaceous insect on native katydid populations is currently unknown.

**KEY WORDS:** ROESEL'S KATYDID, RANGE EXPANSION

**EFFECTS OF *LIGUSTRUM SINENSE* ERADICATION ON AVIAN ABUNDANCE AND SPECIES RICHNESS IN CENTRAL ARKANSAS.** [Jessica Needham](mailto:jeraneedham@aol.com), Katherine Larson, and Mary Victoria McDonald, Department of Biology, University of Central Arkansas, Conway, AR 72035, [jeraneedham@aol.com](mailto:jeraneedham@aol.com); [klarson@uca.edu](mailto:klarson@uca.edu)

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*Ligustrum sinense* is one of the most common exotic and invasive plant species in Arkansas forests, and in many locations, it is being actively managed through cutting, spraying the stumps with herbicide, and burning. However, little is known about the effects of *L. sinense* and these management strategies on avian abundance and species richness. Once established, *L. sinense* provides fruits that birds eat as well as cover, and it is not clear what impacts removal will have. The main goal of this study is to contrast bird abundance and richness in two areas of an urban natural area, one where *L. sinense* was cut and killed with herbicide and the other where the *L. sinense* remained intact. We found that average daily richness increased in the *L. sinense* removal plots but that average daily abundance was not impacted. The urban nature reserve where this study is being conducted contains remnants of native prairie as well as *L. sinense* invaded areas. In a second study we tested the hypothesis that the urban nature reserve containing native vegetation had higher avian abundance and species richness than nearby urban nature reserves lacking native vegetation. Although average daily abundance and richness were not different in the two urban areas, we did observe more total species of birds in the natural area with native vegetation (35 species) than in the less natural park area (23 species). This study showed that removing *L. sinense* had an immediate positive impact on birds using the area, and that urban reserves with native vegetation are visited by more species of birds than more altered natural areas.

**KEY WORDS:** CHINESE PRIVET, AVIAN ABUNDANCE

**CONNECTING THE PONDS: A GRAPH THEORY APPROACH TO ASSESSING WOOD FROG POPULATION CONNECTIVITY IN MISSOURI.** William E. Peterman<sup>1</sup>, Tracy A. G. Rittenhouse<sup>2</sup>, and Julia E. Earl<sup>1</sup> <sup>1</sup>Division of Biological Sciences, University of Missouri-Columbia. [bill.peterman@gmail.com](mailto:bill.peterman@gmail.com); [jee9rb@mizzou.edu](mailto:jee9rb@mizzou.edu). <sup>2</sup>University of Wisconsin-Madison, [trittenhouse@wisc.edu](mailto:trittenhouse@wisc.edu)

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Wood frogs (*Rana sylvatica*) in east-central Missouri are at the edge of their Midwest distribution, and are a species of conservation concern. Previous research has shown that Missouri wood frog populations are very stochastic in time and space. Using 5 years of egg mass survey data, we assessed the demographic connectivity and spatial structure of wood frogs in detail at Daniel Boone Conservation Area, and more generally across the ~70 km River Hills Region. We found that 34 ponds have been used for breeding since 2005 at Daniel Boone, but that only 15 harbor large enough populations to serve as sources. The remainder of the ponds are assumed to act as sinks or pseudo-sinks, whereby populations are generally too small or ponds are too isolated to contribute individuals to other breeding ponds. A broader assessment of the region showed that there are numerous potential breeding ponds, and that generally there is a large amount of connectivity among conservation areas with exception of the eastern part of the region that is likely demographically disconnected from the rest of the region. Our results provide working models for interpreting patterns of occupancy and gene flow at both local and landscape scales. Additionally, our models can serve as an initial guide for future habitat management and restoration for this vulnerable species in Missouri.

**KEY WORDS:** CONNECTIVITY, GRAPH THEORY, SOURCE-SINK

**MAPPING CURRENT AND HISTORIC VEGETATION AT PEA RIDGE NATIONAL MILITARY PARK.** Dyanna Pursell<sup>1</sup>, Mike DeBacker<sup>2</sup>, David Diamond<sup>1</sup>, Kevin Eads<sup>3</sup>, Lee Elliott<sup>1</sup>, Kevin James<sup>2</sup>, Ronnie Lea<sup>1</sup>. <sup>1</sup>Missouri Resource Assessment Partnership, University of Missouri-Columbia. [purselld@missouri.edu](mailto:purselld@missouri.edu); [diamond@missouri.edu](mailto:diamond@missouri.edu); [elliottle@missouri.edu](mailto:elliottle@missouri.edu); [lear@missouri.edu](mailto:lear@missouri.edu). <sup>2</sup>National Park Service, Heartland Inventory & Monitoring Network. [Mike\\_DeBacker@nps.gov](mailto:Mike_DeBacker@nps.gov); [Kevin\\_James@nps.gov](mailto:Kevin_James@nps.gov). <sup>3</sup>National Park Service. [Kevin\\_Eads@nps.gov](mailto:Kevin_Eads@nps.gov).

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Missouri Resource Assessment Partnership (MoRAP) mapped current and historical vegetation at Pea Ridge National Military Park, Benton County, Arkansas, for management planning by the National Park Service. In order to map current vegetation, image objects that circumscribe visually homogeneous polygons were generated from stacked, 1-meter resolution leaf-on and leaf-off aerial imagery. Each of more than 18,000 objects were visually inspected at a scale of 1:2,500 and attributed into one of fifteen land cover classes. The same image objects were also attributed with abiotic variables that influence vegetation patterns, including soil type, percent slope, and solar insolation (exposure and shading). Experts defined current vegetation based on the occurrence of a particular land cover on a specific abiotic site type for each object, resulting in a thematic resolution of 28 mapped vegetation types. MoRAP used ecological interpretation to attribute six historic vegetation types to image objects based on combinations

of soil type, percent slope, and solar insolation. These results allow a comparison between current and historic vegetation, providing a framework for future park management planning.

**KEY WORDS:** CURRENT VEGETATION, HISTORICAL VEGETATION, LAND COVER MAPPING

**DATABASES AS SECURE CONTAINERS FOR LONG-TERM ECOLOGICAL MONITORING DATA.** [Gareth Rowell](#), Heartland Inventory and Monitoring Network, National Park Service. [gareth\\_rowell@nps.gov](mailto:gareth_rowell@nps.gov).

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The Inventory and Monitoring Program of the National Park Service has developed data management practices for monitoring projects on approximately 270 National Parks. An important part of these practices has been to secure monitoring data with the goal of protecting data into perpetuity. Key aspects of database security are determined by design and implementation of databases. This poster describes how databases can be designed to securely store long-term ecological monitoring data. Three components of design are data models, data definition and referential integrity. Ecological data models take advantage of the fact that data are associated with events in ecological time and space. Data definitions restrict the kinds of data that will be stored in each table. Based on the field data you want to collect, you can restrict field definitions by data type (text, numeric integer or float), whether values must be unique and whether nulls are allowed. Referential integrity represents the rules for relationships between tables. For example, if you have a data table containing bird observations and one of the fields is the AOU code which identifies the species, the data table can be linked to a look-up table containing all AOU codes. Using the rules of referential integrity, AOU code values in the data table, by definition, must match those in the look-up table. This eliminates data entry errors. Detailed examples on how to secure ecological data are discussed.

**KEY WORDS:** REFERENTIAL, DESIGN, MODEL, DEFINITION

**THE REPRODUCTIVE BIOLOGY OF AMUR HONEYSUCKLE SUGGESTS A NUANCED CONTROL STRATEGY.** Kurt E. Schulz and [Jessica Wright](#). Department of Biological Sciences, Southern Illinois University Edwardsville. [kschulz@siue.edu](mailto:kschulz@siue.edu); [jchoudh@siue.edu](mailto:jchoudh@siue.edu).

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Amur honeysuckle (*Lonicera maackii*) is an invasive exotic shrub honeysuckle throughout the northeastern U.S. It readily colonizes the continuum of forest light environments (edges, gaps, interior). In practice it is largely impossible to purge forests of honeysuckle, but it is always desirable to limit its ecological impact and further recruitment from bird-dispersed seeds. Informal observations suggested fruit production increases greatly with light availability. If this is the case, larger, faster-growing edge shrubs may be the primary sources of seed, and should be the central focus of control efforts. We compared vegetative growth characteristics, flower production, fruit set, fruit production, fruit size, seed number and seed mass of 100 mature shrubs growing in a continuum of forest light conditions. Shrubs in shade produced equal numbers of nodes per branch as high light plants, but conspicuously fewer flowers. Rates of

fruit set did not differ with light. Fruit production under high light was far higher than in even moderate shade. Fruits produced in high light were twice as heavy and contained 50% more seeds. Seeds produced in high light were 150% heavier than seeds from shade, but did not differ in germination rate. Shrubs in high light contribute very disproportionately to seed rain. We recommend managers with limited resources focus on exterminating forest edge and gap shrubs. Radical pruning, as opposed to extermination, might be an economical way to limit the competitive impact of interior shrubs.

**KEY WORDS:** INVASIVE PLANTS, *LONICERA MAACKII*, ASIATIC HONEYSUCKLE, BIRD DISPERSAL

**COMPARING EVIL TWINS: SEEDLING RESPONSES OF TWO INVASIVE SHRUB HONEYSUCKLES TO LIGHT.** Kurt E. Schulz, Jessica Wright, David Harroun, and Luci Ann Kohn. Department of Biological Sciences, Southern Illinois University Edwardsville. [kschulz@siue.edu](mailto:kschulz@siue.edu); [jchoudh@siue.edu](mailto:jchoudh@siue.edu); [dharrou@siue.edu](mailto:dharrou@siue.edu); [lkohn@siue.edu](mailto:lkohn@siue.edu).

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Amur honeysuckle (*Lonicera maackii*) and the hybrid “bella” honeysuckle complex (*Lonicera x bella*, *L. tatarica* X *L. morrowii*) are common invasive shrubs in the northeastern U.S. Amur honeysuckle seems to be more problematic in the southern part of the range (Ohio River and central Mississippi River valley), while the hybrid complex is apparently a greater problem northward. We asked whether there were simple differences in germination behavior and seedling growth which might resolve these apparent geographic patterns. Seeds of both taxa were collected from the field, with material from different seed mothers kept separately. Seeds were planted in the greenhouse and placed under high light (ambient) and simulated shade (70% shade) after 40 d. Germination rates were much higher for the hybrid than Amur honeysuckle (72 vs. 55%), and variation between mothers was greater in Amur honeysuckle. Height growth began earlier in Amur honeysuckle, and it retained a height advantage through the experiment (108 d). Both taxa showed reduction in height and mass with shade, but no change in leaf or belowground mass. Specific leaf area, an indicator of shade acclimation, increased in the same manner for both species. In general Amur honeysuckle maintained higher allocation to above vs. below ground structures, but the hybrid was more flexible in adjusting allocation patterns to shade. The persistent height advantage of Amur honeysuckle may allow it to overtop competitors in productive post-agricultural landscapes, while higher shade tolerance may benefit the hybrid in forested landscapes.

**KEY WORDS:** INVASIVE PLANTS, *LONICERA MAACKII*, *LONICERA X BELLA*, ASIATIC HONEYSUCKLE, PHENOTYPIC PLASTICITY

**ASSESSING GERMINATION VIGOR AND VIABILITY OF MISSOURI SHORTLEAF PINE SEEDLOTS STORED FOR 43, 30, 23 AND 6 YEARS** Stacey L. Smith<sup>1</sup>, David P. Gwaze<sup>2</sup> John P. Dwyer<sup>1</sup>. <sup>1</sup>Department of Forestry, University of Missouri. [sls13e@mail.missouri.edu](mailto:sls13e@mail.missouri.edu); [dwyerj@missouri.edu](mailto:dwyerj@missouri.edu). <sup>2</sup>Missouri Department of Conservation. [David.Gwaze@mdc.mo.gov](mailto:David.Gwaze@mdc.mo.gov).

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Due to exploitation in the late 19th and early 20th centuries, most of the 6 million acres in Missouri originally described as shortleaf pine (*Pinus echinata* Mill.) forest types have been replaced by oak-hickory forests. Currently, natural regeneration is inadequate and restoration efforts rely heavily on artificial regeneration methods. All seeds used in artificial regeneration were harvested and placed in storage over 20 years ago; this situation is not likely to change in the foreseeable future.

Understanding the impact of length of seed storage on germination vigor and viability of seed is critical to the successful production of shortleaf pine seedlings and for restoring the species by direct seeding. A germination test was conducted to experimentally determine germination vigor and viability for four Missouri shortleaf pine seedlots stored for varying lengths of time: 43, 30, 23 and 6 years. Seeds were stratified according to published recommendations for recently harvested seed. Mean germination values and germination rates were estimated for each seedlot. Seeds in storage for 6 years had the highest vigor and viability, and seedlot stored for 23 years had the lowest vigor and viability. The poor performance of the seedlot stored for 23 years relative to seedlots stored at 30 and 43 years is attributed to sub-ideal storage conditions.

**KEYWORDS:** GERMINATION TEST, STRATIFICATION, SEED STORAGE, SHORTLEAF PINE

**VEGETATION RESPONSE TO INITIAL MANAGEMENT FOR SHORTLEAF PINE COMMUNITY RESTORATION.** Carrie R. Steen and Susan Farrington. Missouri Dept. of Conservation, 551 Joe Jones Blvd., West Plains, MO 65775. 417-256-7161. [Carrie.Steen@mdc.mo.gov](mailto:Carrie.Steen@mdc.mo.gov); [Susan.Farrington@mdc.mo.gov](mailto:Susan.Farrington@mdc.mo.gov).

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Management to address oak decline in the Missouri Ozarks has provided opportunity to restore historic shortleaf pine (*Pinus echinata*) communities. One of the major barriers to promoting pine regeneration and advancement is the re-sprouting ability and greater growth rate of other species after cutting. The MIDCO Shortleaf Pine Restoration area was established to both implement and monitor restoration efforts. The area was harvested or slashed to increase available light, and burned to provide a seed bed conducive to pine. We divided MIDCO into 10 units, with one control unit and 3 replicate units of 3 pine release/competition control methods. Pre-treatment data was collected after site preparation work was completed, with releases being applied when necessary. Data was collected 3 years after initial site preparation. Preliminary results indicate that pine regeneration is already showing advancement in size class, doubling its proportion in the sapling size class (>4.5 ft; 8% to 15%). *Quercus spp.* still dominate by maintaining approximately 50% of the sapling class. Although not all units have been treated, there was an overall reduction of competition from 2006 to 2009 ranging from 32% to 45% decrease. Ground flora estimates currently show expected responses to major canopy reduction with the largest increases in *Panicum spp.*, *Lespedeza spp.*, and oak and hickory regeneration.

**KEY WORDS:** SHORTLEAF PINE; COMMUNITY RESTORATION; OZARK; COMPETITION

**RECREATIONAL USE OF THE MISSOURI RIVER: RESULTS FROM A PUBLIC USE STUDY.** Tom Treiman, Steve Sheriff and Rochelle Renken. Missouri Department of Conservation. [tom.treiman@mdc.mo.gov](mailto:tom.treiman@mdc.mo.gov) ; [steve.sheriff@mdc.mo.gov](mailto:steve.sheriff@mdc.mo.gov) ; [rochelle.renken@mdc.mo.gov](mailto:rochelle.renken@mdc.mo.gov) .

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From 2004 to 2005, a public use survey was conducted by the Missouri Department of Conservation and the Nebraska Game and Parks Commission to estimate the number of recreational users of the Missouri River, describe visitor activities and socio-characteristics, and estimate the economic value of the river to those users. Clerks interviewed over 80,000 users at over 400 access points along the river. Based on this systematic sample, we estimate there were slightly over 2 million recreational visits by more than 1.1 million parties and that users spent over 6.3 million hours on site. Information is available on 71 consumptive and non-consumptive activities. Overall river recreation provided between \$24 million and \$36 million in annual economic value to users. Specific numbers are also available for segments of the river and some individual sites. Natural Areas managers along the river can use these numbers to help understand the pressure on the resource as well as the level of support for sustainable management for recreation implicit in the economic values of the users.

**KEY WORDS:** PUBLIC USE, ECONOMIC VALUE, SURVEY.

**ANY SHEEP IN THE LANDSCAPE? UNLIKELY CONNECTIONS OF LANDSCAPE NATIONAL PARKS IN INTERIOR ALASKA AND NORTHERN ENGLAND.** Lucy Tyrrell, Denali National Park and Preserve. [Lucy\\_Tyrrell@nps.gov](mailto:Lucy_Tyrrell@nps.gov)

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In summer 2007, when I was looking ahead to more than 100 miles of the Coast to Coast walk in England, I was sure I'd see lots of sheep. I was equally sure that I'd be "on holiday" and wouldn't be thinking about my home landscapes in Denali National Park and Preserve. However, as I walked the route within the three national parks in northern England (Lake District, Yorkshire Dales, and North York Moors), I found myself making lists of things that were similar and dissimilar between these landscape parks and Denali. As I saw countless sheep bounded by dry stone walls, I was reminded how Dall's sheep in Denali are the reason this Alaskan park was established. (Mount McKinley National Park was the first U.S. national park to be established for protection of wildlife, rather than grand scenery). While Denali's sheep are not contained by rock walls, they are constrained to rocky locations in the outer Alaska Range, where they can find food, but are relatively safe from large predators, long absent in the English landscape. For me, one of the striking differences between parks was the difference in terminology for landscape features—beck, fell, dale, scar. This comparison of landscape parks touches on themes of mountain landscapes, conservation issues, restoration and management, and the concept of parks and wilderness.

**KEY WORDS:** LANDSCAPE, NATIONAL PARKS, CONSERVATION

**NATURAL RESOURCE CONNECTIONS: CREATING FACT SHEETS TO CONNECT RESEARCHERS WITH GENERAL AUDIENCES.** Lucy Tyrrell, Denali National Park and Preserve. [Lucy\\_Tyrrell@nps.gov](mailto:Lucy_Tyrrell@nps.gov)

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Researchers are accustomed to sharing results in specialized journals or as technical posters and talks. I have collaborated with researchers after their research experiences in Denali to create fact sheets for general audiences, including visitors, educators, and park managers. The researcher provides text and figures to illustrate the key points about the methods and results, and I edit the text, create a two-page color layout, and email a draft fact sheet to the researcher along with questions and comments. The researcher and I work back and forth, until we are satisfied that the messages are clear and scientifically accurate. The outcomes are (1) a printed fact sheet about the research process and results, and (2) an increased ability by the researcher to share data in a straightforward, simplified manner. When researchers working in national parks or other natural areas are able to clearly communicate their research results through fact sheets or other media, they connect people with the landscapes and ecosystems, build support for additional research in natural areas, and provide information for science-based management of these protected areas.

**KEY WORDS:** EDUCATION, RESEARCHER, COMMUNICATION, SCIENCE

**EVALUATING NORTH AMERICAN TALLGRASS PRAIRIE QUALITY USING THE AUCHENORRHYNCHA QUALITY INDEX.** Adam Wallner<sup>1</sup>, Christopher Dietrich<sup>2</sup>, and Brenda Molano-Flores<sup>2</sup> <sup>1</sup>Department of Entomology, University of Illinois, 505 S. Goodwin Ave, Urbana, IL 68101. [wallner@illinois.edu](mailto:wallner@illinois.edu). <sup>2</sup> Illinois Natural History Survey, 1816 S Oak St., Champaign, 61820. [dietrich@forbes.inhs.uiuc.edu](mailto:dietrich@forbes.inhs.uiuc.edu), [molano@inhs.uiuc.edu](mailto:molano@inhs.uiuc.edu).

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Numerous reports indicate that insects respond differently to disturbance-based management (fire) than prairie vegetation. Therefore, plant-based measures, such as the Floristic Quality Index (FQI) may not be sufficient in measuring prairie quality. This project is the first attempt to develop a habitat quality index based on prairie Auchenorrhyncha. The goal of this study was to develop an Auchenorrhyncha Quality Index (AQI) and examine its robustness using different environmental and sampling conditions; examine how the AQI correlates with other measures of prairie quality (FQI); and investigate the effects of burn management on prairie Auchenorrhyncha quality. We sampled Auchenorrhyncha from 71 sites in Illinois, Wisconsin, Missouri, and Iowa from the summer of 2004 through 2008 using a sweep net and vacuum. Results show that AQI values calculated from vacuum samples is a robust measure of prairie quality when computed under different environmental and sampling conditions. No significant difference in prairie quality was detected by either the AQI or the FQI. Strong correlations were observed between percent cover of both perennial C4 grasses and perennial forbs and conservative Auchenorrhyncha, whereas adventive Auchenorrhyncha were more strongly associated with trees and shrubs. Values of AQI, Auchenorrhyncha mean coefficient of conservatism, and auchenorrhynchan species richness were significantly greater on unburned sites than recently burned sites. Because other studies have shown that conservative Auchenorrhyncha respond negatively to frequent fire while the effects of fire on vegetation seem

to be positive it is important to incorporate insects as well as plants into the assessment of prairie quality.

**KEY WORDS:** INSECTS, AUCHENORRHYNCHA, HABITAT QUALITY INDEX, PRAIRE MANAGEMENT

**MOUNT RUSHMORE NATIONAL MEMORIAL CONDITION ASSESSMENT.** Gary Willson<sup>1</sup>, Sunil Narumalani<sup>2</sup>, Christine Lockert<sup>3</sup>, and Paul Merani<sup>2</sup>. <sup>1</sup>National Park Service, Great Plains CESU. [Gary\\_Willson@nps.gov](mailto:Gary_Willson@nps.gov). <sup>2</sup>School of Natural Resources, University of Nebraska-Lincoln. [snarumalani1@unl.edu](mailto:snarumalani1@unl.edu); [pmerani@unlnotes.unl.edu](mailto:pmerani@unlnotes.unl.edu). <sup>3</sup>University of Nebraska-Lincoln, Great Plains CESU. [clockert2@unl.edu](mailto:clockert2@unl.edu).

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Mount Rushmore National Memorial is a small cultural park (517 ha) with limited but important natural resources that are somewhat sheltered in a landscape dominated by the Black Hills National Forest. During 2007–2009, we assessed the condition of natural resources in the memorial using existing data and a scorecard approach similar to that used for Canadian national parks. We identified the major habitats in the memorial (forest, rock outcrop and barren, and stream and wetland) and used those habitats as the ecological framework for the assessment. We assessed natural resource condition and trend through biodiversity and process indicators that range from old-growth ponderosa pine forest to water quality. We characterized indicator condition as poor or good and trend as deteriorating, stable, improving, or no trend. We based our characterizations on a comparison of reference and existing values for one or more measures of each indicator. We also identified existing and potential stressors including three major stressors - fire suppression, exotic trout competition, and mountain pine beetle infestation. Based on our subjective evaluation of the indicators of the habitats, their conditions and trends are forest (poor and deteriorating), rock outcrop and barren (poor and no trend), and stream and wetland (good and no trend). We suggest two priority management strategies to improve natural resource condition – continuation of mechanical removal of dense stands of small ponderosa pine trees followed by prescribed burns and elimination of exotic brook trout from streams followed by stocking of native fish.

**KEY WORDS:** MOUNT RUSHMORE NATIONAL MEMORIAL, NATURAL RESOURCES, CONDITION ASSESSMENT

**RESTORING PIEDMONT PRAIRIE AND HARDPAN WOODLANDS IN VIRGINIA: A DECADE OF SUCCESS AT DIFFICULT CREEK NATURAL AREA PRESERVE.** Claiborne Woodall, Bryan Wender, Rick Myers, and Chris Ludwig. Virginia Department of Conservation and Recreation, Division of Natural Heritage. [claiborne.woodall@dcr.virginia.gov](mailto:claiborne.woodall@dcr.virginia.gov); [bryan.wender@dcr.virginia.gov](mailto:bryan.wender@dcr.virginia.gov); [rick.myers@dcr.virginia.gov](mailto:rick.myers@dcr.virginia.gov); [chris.ludwig@dcr.virginia.gov](mailto:chris.ludwig@dcr.virginia.gov).

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Located in the southern Piedmont Province of Halifax County, Virginia, the Difficult Creek conservation site supports rare ecological communities and several state and globally rare plant species. In the early 1980s, large blocks of the conservation site's native vegetation were

cleared and converted to loblolly pine (*Pinus taeda*) plantations by a timber company. From 2001 to 2003, the Virginia Department of Conservation and Recreation (DCR) acquired and dedicated 819 acres of the site as a State Natural Area Preserve. Since then, DCR's Division of Natural Heritage has worked to restore Difficult Creek Natural Area Preserve to a desired future condition of prairie-like openings within open woodlands, dominated by oaks, hickories, and shortleaf pine.

We evaluated plant community monitoring data, rare plant population monitoring data, and photo monitoring series to chronicle the effects of a decade of restoration efforts, including harvesting loblolly pines, prescribed fire, drum-chopping, exotic plant control, and tree planting. Our results suggest that the current management strategy is (1) increasing native herbaceous richness and abundance and (2) beneficial to the site's high-value conservation species. Similar results may be possible within other portions of the Difficult Creek conservation site and similar sites in the Piedmont of Virginia and North Carolina.

**KEY WORDS:** PIEDMONT PRAIRIE, PRESCRIBED FIRE, RARE PLANTS

**COMPARATIVE ANALYSIS OF AQUATIC INSECT, AMPHIPOD, AND ISOPOD COMMUNITIES IN RHEOCRENE SPRING SYSTEMS OF MISSOURI STATE PARKS.** Megan M. Zeller, Richard M. Houseman, and Robert W. Sites. 1-31 Agriculture Building, Division of Plant Sciences, University of Missouri, Columbia, Missouri. [mmhhr2@mail.missouri.edu](mailto:mmhhr2@mail.missouri.edu) ; [HousemanR@missouri.edu](mailto:HousemanR@missouri.edu) ; [SitesR@missouri.edu](mailto:SitesR@missouri.edu)

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Spring systems in Missouri provide critical initial discharge from subterranean aquifers to streams and harbor a unique biota. However, little research has been conducted on the crenobiology or ecology in these systems. In this study, aquatic insect, amphipod, and isopod communities were examined in 12 rheocrene (flowing) spring systems in Missouri state parks, in some of which associated environmental gradients were measured. The goal of this study was to create a comprehensive list of species present in all studied systems and analyze changes in community composition among select spring systems in relation to environmental gradients, as well as to determine if current stream biomonitoring protocol can be applied to rheocrene spring systems. Sorenson's similarity coefficient and UPGMA cluster analysis suggested that differences between high discharge spring systems may be related to the presence of trout and trout fisherman. Renkonen's similarity coefficient and cluster analysis suggested that differences between low to medium discharge spring systems may be related to the aquatic faunal region in which each is located, as species assemblages in Prairie and Big River faunal region springs were dissimilar from those in Ozark springs. Canonical correspondence analysis (CCA) showed that environmental conditions differ among springs and affect species differently in each aquatic faunal region, which may explain the observed differences in community composition. In addition, several state and federally listed species of conservation concern were collected, as well as several species endemic to the Interior Highlands. Based on the community composition of low to medium discharge spring systems, it is unlikely that current biomonitoring protocol would be useful if applied; however, this protocol may be useful for high discharge spring systems due to their higher abundance and diversity of aquatic insects.

**KEYWORDS:** AQUATIC INSECTS, AMPHIPODS, ISOPODS, SPRING SYSTEMS, MISSOURI