LINKAGES BETWEEN ECOLOGICAL RESTORATION AND ECOSYSTEM SUSTAINABILITY

THIRD MIDWEST-GREAT LAKES SER CHAPTER MEETING

April 1 to 3, 2011 University of Illinois Springfield

ABSTRACT BOOK

Edited By: Peter C. Smiley Jr., Young D. Choi, David P. Benson, Hua Chen, Cody Fleece, Michael J. Lemke, Jennifer Lyndall, and Katherine L. Martin.

SER MIDWEST GREAT LAKES SOCIETY FOR ECOLOGICAL RESTORATION

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PREFACE

The Third Annual Meeting of the Midwest-Great Lakes Chapter of the Society for Ecological Restoration was held April 1 to April 3, 2011 at the University of Illinois Springfield in Springfield, Illinois. We had 122 individuals from nine states (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) in attendance for this three day event. Our goal for the meeting was to explore the linkages between ecological restoration and ecosystem sustainability and to discuss how current restoration efforts contribute to regaining, preserving, and sustaining the structure and functions of Midwestern and Great Lakes ecosystems. Our scientific agenda consisted of a keynote presentation, a plenary session on floodplain restoration, two workshops, 22 poster presentations, 23 contributed oral presentations, a guided tour of the Emiquon Restoration Project, and two field trips to visit restoration projects in central Illinois and northwest Indiana. Additional meeting events included: 1) a sponsorship reception held in conjunction with the poster session; 2) a wine and cheese reception during the Emiquon Restoration Project tour; 3) the annual Chapter business meeting; and 4) an awards ceremony that recognized the Best Student Poster Presentation, Best Student Oral Presentation, and the Student Presenter Who Traveled the Farthest Award. This abstract book contains the abstracts from all meeting presentations, workshops, and the offsite field trips.

ACKNOWLEDGEMENTS

We are very grateful to the tremendous support provided by our generous meeting host (University of Illinois Springfield) and our generous meeting sponsors (Illinois Chapter of The Nature Conservancy, Stantec, Therkildsen Field Station at Emiquon, Great Rivers Partnership –The Nature Conservancy, ENVIRON, Prairie Restorations Inc., Eco Logic, Christopher B. Burke Engineering, Lake States Fire Science Consortium, Spence Restoration Nursery, Northwater Consulting, University of Illinois Springfield Biology Department, Island Press, and JFNew). The support of our meeting host and sponsors enabled us to: hold a sponsorship reception; support student participation; defrayed food costs; and to help us make our Annual Meeting as environmentally friendly as possible. Staff of the University of Illinois Springfield assisted with planning the meeting. Particularly, the contributions of Hua Chen, Michael Lemke, and Carolyn Neitzke contributed greatly to the success of the meeting. We thank other members of the Board of Directors (Kimberly Suedkamp Wells, Bob Barr, Bob Grese, Geoff Morris, Stephen Thomforde, Chris Lenhart, Cara Hardesty, John Shuey, and Anne Remek Kominowski) for assisting the Annual Meeting Committee in organizing and holding the meeting. Nancy Aten, Todd Aschenbach, Cody Fleece, Jennifer Lyndall, Izabella Redlinski, Rocky Smiley, and Donald Tilton served as judges for the Best Student Presentation Awards. Assistance with set up and registration was provided by Jennifer Lyndall, Cara Hardesty, Katie Martin, Belynda Smiley, and student volunteers from the University of Wisconsin-Stevens Point SER Student Guild. We are also thankful for the participation of the meeting presenters, moderators, tour leaders, field trip leaders, volunteers, and attendees for making our Third Annual Chapter Meeting a success.

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KEYNOTE PRESENTATION ABSTRACT

Anderson, Roger C.*. **Midwest oak woodlands and savannah: origins, historic changes, and futuristic trends**. Illinois State University, Normal, Illinois. Email: rcander@ilstu.edu

Oak savannas and woodlands in mid-continent North America were best developed along a north-south gradient from Minnesota to southeastern Texas where eastern deciduous forests and grasslands meet. Extensive occurrence of these communities was of relatively recent origin and was associated with and with concurrent fires set by Native Americans as well as a warming and drying trend (Hypsithermal), which began about 8 kyBP (thousand years before present), peaked near the middle of the Holocene (5-6 kyBP), and ended 3.5-5 kyBP. Cooler and presumably moister conditions following the Hypsithermal would have favored conversion of oak savanna and woodlands to closed forest dominated by mesophytic trees species on most sites. Fires were set by Native Americans as a management tool to maintain needed resources, including oak and hickory mast and species of wildlife hunted for food. These fires also maintained oak savannas and woodlands. In the 1990's, ecologists debated whether Midwest savannas were a distinctive vegetation type or a transitional community between grassland and forest. While this issue remains unresolved, there is recent evidence indicating that there are few, if any, species restricted to savannas. However, several species that occur in prairies or forests reach their greatest abundance in savannas and the species diversity of savannas generally exceeds that of grasslands and forests. Future climate change and invasive species will have negative effects on remaining remnant oak savanna and woodlands, most of which were lost during a relatively short time period from the mid-1800's to the present. For example, in the Midwestern United States, fire suppression in the previous two centuries, habitat fragmentation, and agricultural and urban development reduced these communities to less than 0.02% of the 11-13 million hectares they historically occupied. In addition, the variety and diversity of these communities has declined, as well as the area they historically occupied. On many mesic and dry-mesic sites, successional invasion by native mesophytic trees, and subsequent mesophication has reduced tree and ground layer diversity and all but eliminated possibilities for restoration of degraded remnants of oak savanna and woodlands. Despite extensive loss of savanna and woodland habitat, reasonably large areas with potential for restoration occur on low competition, low nutrient, xeric sites. On these sites, oak savannas and woodlands may persist with appropriate management despite climate change. Nevertheless, as was the case with historic oak savannas and woodlands, intervention by humans, including fire management and efforts to reduce influx of invasive species or their removal once established, will be necessary to maintain these communities.

FLOODPLAIN RESTORATION PLENARY SESSION ABSTRACTS

Sparks, Richard*. **Floodplain restoration: the big picture**. National Great Rivers Research and Education Center, Alton, Illinois. Email: rsparks@illinois.edu

Most of the floodplains and deltas in the developed nations of the world have been leveed for agriculture and commercial development, and developing nations seem to be following suit. Authors of a paper in Nature last fall used a spatially explicit global-accounting approach to quantify threats to human water security (adequate water supply and protection from flooding) and to freshwater biodiversity. They concluded that the United States and other developed nations have been able to achieve water security through massive investments in dams, levees and other technologies, but at the cost of increasing threats to biodiversity. They characterize the actual and potential losses of freshwater biodiversity as a "pandemic", with biodiversity in 65% of the world's rivers and streams falling into the moderate to highly threatened category. The papers in this session describe one floodplain restoration project that is underway at the Emiquon Preserve (a former agricultural levee district) on the Illinois River. During the same period that the Emiquon restoration was being planned, approximately the same acreage was being leveed and developed for commercial and residential use on the floodplain near St. Louis. The development cost $2.2 billion and includes 28,000 new homes on floodplain that was under water in the Great Upper Midwest Flood of 1993. From a larger, policy perspective, insights from the Emiquon Preserve are needed to help us quantify the links among biodiversity, ecosystem processes, and ecosystem goods and services that will enable us to maintain healthy ecosystems and economies. We will not be a sterling example to the developing world until we have done a better job with our own floodplains.

Blodgett, Doug*. **The Nature Conservancy's Emiquon Project: contributing to the long-term health of the Illinois River by restoring and managing functional floodplains**. Illinois River Program, The Nature Conservancy, Lewistown, Illinois. Email: dblodgett@tnc.org

Ecologically, functional floodplains are important not only for habitat they provide for resident and migratory wildlife, but also for essential contributions to ecological processes that sustain large-floodplain river ecosystems. At Emiquon, we are working with partners on a science-based approach for restoring and managing floodplain to contribute to the ecological health and sustainability of the Illinois River for nature and people.

Herkert, James, R*. **Adaptive management at The Nature Conservancy's Emiquon Preserve.** Illinois Department of Natural Resources, Springfield, Illinois. Email: james.herkert@illinois.gov

The Nature Conservancy and its partners have developed a framework for evaluating the success of conservation work. The framework, which was published by Parrish et al. 2003 (Bioscience 53,851-860), includes four core components, (1) identification of a limited number of focal conservation targets, (2) identification of key ecological attributes for these targets, (3) identification of an acceptable range of variation for each attribute as measured by properly selected indicators, and (4) rating of target status based on whether the target's key attributes are within acceptable ranges of variation. The approach provides a foundation for setting conservation objectives, assessing threats to targets, identifying monitoring and research needs, and evaluating conservation progress. Beginning in 2004, The Conservancy initiated an effort to apply this framework to the Emiquon Preserve located along the Illinois River in Fulton County, Illinois. Conservation targets identified in the Illinois River

Site Conservation Plan were used as the initial set of potential targets for the Emiquon Preserve. Key ecological attributes and indicators were then developed during a meeting of The Nature Conservancy's Emiquon Science Advisory Council in April 2004. These key ecological attributes and indicators have served as the basis for restoration and management planning at Emiquon and also have provided the framework for evaluating the progress of the ecological restoration at this site. A monitoring program focused on collecting data on these key attributes has been initiated and these monitoring data are being used to drive an adaptive management process.

Lemke, Mike*. **Microbes of the river floodplain: connecting restoration structure to function.**
Therkildsen Field Station at Emiquon, Lewistown, Illinois. Email: lemke.michael@uis.edu

Along the Illinois River, levees disrupt the hydrologic connection between many floodplain lakes and the river. In addition, it likely that lakes restored on former agricultural lands have altered microbial communities and biogeochemical cycles. I will examine the role of microorganisms in ecosystem services important to floodplain sustainability. I will also use microbial communities to track changes in a newly restored floodplain lake not yet connected to its flood pulse river source (Thompson Lake converted from agriculture in 2007) compared to an established reference floodplain lake that receives flood pulses (Lake Chautauqua). The incredible metabolic diversity and range in response times make the study of microbial ecology in floodplains a necessary consideration for restoration projects.

Wiant, Michael D.*[1], Jason Beverlin[2], and Michael Lemke[3]. **Propagating public interest in restoration: a case study from Emiquon**.
[1] Illinois State Museum—Dickson Mounds, Lewistown, Illinois. [2] The Nature Conservancy, Lewistown, Illinois. [3] Therkildsen Field Station at Emiquon, Lewistown, Illinois. Email: wiant@museum.state.il.us

A significant component of the restoration of Emiquon, a stretch of Illinois River valley above the confluence of the Spoon River, is propagating public interest in the project. Interested members of the public include stakeholders, students, tourists, and volunteers. There is a role for everyone and each must participate to promote and sustain restoration. We engage and involve people to accomplish the tasks at hand, but we also educate and enrich them to foster support for future restoration efforts.

WORKSHOP ABSTRACTS

Lenhart, Chris[1], John Shuey[2], and Kim Hall[3]. **The role of ecological restoration in climate change adaptation for the Midwest**. [1] Department of Bioproducts and Biosystems Engineering, University of Minnesota, St. Paul, Minnesota. [2] The Nature Conservancy, Indiana Field Office, Indianapolis, Indiana, [3] The Nature Conservancy, Great Lakes Project, Lansing, Michigan Field Office, Lansing, Michigan. CL Email: lenh0010@umn.edu, JS Email: jshuey@tnc.org, KH Email: kimberly_hall@tnc.org

Climate change is predicted to stress Midwestern ecosystems in a variety of ways in upcoming decades. Typically global climate models predict increased precipitation, more frequent extreme events, greater evapotranspiration and more variable streamflow for the Midwest. Recent studies of the response of upper Midwestern watersheds to increased rainfall and higher temperature over the past three decades show that these responses are region-specific depending on land use, drainage, geology and other site specific factors. Therefore, unique management strategies must be developed that address the specific conditions of each ecoregion or major river basin. Upland prairie and woodland ecosystems will face shifting plant distributions, invasive species, and fragmentation issues. Aquatic environments will face increased water temperature and changes to streamflow variability, baseflow, and sediment and nutrient dynamics in many streams. Three 40-minute presentations will be given to address climate change-related management issues with Midwestern ecological restoration and management. The first presentation by Kim Hall will review recent climate change predictions for the Midwest and discuss efforts to downscale global models to specific Midwestern watersheds. John Shuey will then discuss the role of prairie restoration in mitigating climate change impacts on shifting plant distributions, fragmentation, and invasive species. Third, researchers from the University of Minnesota will discuss the management implications of increased streamflow in agricultural watersheds of the upper Midwest. The use of wetland and stream restoration as well as alternative ditch and subsurface drainage designs for reduction of water, sediment and nutrient loading will be presented.

Banovetz, Steven J.* and Eric Johnson. **Prescribed fire as a management tool**. Stantec Consulting, Madison, Wisconsin. Email: steve.banovetz@stantec.com

Fire was a natural occurrence throughout the Midwest prior to European settlement. Many of our native plants and the ecosystems in which they occur – from woodlands and savannas to prairies and wetlands – not only developed a tolerance to fire, but also a dependency on it. The use of a prescribed burn program is one of the single best tools a land manager can implement for long-term maintenance and restoration of native plant communities. The objective of this workshop is to describe the role of prescribed fire in the natural landscape and the use of fire as a tool for managing plant communities. Participants will learn: 1) the ecological benefits of prescribed fire and role of fire in maintaining natural areas; 2) the essential components of a complete and successful burn plan, including an introduction to common burn objectives, permits and notifications, staffing, safety and equipment, hazard assessment, go/no-go decision-making, contingency planning, site and fuel preparation, and fuel ignition; 3) introduction to basic equipment used on prescribed burns through an outdoor hands-on demonstration by the instructors; and 4) opportunities for additional training to serve as a crew leader or burn boss on prescribed burns. Additionally, we will address commonly asked questions related to restoration objectives, appropriate habitat types, fire behavior, frequency of use, and success criteria. Case studies will be presented to highlight a spectrum of challenges frequently encountered on prescribed burns, from overhead power lines to adjacent highway traffic to smoke management near residential areas. Throughout the workshop we will present and accept questions and strive to provide the most complete answers our experience allows.

POSTER PRESENTATION ABSTRACTS (ALPHABETIC)

Borges, A. Puanini[1], Carl Bernacchi[2], Kelly D. McConnaughay[1], Elsor A. Paul[3], and Sherri J. Morris*[1]. **Emiquon nutrient dynamics: an examination of wetland and former wetland soils following 80+ years of agriculture**. [1] Bradley University, Peoria, Illinois. [2] University of Illinois, Urbana, Illinois. [3] Colorado State University, Fort Collins, Colorado. Email: sjmorris@bradley.edu

Soil C content and nutrient dynamics are important factors for developing plant communities and can be altered by moisture regimes. We examined C dynamics at Emiquon, a large-scale wetland restoration project along a major river system following soybean/corn cultivation for 80+ years. At Emiquon are two former wetlands of differing ages (50 and 1,000+ years) prior to cultivation. C and N dynamics at wetland and agriculture sites of similar soil types to Emiquon were compared. Composite cores from 0-10, 10-25, and 25-50 cm depths were taken, analyzed for bulk density, total and resistant carbon and nitrogen, and incubated for nitrogen turnover for 30, 60, and 120 days. Organic C, total C content, N content, and C:N ratio differed between sites. All variables were lowest in agriculture, followed by the younger former wetland then older former wetland, and greatest in current wetland soils. This trend occurred at all depths. Resistant C and N followed this trend except at 10-25 cm where RC was highest in agriculture followed by the younger former wetland. Nitrogen mineralization, nitrification, and percent nitrification were significantly higher in former wetland soils following 60 and 120 days. After 120 days, N mineralization in the younger former wetland was significantly greater than the older former wetland with the reverse for nitrification and percent nitrification. Results suggest that nutrient content and nitrogen turnover differ between former wetland sites and among land uses. Further investigation is needed to evaluate whether differences are associated with soil type, topography, or moisture.

Cusser, Sarah* and Karen Goodell. **Invasive plant removal reduces vegetation structural complexity with positive effects on pollinator abundance on native plants**. The Ohio State University, Columbus, Ohio. Email: cusser.1@osu.edu

Many restorations employ invasive plant removal as a strategy to promote the establishment and success of native plants. In the long term, removal of such plants encourages the establishment of native plants and a return of the pre-disturbance vegetation community. The short-term effect of invasive plant removal may drastically alter the floral abundance, floral richness and vegetation structure as perceived by pollinators. This study focuses on the effect of invasive plant removal on pollinator visitation to native plants. Specifically, we investigated how removal of invasive plants affected floral abundance, floral richness, vegetation structure, and pollinator abundance and richness on native plants. Our results show that weed removal in small plots significantly decreased short-term floral abundance, floral richness and the structural complexity of the vegetation community as compared to unmanipulated invaded plots. Contrary to previous studies reduced floral abundance and richness were associated with greater pollinator visitation to native plants. We suggest that the increased pollinator activity resulted from a negative correlation between structural complexity of vegetation and pollinator activity. The removal of invasive plants creates a structurally open vegetation community that may promote floral visitation by foraging insects either through increased apparancy of native flowers, or less costly foraging effort in the more open habitat.

Dungey, Keenan E.* and Michael J. Lemke. **Sustaining ecosystem restoration through educating the public: an online course about Emiquon**. University of Illinois Springfield, Springfield, Illinois. E-mail: dungey.keenan@uis.edu

Engaging the community is vital to sustaining ecological restoration efforts. One way to engage members of the public is through education. "Engaged Citizenship" is an emphasis at the University of Illinois Springfield and so faculty involved with the Emiquon restoration project on the Illinois River developed an online course for students to learn about restoration and communities. The course is also available to the general public through the Office of Continuing Education. Course participants learn about the communities that have lived and worked at Emiquon for the past 10,000 years and how historians, archeologists, biologists, and ecologists are discovering the different ways these peoples interacted with the land. The course is composed of streaming lectures, short videos of scientists and archeologists, readings and discussions, and writing assignments. It culminates with the students researching a restoration site in their area and describing how the local community is involved with the restoration. The students are not necessarily science majors, and have been from as far away as Japan. This presentation will describe the course and share the students' responses to what they have learned about restoration ecology, including evidence that some of these students may be the next generation of scientists, volunteers, and citizens who can sustain restoration projects into the future.

Ghotra, Kamalprit* and Hua Chen. **Methane emissions at two restored Illinois wetlands: Spunky Bottoms and Emiquon Preserve**. University of Illinois Springfield, Springfield, Illinois. Email: kghot2@uis.edu

Over the past few decades global warming has been a global environmental problem which has attracted a lot of attention and concern. Increasing atmospheric concentration of greenhouse gases such as carbon dioxide and methane are responsible for the warmer climate. Methane is considered to be the second most important greenhouse gas in comparison with carbon dioxide. Wetlands are the largest natural source of atmospheric methane. However, it is not clear how the methane emission changes in restored wetlands from croplands. In this study, we used a chamber approach to examine methane emission at two restored Illinois wetlands including Spunky Bottoms and Emiquon during May to November in 2010. Gas samples were collected from two habitats including terrestrial plot and marshy plot at each site biweekly. Methane concentrations were analyzed using a gas chromatography instrument. Concentration of methane emission and flux rate was greater in the marshy habitat than the terrestrial habitat. Methane emissions were also greater in the Spunky Bottoms site than the Emiquon site. Temperature also varied from terrestrial to marshy habitat. Water table levels were significantly less in the terrestrial habitat (always <12 cm) compared to marshy habitats. Some of the differences of methane emission can be attributed to the variation of temperature and water table level. Restoration age (years since restoration) has direct impact on methane emission.

Grabowski, Paul*, Geoffrey Morris, and Justin Borevitz. **Genetic variation of *Panicum virgatum* in Indiana Dunes State Park**. University of Chicago, Chicago, Illinois. Email: grabowsp@uchicago.edu

Switchgrass (*Panicum virgatum*) is a warm-season (C4) perennial grass that forms an important component of many habitat restoration projects. Natural populations of switchgrass are found in a variety of habitats across its range in North America. Within coastal sand dune ecosystems, switchgrass grows in habitats including xeric sand flats, hydric swales, and partially shaded savannas. Characterizing genetic variation and population structure in these systems can provide important information such as evidence of barriers to gene flow and local adaptation. However, studies of

genetic variation in switchgrass are difficult using traditional genotyping methods because switchgrass is outcrossing and wind-pollinated. In this study, we use genotyping-by-sequencing, a method using second-generation sequencing technology, to genotype switchgrass plants in Indiana Dunes State Park at thousands of candidate single-nucleotide polymorphism markers, enabling us to resolve patterns of genetic variation at a fine spatial scale.

Heflin, R. Menyon* and Mark J. Renz. **Impact of mowing timing on seed production by invasive Japanese hedge parsley (*Torilis japonica*)**. University of Wisconsin-Madison, Madison, Wisconsin. Email: rheflin@wisc.edu

Despite being a relatively new invasive species in Wisconsin, Japanese hedge parsley (*Torilis japonica*) is widely feared and frequently compared to the ubiquitous garlic mustard. Under new Wisconsin state legislation, management may be required by law in some areas, and spreading Japanese hedge parsley seed is now illegal in the state. Meanwhile, the species continues to spread throughout the Midwest. Although it is a common and valued technique for managing invasive species during the restoration process, mowing can accidentally disperse unwanted seed to unaffected areas. We sought to determine the correct time to mow to prevent the production of Japanese hedge parsley seeds and their accidental spread. To determine the impact of mowing timing on the quantity of seeds produced, randomly selected plants at three sites in south central Wisconsin were clipped at different phenological stages throughout the summer. At each mowing interval, data on plant height, phenology, aboveground biomass, surrounding vegetation cover, and the percent cover of Japanese hedge parsley were collected. Cut plants were removed from the sampling sites and allowed to air dry at room temperature. Sampled individuals were revisited in the fall, and when applicable, the resprouting tissue and seeds produced were collected and counted. A similar reassessment of plant survival will occur in the early spring. In addition to illuminating the phenology and basic ecology of this new and increasingly problematic invasive species, the results of this study will provide specific information on how to effectively use mowing to prevent Japanese hedge parsley seed production.

Hitz, James and Damien Gabis*. **Ecological restoration/sustainability at Taltree Arboretum and Gardens: benefits to the South Lake Michigan region**. Taltree Arboretum & Gardens, Valparaiso, Indiana. Email: DAGabis@taltree.org

Taltree Arboretum and Gardens is a significant asset to the South Lake Michigan region. Sitting on top of the Valparaiso moraine, Taltree has more than 1.2 km^2 of woody plant collections, gardens, wetlands, woodlands, and prairies. In 1997, Damien and Rita Gabis, founders of Taltree, recognized that population growth was resulting in increased loss of green space with a detrimental effect on people and wildlife. To counteract this loss, they envisioned a place where people would come to be refreshed and restored, find inspiration and creativity in nature, and learn about horticulture and ecology. During the spring of 1998 Taltree staff and volunteers planted 0.14 km^2 of warm season prairie and more than 7000 oaks and hickories on eroded land that had been used for agriculture. In 1999 a large wetland that had been drained for agriculture was restored and expanded. In 2000 0.02 km^2 were planted to warm season prairie. Trails connecting each area were constructed enabling people to easily explore Taltree. Management plans were developed and have been implemented to ensure sustainability of restoration projects. In the 10 years since these areas were restored numerous species of mammals, birds, insects, invertebrates, and amphibians have come to call Taltree home. Today the ecosystem restoration projects at Taltree serve the people of the region through docent led interpretive hikes for school children, research opportunities for graduate students from Midwest

universities, improved air and water quality, and a place to be refreshed from the strains of everyday life.

Kern, Meaghan E.*[1], Lauren G. Umek[1,3], Liam Heneghan[1], and Dayani Pieri[2,3]. **European buckthorn seed germination and seedling growth in mulch amended soils: implications for restoration**. [1] DePaul University, Chicago, Illinois. [2] Oakton Community College, Skokie, Illinois. [3] Chicago Botanic Garden, Glencoe, Illinois. E-mail: meaghankern@gmail.com

Rhamnus cathartica (European buckthorn*)* is a woody invasive shrub that disrupts plant and animal biodiversity in many prairie, woodland, and savannah ecosystems. Current restoration consists of removal, addition of herbicide, and native seed distribution. Reinvasion following initial removal is common, likely due to elevated nitrogen from buckthorn invasion. Carbon addition has been shown to decrease available nitrogen in soils, and reduce reinvasion in field studies, but little is known about the impacts of carbon addition on growth of the target invasive species. Our experiment tests the effect of mulch on *R. cathartica* reinvasion in the field and seed germination and growth in a greenhouse. We hypothesize that *R. cathartica* reinvasion, germination and growth will be reduced in soils with mulch. In the field, buckthorn reinvasion was reduced, but not inhibited. Mulch amended soils reduced the germination and growth of *R. cathartica* compared to treatment with no mulch. There was not a significant difference between commercial and buckthorn mulch. We suggest that the addition of mulch can enhance the restoration process by delaying reinvasion.

Knight, Kathleen S.*[1], Daniel A. Herms[2], John, Cardina[2], Robert P. Long[1], John P. Brown[1], Catherine P. Herms[2], Wendy S. Klooster[2], and James M. Slavicek[1]. **Forests impacted by emerald ash borer: understanding effects on forest plant communities and planning restoration using DED-tolerant American elm**. [1] USDA Forest Service Northern Research Station, Delaware, Ohio. [2] The Ohio State University, Wooster, Ohio. Email: ksknight@fs.fed.us

Emerald ash borer (EAB) (*Agrilus planipennis*) is an introduced insect pest that has killed millions of ash (*Fraxinus* spp.) trees in the Midwest and is spreading rapidly. The effects of EAB on forest ecosystems are being studied through a collaborative research program between the US Forest Service and the Ohio State University. Although there is some variation due to ash density, habitat type, ash species, light exposure, and initial health, survival analysis shows healthy ash stands experience nearly complete mortality within approximately six years. Often, only a single cohort of ash seedlings remains, and their future is uncertain. The effects of ash mortality on these forest ecosystems, including effects on invasive plants, are being studied. We have identified 14 species of invasive plants in ash ecosystems. Initial cover of invasive species was low in most sites, which may indicate an opportunity to control invasive plants in these ecosystems before they respond to canopy gaps. Predictions of the timing and effects of ash mortality can be used to plan forest restoration and management actions. We have begun research on the restoration of EAB-impacted ecosystems through control of invasive plants and planting of native tree seedlings. Along with other native tree species, we are planting Dutch elm disease-tolerant American elm (*Ulmus americana*) to restore forest cover, diversity, and resilience to floodplain forests.

Kosson, Elizabeth*, Lauren Umek, and Liam Heneghan. **Do invasive earthworms in the Chicago Wilderness region respond to restoration management directed at plant populations**? DePaul University, Chicago, Illinois. Email: Ekosson@gmail.com

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Invasive species are an increasing threat to biodiversity and there is a relationship between plant and soil fauna invasion and earthworms. Invasive earthworms have become a recent concern in the fight against restoration due to their role as ecosystem engineers. The invasion of European earthworms has had detrimental effects to woodland communities such as reducing the understory plant communities, reducing the thickness of the organic layer, increasing soil bulk densities, and decreasing essential nutrient availability. In this study we investigate the impacts of restoration on the earthworm community in woodlands in the Chicago region. Woodland study sites were selected and grouped into three management categories: 1) invaded and unmanaged, 2) recently managed, and 3) managed for 10 or more years. The managed for > 10 years category included two high quality reference woodlands. Our objective was to examine if there is a correlation between degradation and earthworm biomass. Earthworms were collected using hot mustard extraction. Earthworm abundance was lower in the reference sites than the unmanaged controls. There was no significant difference in earthworm abundance between early and intermediate management categories. The results imply that the invasion of exotic species in the Chicago wilderness region is complex and needs attention both above and below ground.

Lemke, A. Maria*[1], Krista G. Kirkham[1], Tim T. Lindenbaum[1], William L. Perry[2], Elias G. Bekele[3], Yanqing Lian[3], Michael P. Wallace[4], David A. Kovacic[4], and Kent Bohnhoff[5]. **Targeted implementation and evaluation of constructed wetlands in agricultural watersheds to reduce nutrient loadings, improve drinking water quality, and address hypoxia in the Gulf of Mexico**. [1] The Nature Conservancy, Peoria, Illinois. [2] Illinois State University, Normal, Illinois. [3] Illinois State Water Survey, Champaign, Illinois. [4] University of Illinois, Champaign, Illinois. [5] McLean County Natural Resources Conservation Service, Normal, Illinois. Email: mlemke@tnc.org

Previous research in the Mackinaw River has shown that intensive outreach can significantly increase implementation rates of certain conservation practices. However, these practices have not historically been implemented to remediate nutrient export from agricultural fields that enters freshwater systems through subsurface drainage tiles. Like much of the Midwest, land use in the Mackinaw River watershed is primarily row crop agriculture with drainage patterns extensively modified using subsurface tiles. We are testing the effectiveness of intercepting tile water using wetlands to reduce nutrient exports. Specific questions include: 1) optimum placement of wetlands on the landscape; 2) watershed to wetland area ratio needed for wetlands to effectively retain tile water and reduce nutrients; and 3) how to implement watershed-scale implementation. A hydrologic model has been developed to target where wetlands and other conservation practices will be most effective in two small subwatersheds where we are currently implementing constructed wetlands. Results from a four year study that used a series of experimental wetland systems indicate that wetland to watershed ratios of 3%, 6% and 9% will remove 23%, 42%, and 53% of nitrate nitrogen loadings, respectively, and 52%, 64%, and 72% of orthophosphorus loadings, respectively. We are also currently launching a watershed-scale effort to demonstrate the effectiveness and efficiency of constructed wetlands to improve local drinking water quality and to remediate additional agricultural impacts on Mackinaw River tributaries. This project will develop an innovative partnership model that leverages Farm Bill Programs and that is transferable to watersheds throughout the Upper Mississippi River Basin.

Lenhart, Chris*, Jason Ulrich, and John Nieber. **Quantification of channel erosion and floodplain deposition processes in the Minnesota River Basin for prioritization of restoration activities**. University of Minnesota, St. Paul, Minnesota. Email: lenh0010@umn.edu

The Minnesota River basin (MRB) is one of the largest contributors of sediment and nutrients to the Upper Mississippi. Recent research indicates that erosion from stream channels now contributes > 50% of the sediment load. Much of the sediment comes from streambanks and bluffs in steep zones near the Minnesota River valley and the main channel. This study focused on quantifying streambank erosion and floodplain deposition processes on the lower Minnesota River and its tributaries using historic investigations, field monitoring and modeling. The Minnesota River runs through an alluvial valley while tributaries are in glacial till. Most streambanks had low cohesive and shear strength, making them susceptible to increased erosion. Channel widening has occurred in many MRB streams in recent decades from hydrologic changes and direct alteration, such as channelization that have increased sediment load and transport efficiency. In recent decades, greater streamflow and reduced floodplain connectivity have also contributed to greater sediment loads. The main channel of the Minnesota River and steep tributaries had the greatest rates of lateral bank erosion while tributaries in the flat Des Moines Lobe till plain had the least rates. Long-term rates of bank migration ranged from 0.01 m/yr to 3 m/year from 1938-2009. Channel expansion can occur rapidly while return to equilibrium takes decades. There is a pressing need to develop an approach for prioritizing channel erosion control strategies across this 44,030 km^2 watershed that considers physical, social and economic issues. Two projects are currently underway to develop such a decision support system.

Pieri, Dayani S.*[1,2], Lauren G. Umek[2,3], and Liam Heneghan[2,3]. **The response of European buckthorn, *Rhamnus cathartica,* to soil amendments in restoration** [1] Oakton Community College, Des Plaines, Illinois. [2] Chicago Botanic Garden, Glencoe, Illinois. [3] DePaul University, Chicago, Illinois. Email: dapieri@flash.net

European buckthorn, *Rhamnus cathartica*, is a non-native, woody shrub in the Midwest that has been associated with modified soil properties at a number of sites in the Chicago area. Studies show that *R. cathartica* may increase gravimetric water and nitrogen contents in invaded soils. Field studies indicate that amending soil with mulch after invasion and removal reduces reinvasion of this species. This study investigated the impacts of soil amendments with mulch on *R. cathartica* sapling growth and seed germination in a controlled environment compared to field results. Our experiment incorporated commercial and *R. cathartica* mulch into field collected soil, simulating treatments used in the field. We also examined the effects of these treatments on native *R. alnifolia* seed germination. We examined the alterations of nitrogen and moisture levels that occur in each treatment. In the field, we observed that mulch amended plots had reduced *R. cathartica* seedling and sapling density compared to control. In the greenhouse, mulch amendments significantly reduced *R. cathartica* sapling growth and soil ammonium but not nitrate. After 4 weeks, no native *R. alnifolia* seeds germinated. *R. cathartica* seed germination was significantly lower in mulch-amended soils. Our results suggest that addition of mulch may be a useful tool in reducing elevated soil nitrogen levels and preventing reinvasion and growth of *R. cathartica*.

Powers, Rachel C.*[1], Spencer A. Goehl[1], and Kevin M. Tungesvick[2]. **Integrating ecological restoration practices into wetland mitigation design and installation to create successful, sustainable wetland mitigation sites**. [1] Eco Logic, Bloomington, Indiana. [2] Spence Restoration Nursery, Muncie, Indiana. Email: rachel@ecologicindiana.com

Eco Logic performed a stream and wetland mitigation to mitigate the loss of riparian habitat along the Jordan River on Indiana University's Bloomington Campus in Monroe County, Indiana. The goal of this mitigation design was to avoid the typical pitfalls that mitigation sites often succumb to by incorporating features to circumvent the standard mistakes that cause stream and wetland mitigation to fail. We chose the mitigation site for its existing hydrology and soil types beneficial to facilitating rapid plant establishment and producing a sustainable stream/wetland mitigation. The mitigation site was also chosen to restore habitat along the same body of water that was suffering habitat loss to development. We created a low impact restoration requiring minimal site disturbance and grading. All areas that had to be graded and reshaped, received 100% biodegradable erosion control materials and seed. We installed coconut logs planted with two plugs every 0.31 meters to redefine the toe of the stream bank in areas that had been lost to erosion. We created habitat features for amphibians using logs and limestone boulders. We confirmed that 95% of the species used in the mitigation were native to Monroe County, Indiana. The seed and plugs were all Yellow Tag Source-identified to reintroduce local genotypes to the site. Before plant installation, we removed all nonnative vegetation. In summary, we installed 16,535 plugs, 261 trees, 131 shrubs, and 3.5 kilograms of seed and developed a long term site specific management plan to defend the mitigation site against invasive species.

Ramey, Justin D.* and Amy B. McEuen. **Seed additions fail to increase plant biodiversity in an establishing tallgrass prairie**. University of Illinois at Springfield, Springfield, Illinois. Email: jrame01s@uis.edu

Tallgrass prairie is one of the most highly disturbed and critically endangered ecosystems in the world. In response to this, tallgrass prairie reconstruction efforts are taking on the challenge of finding ways to quickly develop resilient prairie ecosystems. Our study examined whether a second seed-sowing event at two newly-established prairie restoration sites could significantly influence native plant species richness and floristic quality. Four seed addition transects containing randomized sample plots were established at the Emiquon Preserve in Lewistown, Illinois. During the 2008 growing season, all plant species within plot locations were identified and percent covers were visually estimated. In August 2008, 18 native prairie species were selected based on individual coefficients of conservatism (C) and hand-sown in randomly selected transect plots. Plots were again censused during the 2009 growing season and changes were statistically analyzed using a modified floristic quality index (FQI). Initial results suggest that seed additions did not cause a large change in plant biodiversity and no new species were found to be establishing specifically in seed addition plots. However, differences were found in the effects of the seed addition between sites. Specifically, the site burned the spring following seed addition showed a small but significant increase in richness in seed addition plots (paired $t = 2.17$, $p = 0.048$, $n = 30$) whereas the unburned site did not (paired $t = 0.62$, $p = 0.544$, $n = 32$). This suggests the timing of additional seed additions in relation to burning may be important when considering additional seeding of prairie restorations.

Rasche, Zachary A.*. **Assessing optimal sampling methods for Illinois freshwater mussels**. University of Illinois Springfield, Springfield, Illinois. Email: zrasc2@uis.edu

Accurate values for mussel abundance and richness are needed in order to properly assess and conserve the communities of this imperiled taxon. The current method typically used by the Illinois Natural History Survey to survey freshwater mussels is the four man-hour method. This study will compare the four man-hour sampling method to the quadrat sampling method. The results will be analyzed for differences in richness, abundance, and size selectivity. The percent of endobenthic mussels in the community may influence which method is preferred, as the four man-hour approach may not address the endobenthic community as well as the quadrat method. For this reason, the endobenthic community will also be examined to see if it changes with time of year. The results of the study will help determine which sampling method is most appropriate, and whether or not the appropriateness is dependent on the time of year.

Roos, Robert C.*[1], Todd A. Aschenbach[1], and Carolyn Henne[2]. **A sand prairie restoration experiment: nature or nurture?** [1] Grand Valley State University, Allendale, Michigan. [2] United States Forest Service, Manistee National Forest, Michigan. Email: roosro@gvsu.edu

Sand prairie in Michigan was a primary component of the state's historical oak-pine barrens ecosystem. However, sand prairie has been all but eliminated in the state and few attempts at restoring this ecosystem have been conducted. Our sand prairie restoration experiment, established in 2009 at the Chittenden Nursery in the Manistee National Forest, seeks to develop a successful approach to restoring this ecosystem. Specifically, we examine the influence of variable seeding rates of native plant functional groups (graminoids, early season forbs, late season forbs, legumes) on plant community restoration success. We analyzed data from 2010 to examine how seeding has influenced community variables since the initiation of the experiment. Seeded plots exhibit significant changes in these community variables over and above changes exhibited in non-seeded plots. We were also able to differentiate between changes due to succession (i.e. "nature") from changes due to our restoration efforts (i.e. "nurture").

Shahani, Priya C.*[1] and Orley R. Taylor[2]. **Selecting milkweeds for monarch and pollinator habitat enhancement efforts in the Upper Midwest**. [1] Monarch Joint Venture, St. Paul, Minnesota. [2] University of Kansas, Lawrence, Kansas. Email: pshahani@umn.edu

Monarchs have been the focus of increasing conservation concern. Most habitat enhancement efforts have been at the garden level, where homeowners and nature centers have created Monarch Waystations and butterfly gardens to provide habitat for this iconic species. Increasingly, public land managers are engaging in enhancing and restoring natural habitats in ways that foster habitat for monarchs and other pollinators. Milkweeds, critical for monarch caterpillar growth and development, are an excellent resource for many pollinator species due to their high nectar content, and these habitat enhancement efforts thus help to address the broader issue of pollinator declines. The Monarch Joint Venture is a collaboration of multiple federal and state agencies, non-profits, and academic programs working to improve habitat for monarchs and other pollinators throughout the United States. We will review different tools that can assist with: 1) better understanding monarch population numbers; 2) identifying priority areas for habitat work; 3) selecting milkweed and nectar plant species appropriate for inclusion in habitat restoration projects in the Great Lakes and Upper Midwest regions; and 4) monitoring to evaluate the effectiveness of habitat restoration and enhancement efforts in fostering

monarchs. Finally, we discuss the efforts of the Monarch Joint Venture to further monarch habitat conservation, including our partners' efforts to increase milkweed seed availability for habitat restoration efforts.

Smiley, Peter C., Jr.*, Kevin W. King, and Norman R. Fausey. **Evaluating the ability of grass filter strips to contribute to the restoration of degraded agricultural headwater streams in central Ohio**. USDA-Agricultural Research Service, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

Grass filter strips are planted adjacent to agricultural streams in the United States as riparian buffers to reduce nutrient, pesticide, and sediment input into streams. This frequently used agricultural conservation practice is assumed to have the ability to mitigate the effects of agriculture on streams. However, the ecological impacts of grass filter strips have not been evaluated. Our hypothesis was establishing grass filter strips adjacent to channelized agricultural headwater streams will alter riparian habitat and geomorphology, which will then cause changes in water chemistry, instream habitat, and stream communities. Beginning in 2006 we sampled riparian habitat, geomorphology, instream habitat, water chemistry, fishes, and amphibians from three channelized streams without filter strips, three channelized streams with filter strips, and two unchannelized streams with forested riparian buffers in central Ohio. Preliminary analysis of the first four years of data indicated riparian widths were greater adjacent to channelized streams with filter strips than channelized streams without filter strips. Percent insectivores and percent minnows were greater in channelized streams without filter strips than channelized streams with filter strips. No differences in nutrient concentrations, herbicide concentrations, geomorphology and amphibian communities occurred between channelized streams with and without filter strips. Our preliminary results suggest installation of grass filter strips adjacent to channelized agricultural headwater streams in central Ohio and other parts of the midwestern United States may not be contributing to the restoration of these streams. Future analyses will compare long term trends in the physical, chemical, and biological characteristics among the three buffer types.

Timpe, Megan J. and Roger C. Anderson*. **Phenological niche separation from native species increases reproductive success of an invasive species: *Alliaria petiolata* (Brassicaceae) – garlic mustard**. Illinois State University, Normal, Illinois. Email: rcander@ilstu.edu

Successful biological invasion requires correspondence between invader functional traits and their adaptability in novel environments. We focused on specific phenological and ecophysiological characteristics of the herbaceous biennial, *Alliaria petiolata*, related to its successful invasion of deciduous forest ground layers in eastern North American. We tested for phenological separation between *A. petiolata* and native ground layer species during spring of its second year, when the plant accumulates 91% of its total biomass, and assessed importance of availability of high irradiance before tree canopy closure on growth and reproductive output. We experimentally shaded plants *in situ* during three intervals: 1) before native ground layer was well developed (March 3 - April 20); 2) after April 20 to tree canopy closure (May 18); and 3) after canopy closure to May 29. We measured maximum photosynthetic rates (A_{max}) in early (April 13-14) and late (May 22-26) spring. *A. petiolata* began rapid growth and reached maximum cover earlier than most native ground layer species. Shading effect on plant growth and resource allocation to vegetative growth and reproduction varied depending upon timing and duration of shading. Comparison of treatments differing by being shaded or unshaded in only one of three intervals showed that unshaded plants consistently had significantly higher production than shaded plants only during the first interval. Greatest A_{max} occurred in early spring, when ground layer irradiance was high. Success of *A. petiolata* in invading this community is

likely related to phenological niche separation and temporal availability of resources not available to most native species in early spring.

Troxell-Thomas, Christy* and Amy B. McEuen. **Early burning and composition and floristic integrity of tallgrass prairie restorations at the Emiquon Preserve, Illinois**. University of Illinois at Springfield, Springfield, Illinois. Email: ctrox01s@uis.edu

Tallgrass prairie has been classified as critically-endangered due to widespread conversion, with approximately 55% of all tallgrass prairie flora currently listed as threatened. Prairie management and monitoring are important for restoration success, especially in early restoration stages. The purpose of our study at the Emiquon Preserve was to determine floristic quality, examine effects of seasonal burning, and to develop Key Ecological Attributes for five prairie restoration management units. Restoration units were seeded in spring 2007 using 81 native species. Two transects were set up in five tallgrass prairie units (three burned spring 2008 and two unburned). Each transect had ten $1m^2$ subplots. During summer 2008, 15 total subplots were sampled within each unit. Of species found during data collection (63), approximately 50% were seeded whereas 50% naturally recruited. Approximately 75% of the species were native and 25% nonnative. Within subplots, mean native richness ranged across units from 7.33 to 10.07 per $1m^2$, with much lower nonnative means (0.60 to 2.07). Differences in average subplot native richness between units was not related to burn status (complex contrast (CC), $t=1.73$, $p=0.089$). However, differences in average subplot nonnative richness between burned and unburned units showed higher nonnative levels in burned units (CC, $t=4.74$, $p<0.0005$). Contrary to our predictions, unburned sites had a significantly higher mean C (CC, $t=3.74$, $p<0.0005$) and FQI (CC, $t=3.73$, $p<0.0005$) compared to burned sites. These results suggest that burning very early in restoration may have negative consequences in terms of increased risk of nonnative recruitment and overall site quality.

Van Thiel, Benjamin, K.*, Kristin Floress, and Katrina Shankland. **Policy options for community solar projects in the Midwest**. University Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: Benjamin.K.VanThiel@uwsp.edu

Community solar projects include photovoltaic and solar thermal technologies purchased with the help of multiple investors and have the potential to increase solar energy installations by reducing initial costs. These projects also provide opportunities and have a multitude of benefits for investors, including lower cost barriers, reduced cost-per-watt projects, and larger production capacity over a typical small solar installation. Community solar projects also provide the opportunity for preferential site selection. While several financial incentives exist for photovoltaic and solar thermal technologies in the Midwest, very few specifically address community solar options. Examining policies currently in place in seven midwestern states (Minnesota, Iowa, Wisconsin, Illinois, Michigan, Indiana, and Ohio) this research analyzes the existing policy tools that benefit community solar projects and finally develops recommendations for policy development targeting community solar market creation in the Midwest.

ORAL PRESENTATION ABSTRACTS (ALPHABETIC)

Bird, Eric J.E.* and Young D. Choi. **Monitoring the development of a restored tallgrass prairie ecosystem in Taltree Arboretum, Valparaiso, Indiana**. Purdue University Calumet, Hammond, Indiana. Email: ejbird@purduecal.edu

Taltree Arboretum in Valparaiso, Indiana consists of over 16 hectares of former agricultural land that has been converted to a native prairie ecosystem. Restoration was accomplished by seeding native tallgrass prairie species in 1996, 1998, and 2000. According to our survey of 98 plots from 2008 to 2010, nearly 90% of the species that were seeded occurred in the restored prairie. Soil samples were obtained during the survey period and seeds within the soil samples were germinated to determine the composition of the seed bank. Composition of the seed bank varied greatly from the composition of the standing vegetation. More than 99% of the genera germinated from the seed bank consisted of naturally occurring native and non-native plants that were not seeded during restoration. Prairie vegetation is dominated by *Andropogon gerardii, Solidago* spp., and *Monarda fistulosa* while the seed bank composition is dominated by the plants *Juncus tenuis*, *Ambrosia artemisiifolia,* and *Setaria* spp. Our results indicate that seeding of native tallgrass species has restored the vegetation of Taltree, while altering the composition of the seed bank will likely take many more years.

Dell, Jane* and Adam Shirley*. **Native plants education for Iowa cities**. University of Northern Iowa, Cedar Falls, Iowa. Email: marquarj@uni.edu

The city of Cedar Falls, Iowa welcomes visitors with flowing prairies within its parks, alongside its roads, trails, and throughout the city. With this successful vision in mind, we are involved in a project as part of our Professional Science Master's degree at the University of Northern Iowa. Our goal is to share the idea of creating more sustainable communities by incorporating native vegetation into city planning. Our work concentrates on converting urban areas planted with turf grass to perennial, native vegetation. We are funded by the Iowa Living Roadway Trust Fund, an organization dedicated to restoring Iowa's natural plant communities to roadsides across the state. Our particular effort focuses on assisting city land managers with the creation of sustainable ecosystems within their community. Our methods highlight the potential benefits of native prairie vegetation, specifically the numerous ecosystem services provided in comparison to turf grass systems. Not only are we reintroducing suitable vegetation to the landscapes, but we are helping to create a more sustainable framework for city managers to operate within by connecting them with a support network that is built to deal with the problems and concerns they will likely face during the conversion to more sustainable landscapes. Some common problems addressed include funding, education, personnel training, storm water management, and equipment acquisition.

Feggestad, Aaron J.*[1], Sara Race[2], and Jeff Kraemer[1]. **Prairie restoration program on Commonwealth Edison landholdings in northern Illinois**. [1] Stantec Consulting, Madison, Wisconsin. [2] Commonwealth Edison, Oakbrook Terrace, Illinois. Email: aaron.feggestad@stantec.com

The primary goal of the Prairie Program is to maintain existing prairies and to establish new prairies on Commonwealth Edison (ComEd) electrical transmission and distribution right-of-ways in northern Illinois. The program was started in 2004, and today more than 20 sites encompassing over 0.81 km^2 of remnant and prairie restorations are active in the Program, with new sites added on an annual basis.

Included in ComEd's landholdings are several high quality remnants located within a heavily urbanized regional landscape. Such sites are significant, primarily because they are often linked to adjacent protected natural areas and because they possess high floristic diversity with ability to support rare and conservative species. A Prairie Standardization Plan is currently being developed to streamline the identification, assessment, and restoration of existing prairies and potential restoration sites on ComEd landholdings. Developed by resource specialists from multiple organizations, the intent of the Standardization Plan is to provide a framework for ComEd and its representatives to implement the Prairie Program. Due to the large amount of land targeted for restoration, the Plan uses both sound ecological restoration principles while controlling overall cost. Following establishment of prairies, the long-term decrease in right-of-way maintenance costs and concurrent increase in ecosystem functions and values make restoration feasible on a large scale. ComEd is currently seeking additional stakeholder support, public and private partnership opportunities, and long-term stewardship support to expand the Prairie Program to the remaining 25,900 km^2 of right-of-way in Illinois.

Frischie, Stephanie*. **From *Acorus* to *Zizia*: high-diversity restoration at Kankakee Sands**. The Nature Conservancy, Morocco, Indiana. Email: sfrischie@tnc.org

Kankakee Sands is 31 km^2 area that The Nature Conservancy owns and manages in Newton County, Indiana. It was formerly all agricultural ground with sandy soils and a high water table. Since 1997, high-diversity native plantings have been sown as a strategy to connect the surrounding natural areas and remnants. In any given year over 300 native species are planted and cumulatively over 600 native species have been planted. Restoration work includes the establishment of many state-listed vascular plants from tall grass prairie and black oak barrens communities, including Atlantic coastal disjunct species. The site also is home to regal fritillary butterflies. To support this butterfly, many techniques are used to establish *Viola* populations.

Goldfarb, Daniel J. and Ryan Templeton*. **Advancing ecological restoration on industrial facilities in Indiana and Illinois**. Wildlife Habitat Council, Portage, Indiana. Email: dgoldfarb@wildlifehc.org

The Wildlife Habitat Council develops public-private partnerships leading to long-term rehabilitation and management of ecosystem and species biodiversity on industrial properties in the Calumet region and throughout the United States. The focus of our work with industries and corporations is to build ecosystem restoration and community outreach projects as a way to increase the environmental and community sustainability of industrial properties and to develop ecological connectivity between private, industrial lands with public lands and urban neighborhoods. We will present several examples of ecological restoration projects in Indiana and Illinois that includes: 1) native landscaping projects between schools in Hammond and East Chicago and BP Whiting Refinery employees; 2) Caterpillar ecological programs; 3) US Steel conservation education and restoration projects in Gary and at the USS facilities; 4) ArcelorMittal Burns Harbor Plant employee participation in dune restoration; 5) SEARS Corporate Headquarters prairie restoration; and 6) a joint Wildlife Habitat Council and Heinze Land Trust program in job training former steel and manufacturing workers to work as ecological restoration technicians in dune and swale ecosystems. We will provide an overview to other ecological restoration projects in Upper Midwest industrial and corporate facilities and discuss ways for SER to expand outreach to industries.

Haake, Danelle*. **Ecological restoration in an urban floodplain: challenges and opportunities**. Litzsinger Road Ecology Center, St. Louis, Missouri. E-mail: danelle.haake@mobot.org

The Litzsinger Road Ecology Center (LREC) is a 0.14 km^2 study center within metropolitan St Louis, Missouri. Restoration of the site began in 1989 and continues today in the 0.04 km^2 of tallgrass prairie, 0.06 km^2 of bottomland woodland, and 0.8 km of meandering stream. Habitats at LREC support a variety of wildlife, including deer, coyote, mink, several species of turtle, turkey, woodpeckers, red-shouldered hawks, a variety of songbirds, and countless insects. Approximately 80% of the property at LREC is within the floodplain of Deer Creek. Being located within both a floodplain and an urbanized watershed has presented a number of challenges for ecological restoration. The challenges we face include: 1) urban streams are flashy and can cause frequent strong floods as a result of the high proportions of impervious surfaces in the watershed; 2) erosion can take away large areas of restored stream bank habitat; and 3) streams and their associated flood events often carry weed seed. However, location of LREC also offers special opportunities for restoration because of the high fertility of the floodplain soils and the availability of water in conjunction with the topographic gradient supplies an abundance of diverse habitats, which, in turn provide opportunities for a variety of species.

Iannone, Basil V., III*[1], Lauren G. Umek[2], Liam Heneghan[2], and David H. Wise[1]. **How does amending soils with mulch after *Rhamnus cathartica* (European buckthorn) removal limit reinvasion?** [1] University of Illinois at Chicago, Chicago, Illinois. [2] DePaul University, Chicago, Illinois. Email: bianno2@uic.edu

Although tilling mulch into soils after buckthorn (*Rhamnus cathartica*) removal can decrease reinvasion, the exact mechanism by which this decrease occurs is unclear. To identify this mechanism, the following hypotheses were tested in an ongoing field experiment located north of Chicago in an old horse pasture that was historically a dense buckthorn monoculture: H1) tilling mulch into the soil buries the remnant buckthorn seedbank thereby limiting buckthorn germination and H2) decreased levels of inorganic nitrogen caused from amending soils with high carbon:nitrogen ratio materials (e.g., mulch) limits buckthorn reinvasion. At our study site, buckthorn was removed from five 56-m^2 blocks during the winter of 2008/2009. These blocks were then divided into 4 plots, each of which was randomly assigned one of two levels of mulch (mulched or non-mulched) and tilling (tilled or non-tilled) and resulted in a completely-randomized block design with five replications. After two growing seasons, neither tilling nor mulching reduced buckthorn seedling establishment or stump resprouting. However, tilling reduced buckthorn saplings (individuals < 2 cm in height and at least one-growing season old) by 71 to 90%. Contradictory to our hypotheses, tilling did not bury buckthorn seeds, and mulching caused an initial 29% increase in soil nitrate-nitrogen followed by a short-lived (< 8 weeks) 20% decrease in total available nitrogen. These findings show that the physical process of tilling rather than mulching itself reduced reinvasion and limiting buckthorn reinvasion will require follow-up removal of overlooked buckthorn saplings in addition to herbicide treatment of buckthorn stumps.

Kohls, Jessica Ann* and Kelly Cain. **Restoration built on community inclusivity: restoring a campus river ecosystem**. University of Wisconsin-River Falls, River Falls, Wisconsin. Email: jessica.kohls@uwrf.edu

A best design and management plan (BDMP) is being formulated for a 3.2 km stretch of the South Fork of the Kinnickinnic River as it meanders the entire length of the University of Wisconsin-River Falls campus. The restoration of the river ecosystem is a pertinent issue due to years of bank erosion,

sedimentation issues, and invasive species problems. Additionally, old aerial photos hint to a river ecosystem that held natural wetlands, prairie, and oak savanna and is much different than the one observed today. While the community is aware of the problems with the South Fork and its downstream impacts, this restoration plan poses challenges to success due to its many concerned and interested parties. These include professors, students, administration, environmental organizations, the Wisconsin Department of Natural Resources, and the local and regional community. The strategies being employed in order to include all stakeholders are interviews and meetings to obtain scientific perspectives on appropriate restoration techniques. The goal is to establish a consensus between all parties that can positively benefit the Kinnickinnic. One way we can accomplish this includes removing invasive species, attempting to stabilize banks without affecting natural succession of geologic features, and reintroducing native species consistent with the more natural environment. One of the most important components to the BDMP is the educational features for an outdoor laboratory. The outdoor laboratory allows professors the ability to use the River for their curriculum, and gives the students the unique ability to use the River for scientific investigation.

Lampe, John K.*. **New control method for buckthorn and other invasive tree species**. Green Shoots, LLC, St. Paul, Minnesota. Email: john@greenshootsonline.com

This presentation describes a new method for controlling buckthorn (*Rhamnus* spp.) called the "tall stump treatment method." The method can easily be undertaken by one person. It may be suitable for other invasive tree and shrub species too. The tall stump method involves first using a hand saw or lopper to cut the trunk of the tree to waist or shoulder height, making sure to cut off virtually all branches with leaves or buds. The second step in the process is to haul the cut tops and branches to a pile for burning or chipping. The tall stumps can then be left alone for as long as eight months. The third step is to use the cut-and-frill method to treat the stump at its base. Winter is an ideal time for treatment. An herbicide such as glyphosate (20% to 30% concentration) can be used. The tall stump method has a number of advantages which will be explored during the presentation.

MacDonald, Neil W.*, Corey K. Kapolka, Timothy F. Botting, and Laurelin M. Martin. **Second-year site preparation and hand pulling effects on spotted knapweed control on a degraded site in western Michigan**. Grand Valley State University, Allendale, Michigan. Email: macdonan@gvsu.edu

The objective of our study is to examine the effects of initial mowing and herbicide (clopyralid, glyphosate) site preparation treatments combined with hand pulling on spotted knapweed (*Centaurea maculosa* Lam.) control and native plant establishment on a degraded, knapweed-infested site in western Michigan. We applied factorial combinations of these treatments to 48 plots in a randomized complete block design beginning in the summer of 2008. We collected soil seed bank samples from each plot in March 2009 and 2010. Beginning in 2009, we hand pulled mature knapweed and determined residual knapweed densities and native plant occurrence on all plots in July. The knapweed seed bank has gradually declined on herbicide-treated plots with additional effects of hand pulling appearing in 2010. The amount of mature knapweed removed from hand-pulled plots varied with initial site preparation treatment and year, with the mowed-only plots requiring the greatest removals in 2009 and the glyphosate-treated plots requiring the greatest removals in 2010. Densities of seedling and juvenile knapweed have declined on all treatment combinations except for the non-pulled mowed plots, where mature, juvenile, and seedling knapweed densities increased from 2009 to 2010. In contrast, substantial reductions in mature, juvenile, seedling, and seedbank knapweed densities on the pulled mowed plots show the impacts that hand pulling alone can have on knapweed

recruitment after only two years of treatment. While native plant communities are becoming established on all plots, differential effects of the various treatment combinations on native plant community density and diversity are not yet evident.

Martin, Katherine L.*[1] and P. Charles Goebel[2]. **Eastern hemlock as a shifting foundation in forest of the eastern United States**. [1] Ohio State University, Columbus, Ohio. [2] Ohio State University and the Ohio Agricultural Research and Development Center, Wooster, Ohio. Email: martin.1678@osu.edu

Eastern forests from Appalachian cove and riparian forests to mixed hemlock-hardwood forest of the northeast and Great Lakes are undergoing widespread change as eastern hemlock [*Tsuga canadensis* (L.) Carr] is eliminated by hemlock woolly adelgid (*Adelges tsugae*). Eastern hemlock is an evergreen conifer tree thought to be a foundation species in forest ecosystems, driving the microclimate and exchanges of energy and nutrients. We are working to clarify how the loss of eastern hemlock will influence ecosystem function in forests of the central Appalachians within regions classified as long-term invaded (> 10 years), recently invaded (5-10 years), and intact (not invaded). We are examining plant community composition and key ecosystem metrics (light, decomposition) and comparing our results to other studies of hemlock ecosystems in other portions of its range. Our preliminary analyses indicate central Appalachian riparian ecosystems dominated by eastern hemlock have little species or functional redundancy in any vegetation strata. This translates to functional dominance as well, with little difference in light availability either during the growing or dormant season or decomposition rate moving from headwater streams upslope. However, moving upslope there is a slight increase in species and functional richness. Unlike previous studies that focus on broad scale species changes, our study indicates that ecosystem functions may diverge between stream edges and upslope positions. We compare our results with our understanding of eastern hemlock ecology throughout its range and discuss how this can advance our understanding to develop restoration and management strategies.

Michaels, Nerissa N.*[1,2], Greg G. Sass[1], and Tim W. Spier[2]. **The Nature Conservancy's Emiquon Preserve: largemouth bass diet response to restoration**. [1] Illinois Natural History Survey, Champaign, Illinois. [2] Western Illinois University, Macomb, Illinois. Email: nnm@illinois.edu

The Nature Conservancy's (TNC) Emiquon Preserve is a 2,800 ha floodplain restoration effort located in Fulton County, Illinois. The area is historically significant in that it once housed two of the most productive backwater lakes in the Illinois River Valley: Thompson and Flag lakes. The area was leveed, drained, and converted into agricultural land in the 1920's. TNC purchased the property in 2000 with hopes of restoring it to its natural state. The area was allowed to naturally flood after a large-scale rotenone of the remnant agricultural farm ditches in 2007. A large piscivore population (mainly largemouth bass *Micropterus salmoides*) was immediately established to reduce the effects of two common ecosystem stressors: eutrophication and common carp *Cyprinus carpio* establishment. I tested the potential of the largemouth bass population to control eutrophication through trophic cascade of the food web and common carp populations through diet analyses and bioenergetics modeling during the first two years of restoration (2008 to 2009). Largemouth bass showed a shift in prey use from less profitable prey types (i.e. benthic invertebrates) to highly profitable prey types (i.e. fish) in early July 2008 and 2009. There was evidence to suggest density dependence occurring in 2008, but an increase in lake surface area reduced the effects of density dependence in 2009. Secchi disc transparencies significantly decreased from 2007 to 2010. Additionally, no common carp were collected in largemouth bass diets. My results suggest that the largemouth bass population may not be

controlling eutrophication or common carp populations.

Middleton, Elizabeth L.*[1] and Chip O' Leary[2]. **Evaluating the effect of patch burn grazing on an eastern Tallgrass Prairie restoration**. [1] Indiana University, Bloomington, Indiana. [2] The Nature Conservancy, Indiana. Email: ellporte@indiana.edu

The goal of this project was to evaluate the efficacy of patch burn grazing (PBG) in an eastern tallgrass prairie restoration with the goal of enhancing forb diversity. PBG refers to burning a portion of a larger restoration unit and grazing an intermediate number of cows on the restoration from spring to late fall. The objectives were to test the effects of PBG (fire, grazing, and fire x grazing) on plant community characteristics. Based on previous studies in western prairies, we expected fire to increase regrowth of C_4 grasses, attracting cattle to the newest burned patch. The resulting decline in above ground biomass of grasses would allow for forb diversity to increase by reducing competition. We also expected aboveground productivity to increase because standing dead biomass removal would be maximized. We monitored vegetation for three growing seasons using a series of paired plots and exclosures. Our results did not demonstrate an increase in diversity, especially in forbs, with the application of PBG. Moreover, reduction in grass density did not result in an increase in forb density. We were unable to sufficiently evaluate the influence of PBG on forbs because forb distribution was diffuse and made our experimental design insufficient. However, we observed that cows often chose forbs over grasses first, an important caution to consider when deciding to apply this method on a forb-rich restoration. Finer-scale studies monitoring forb species over time need to be performed prior to evaluating the utility of this method in eastern tallgrass prairie restorations.

Morris, Geoffrey P.*[1], Paul Grabowski[1], Justin O. Borevitz[1], R. Michael Miller[2], and Julie D. Jastrow[2]. **The effects of biodiversity on establishment of reconstructed native grasslands and outputs of ecosystem services**. [1] University of Chicago, Chicago, Illinois. [2] Argonne National Laboratory, Batavia, Illinois. Email: gmorris@uchicago.edu

Payments for ecosystem services and sustainable bioenergy production may offer new impetus for large-scale reconstruction of native grassland habitats. Long-term studies of reconstructed native grasslands have shown that increasing biodiversity leads to greater primary production, soil carbon accumulation, and resilience to invasive species. However, there has been little study on whether increasing within-species diversity (i.e. genetic or ecotypic diversity) has similar benefits and whether high-diversity systems are compatible with current agricultural practices. To address this question we established 200+ plots with varying numbers of switchgrass (*Panicum virgatum*) and big bluestem (*Andropogon gerardii*) varieties and other prairie species on a 5.4-ha site at Fermilab National Environmental Research Park in Batavia, Illinois. Over the past three years since establishment we have collected data on above and below ground biomass, soil carbon and nitrogen, and greenhouse gas fluxes. Our findings suggest that increasing the ecotypic diversity of seed is an effective, cost-neutral strategy for improving establishment and productivity in reconstructed grasslands. We have also employed new methods to quantify ecotype genetic diversity and relatedness in switchgrass using high-throughput genomics tools. These methods were specifically designed to be applicable even to species with no genetic resources (i.e. genome sequence or genetic markers) in hopes that they may be used widely to strengthen population genetic and evolutionary biology basis of restoration ecology.

Peralta, Ariane L.*[1], Jeffrey W. Matthews[1,2], Eric Johnston[1], Sarah Ludmer[1], Angela D. Kent[1,2]
Assessment of abiotic controls on microbial community structure and function: linking microbial community structure and water quality function in restored floodplain wetlands. [1] University of Illinois at Urbana-Champaign, Champaign, Illinois. [2] Illinois Natural History Survey, Champaign, Illinois. Email: alperalt@illinois.edu

Hydrology can influence the oxygen and nutrients available to microorganisms within wetlands. Variation in redox conditions resulting from fluctuations in soil moisture can also influence microbial communities across a hydrological gradient. Understanding how soil characteristics influences microbial communities can improve the ability to predict microbial response to restoration activities intended to support desired ecosystem functions. We investigated the response of nitrogen (N) cycling microbial communities to water levels in restored wetlands. The objectives of this study were to: 1) assess microbial function through measuring anaerobic denitrification and aerobic nitrification; and 2) compare microbial community composition of denitrifiers and ammonia oxidizers along an upland-to-wetland gradient. Denitrifier and ammonia oxidizer groups have contrasting sensitivity to oxygen concentration, thus changes in soil moisture can result in shifts in microbial community structure and activity. Microbial structure-function relationships were compared at two restored floodplain sites at St. Joseph Wetland and Emiquon Preserve. Four transects were established perpendicular to each wetland and four plots along each transect were placed along an upland to wetland gradient. Soil chemistry and microbial community composition and activity associated with denitrification and nitrification were analyzed. Abiotic differences along the gradient produced contrasting assemblages of denitrifiers and ammonia oxidizers. Soil inorganic N levels were positively correlated to N-cycling activity. Additionally, different combinations of soil factors influenced community patterns of denitrifiers and ammonia oxidizers. Gradients in soil moisture and pH more strongly influenced the microbial community than inorganic N. Variation in microbial response to the local environment can impact restoration of ecosystem functions.

Popovich, Sarah and Hua Chen*. **Carbon and nitrogen storage in two restored wetlands in Illinois**. University of Illinois Springfield, Springfield, Illinois. Email: hchen40@uis.edu

Terrestrial ecosystems can play important role in carbon (C) and nitrogen (N) cycle. The loss of wetlands for croplands results in a release of significant amount of C from soil organic matter into atmosphere. Wetland restoration from croplands has potential for C sequestration and reduction of elevated stream water N concentrations. The overall goal of this study was to quantify C and N storage in two restored wetlands at Emiquon and Spunky Bottoms in Illinois. These two restored wetlands were created in 2007 and 1997, respectively. Aboveground plants, roots, and soil were collected along two 100-m long transects at each site. C and N concentration of plant, root, and soil samples were analyzed with a CHN Elemental Analyzer. The organic carbon (OC) and total nitrogen (TN) storage in plants, roots, and soils were estimated using C and N concentration, plant biomass or soil bulk density data. Overall, the total ecosystem storage of OC at Emiquon was 43.0 Mg ha^{-1} and Spunky Bottoms was 53.3 Mg ha^{-1}. The total ecosystem storage of TN at Emiquon was 2.6 and Spunky Bottoms was 2.3 Mg ha^{-1}. At both sites, soil organic C (SOC) is the most important C and N pool. Spunky Bottoms had significantly more total SOC storage than Emiquon. Emiquon and Spunky Bottoms have not yet reached natural wetland functioning, but they have increased functioning in comparison to croplands. These two wetlands are still young and OC and TN storage of these restored wetlands likely will continue to increase over time.

Richardson, Sarah C.*[1], Corey E. Palmer[1], Stephanie Hughes[1], Isaiah Cole[1], Elizabeth L Middleton[2], James D. Bever[2], Peggy A. Schultz[2], and Zhanna Yermakov[3]. **Investigating the effectiveness of mycorrhizal fungi and its colonization into a new prairie habitat at Burnham Park, Chicago**. [1] DePaul University, Chicago, Illinois. [2] Indiana University, Bloomington, Indiana. [3] Chicago Park District, Chicago, Illinois. Email: sarah.richardson242@gmail.com

Most of the original tallgrass prairie in the Midwest has been lost. Prairie restoration efforts have been conducted to restore these lost terrestrial habitats, but prairie restoration sites typically have less plant diversity than remnant prairies. Restoring soil might increase success of prairie restorations. Commercial inoculum of mycorrhizal fungi is sold for this reason, but its effectiveness has not been proven scientifically. A new prairie habitat at Burnham Park in Chicago, Illinois was designed as an experiment investigating whether adding mycorrhizal fungi to soil improves survival and growth of prairie plants in a restoration. In July 2010, seedlings were planted that had been grown with one of three types of inoculum (sterile, commercial mycorrhizal fungi, or fungi from a remnant prairie). Uninoculated plants were also planted alongside inoculated plants to test whether mycorrhizal fungi spread from inoculated plants into the habitat. In the first year of this long-term study, native prairie fungi increased growth of inoculated prairie plants and started to spread into the habitat. The fungi have not influenced carbon sequestration in the soil so far. Future work will determine whether mycorrhizal fungi increases establishment of prairie plants from seeds and whether carbon sequestration is influenced.

Rothrock, Paul E.* and Barri Pruitt. **Prairie reconstruction in Indiana: status and sustainability**. Taylor University, Upland, Indiana. E-mail: plrothroc@tayloru.edu

The earliest prairie reconstructions in Indiana were begun in the period 1987-1993. Today over 20 major reconstructions are scattered through the northern half of Indiana and the art of reconstruction has gained the attention of the landscape architecture community. In order to evaluate the ecological success of prairie reconstructions in Indiana, 21 reconstructions and four native prairies were sampled and analyzed by means of a standard floristic quality assessment (FQA) protocol. Sampling consisted of one to three transects per reconstruction and a weighting of FQA metrics by species frequency. Three reconstructions were revisited after a lapse of four to five years to assess persistence of floristic quality. Results indicate that a few reconstructions can attain what is deemed remnant natural quality and can sustain this quality, at least over the short term. However, even the best reconstructed prairies have low species richness, particularly at the per quadrat level. At the same time, 1/3 to 1/2 of Indiana reconstructions are of medium or low reconstruction quality. For ecological restoration to indeed be a sustainable activity, our experience suggests that even more attention needs to be given to communicating the ecological and human values derived from prairie reconstruction.

Smith, Randy V.*, Christopher S. Hine, Aaron P. Yetter, Michelle M. Horath, and Joshua D. Stafford. **Diverse wetland habitats attract waterbirds to the Emiquon Preserve during fall**. Forbes Biological Station, Havana, Illinois. Email: rvsmith@illinois.edu

We monitored wetland vegetation, plant seed production, and waterbird use of the Nature Conservancy's Illinois River valley (IRV) floodplain restoration, The Emiquon Preserve, from 2007 to 2010. Wetland mapping revealed a diverse and heterogeneous assemblage of aquatic plant communities, several of which are rare or absent in other IRV wetlands (e.g., submersed aquatic vegetation). Production of wetland plant seeds, which are important waterfowl foods in the IRV, averaged 588.2 kg/ha, which was slightly less than other regional estimates. We computed use-days

(UDs) for 3 waterbird groups from fall aerial inventory data and compared use at Emiquon to use in the rest of the IRV. Waterbird use at Emiquon was impressive. For example, non-mallard dabbling duck use at Emiquon represented 33–51% of total UDs in the IRV. Similarly, use by diving ducks at Emiquon accounted for 1–42% of IRV UDs and American coot UDs at Emiquon were exceptional comprising 50–93% of IRV UDs. Comparing UDs at Emiquon to UDs at the adjacent Chautauqua National Wildlife Refuge, we conclude that wetland area and refugia alone are inadequate to attract and hold diverse waterbird assemblages in the IRV during fall. Although some food resources at Emiquon were less abundant than expected, waterbird use remained high, and we suggest that the spatial arrangement and diversity of specific wetland habitat types likely explains this phenomenon. As such, composition and arrangement of vegetation are likely important considerations when planning wetland restorations or enhancements in the IRV.

Spyreas, Greg*[1,2], Scott J. Meiners[3], Jeffrey W. Matthews[1], and Brenda Molano-Flores[1]. **Successional trends in floristic quality**. [1] Illinois Natural History Survey, Champaign, Illinois. [2] University of Illinois Urbana-Champaign, Champaign, Illinois. [3] Eastern Illinois University, Charleston, Illinois. Email: Spyreas@illinois.edu

Restoration progress is frequently judged using of floristic quality assessment (FQA) because these measures allow the conservation value of plant communities to be easily quantified and compared temporally and spatially. Despite its widespread use, the general successional and temporal behavior of floristic quality is poorly understood. We analyzed floristic quality values in 10 old-fields over 50 years of unaltered succession to determine: 1) their trends over time; 2) the influence of invasive species; 3) whether field initiation treatments influenced them; and 4) how floristic quality compares to other ecological measures over time. All fields followed a rapid rise in floristic quality to an asymptotic value (Mean $C \approx 2.25$, FQI ≈ 17). Field abandonment treatments did not seem to influence floristic quality values, while non-native species dominance probably did. The specific species composition of the fields differed from each other over time, but their floristic quality values did not – suggesting a consistent, predictable path over early- to mid-successional time frames. Floristic quality values were limited by unsuccessful reestablishment of conservative understory plants from nearby old-growth forest, which is a pattern which is probably common to other habitat types. Understanding the behavior of floristic quality in restorations can help to evaluate recovery, adapt management, and to understand the determinants of creating successful restorations with high conservation value. The specific trend in scores described here should be useful in generating expected values in other habitats of various ages and enable the assessment of their recovery progress relative to "background" floristic quality trends.

St. Aubin, Anthony J.*. **Skokie River Woods wetland restoration and enhancement project**. JFNew, Monee, Illinois. Email: astaubin@jfnew.com

An approximately 0.10 km^2 site owned by the City of Highland Park, Illinois was in need of wetland restoration and wetland and stream enhancement. Invasive shrubs, trees, and herbaceous vegetation had become established and were impacting the site. Prior to site excavation this vegetation was removed. Wetland restoration occurred in two areas of the site. Along the eastern property line, it was accomplished through excavation of existing fills to expose historic hydric soils found and mapped on the site. Excavated areas were revegetated with a wet meadow seed mix and the side slopes were planted in mesic prairie. Near the south end of Skokie River Woods the wetlands restoration consisted of removing a decrepit dam and constructing a new adjustable water level structure at the southernmost

limits of hydric soils. In addition, the Skokie River Woods project included wetland buffer and upland restoration to further increase the site's overall ecological value. The project restored and created 0.01 km^2 of wetlands, enhanced 0.06 km^2 of wetland, and enhanced 0.02 km^2 of oak-hickory woodland buffer. Following construction, management activities such as selective herbicide application, mowing, and replanting, were conducted for five years to help maintain the site and meet project objectives. The site was also subject to a five year monitoring plan which included monitoring for vegetative quality, using transect surveys, and for hydrological response to restoration activities using data loggers. Following final design, the project obtained permits from the U.S. Army Corps of Engineers and the Lake County Stormwater Management Commission.

Taylor, Orley R.*[1] and Priya Shahani[2]. **Restoring milkweeds to save the monarch migration and protect pollinator habitats**. [1] University of Kansas, Lawrence, Kansas. [2] Monarch Joint Venture, St. Paul, Minnesota. Email: chip@ku.edu

Monarch butterfly populations in North America are declining. Factors implicated are habitat losses in the United States (8903 km^2/year) and Canada, degradation of the forests that support the eastern overwintering population in Mexico, and a combination of increasing temperatures and habitat loss for monarchs wintering along coastal California. To address these changes and restore habitats for monarchs, pollinators, and other wildlife, Monarch Watch, as part of the Monarch Joint Venture, has initiated a nationwide landscape restoration program called "Bring Back The Monarchs". The goals of this program are to restore 20 milkweed species that serve as host plants for monarchs to their native ranges and to encourage the planting of nectar-producing native flowers that support adult monarchs and other pollinators. Milkweed seeds from an eco-region will be used in seed mixes and plugs to restore milkweeds within the region. Fortunately, monarchs do not use specialized habitats, instead they use open spaces, fly great distances, and can find the resources they need (i.e., milkweeds, nectar sources, and shelter) if they are present. The mission of this campaign is to restore milkweeds and protect monarch habitat so that these resources are broadly available and sufficient to sustain the monarch migration. Monarchs share their habitats with a large number of pollinators as well as other organisms that benefit from the fruits, nuts, berries, seeds and foliage that are a consequence of pollination. By restoring habitat for monarchs, we will provide resources and create habitat for many additional species.

Thomforde, Steve L.*. **Catastrophic regime shift in the Midwest Great Lakes Savanna Ecoregion**. University of Wisconsin-Madison, Madison, Wisconsin. Email: thomforde@gmail.com

Catastrophic regime shift provides a framework used to describe declines in ecosystem function for freshwater lakes, coral reefs, estuaries, and semi-arid grassland ecosystems. The framework provides the ability to identify switches in biotic controls resulting in a threshold, where the former functional ecosystem transitions to a dysfunctional ecosystem. This information is used to construct state transition models that inform land managers on strategic restoration plans. This presentation is the first attempt to use the catastrophic regime shift framework to describe the loss of the former Midwest Great Lakes Savanna Ecosystem. The information provides a succinct description for the transition from functional open grown grassland groves dominated by high quality species to dysfunctional occluded thickets dominated by low quality species. This information elucidates an array of novel management procedures to restore former ecosystem function in the Midwest Great Lakes Savanna Ecoregion.

Vanmiddlesworth, Todd D.*[1, 2], Greg G. Sass[1], Timothy W. Spier[2], Michael A. McClelland[1], Nerissa N. Michaels[1], Stephen M. Tyszko[1], and Thad R. Cook[1]. **Aquatic vegetation and fish community monitoring at The Nature Conservancy's Emiquon Preserve: testing for regime shifts in ecosystem state**. [1] Illinois River Biological Station, Havana, Illinois. [2] Western Illinois University, Macomb, Illinois. Email: td-vanmiddlesworth@wiu.edu

Thompson and Flag lakes of The Nature Conservancy's Emiquon Preserve comprise one of the larger floodplain restoration projects in the United States. From 2007 to the present aquatic vegetation and fish community monitoring has been conducted using a multiple gear approach to evaluate a series of Key Ecological Attributes (KEA) relevant to restoration success. Currently, native aquatic vegetation and fish species remain dominant. However, 2007-2010 monitoring has detected a significant decline in water clarity over time. Biomass of invasive aquatic vegetation species such as eurasian water milfoil *Myriophyllum spicatum* and curlyleaf pondweed *Potamogeton crispus* have also increased, as well as the relative abundances of invasive common carp *Cyprinus carpio* and undesirable gizzard shad *Dorosoma cepedianum*. These trends may foreshadow a regime shift in ecosystem state from a clear-to turbid-water state. Therefore, the goals of my graduate research include: 1) testing for prey selection by largemouth bass *Micropterus salmoides* and bowfin *Amia calva* based upon fish prey availability (e.g., common carp, gizzard shad, and other fishes); 2) using otilith microchemistry to test for the origins of common carp at Emiquon; 3) laboratory studies with native fish species and common carp to test for physiological refuges from predation based on dissolved oxygen concentrations; and 4) testing trends in common carp, largemouth bass, bowfin, waterfowl species diversity and use, submersed aquatic vegetation, and water quality to predict regime shifts.

OFFSITE FIELD TRIP ABSTRACTS

Matheis, James*. **Jens Jensen's Landscape at Lincoln Memorial Garden.** Lincoln Memorial Garden, Springfield, Illinois. E-Mail: LMG2301@comcast.net

In 1936, nationally acclaimed landscape architect, Jens Jensen, began a process that would eventually turn a 0.26 km^2 pasture into a lush mosaic of woodlands, wetlands and prairie openings called Lincoln Memorial Garden. It could be argued that Jensen was one of the country's earliest restoration ecologists. His appreciation of natural ecosystems led him to champion the protection of the Indiana Dunes National Lakeshore, and the establishment of the Cook County Forest Preserve District, and the Illinois State Park System. Lincoln Memorial Garden is considered by many to be one of Jensen's greatest intact works and was his last major public project. Using contractual workers, scouts, and garden club volunteers, Jensen and the Garden's founder, Harriet Knudson, began the plantings which today include 75 year old white oaks, a cypress grove, tall grass prairie, oak/hickory woods, soft maple/cottonwood wetlands and more. In early April, spring wildflowers, planted by volunteers years ago, such as bloodroot, trillium, Dutchman's breeches and dogtooth violets will greet visitors. The Garden's Executive Director, Jim Matheis, will lead a tour of the original 0.26 km^2 Garden, pointing out Jensen design characteristics, plant communities and other points and plants of interest. We will also visit the Garden's recently restored 0.12 km^2 prairie center addition and discuss outside threats to the Garden's natural communities.

Shuey, John*, Stephanie Frischie*, and Alyssa Nyberg*. **Field trip to the Efroymson Restoration at Kankakee Sands in northwest Indiana**. Indiana Chapter of the Nature Conservancy, Morocco, Indiana. Email: jshuey@tnc.org

Join us for a tour of the Efroymson Restoration at Kankakee Sands located in northwest Indiana. This landscape-scale restoration is designed to reestablish a semblance of the original wetland / grassland / oak barrens mosaic that once characterized the region. The Indiana Chapter of The Nature Conservancy (TNC) is attempting to reconnect and rebuild a biologically diverse landscape of over 65 km^2. The restoration is designed to reconnect three important preserves (Conrad Savanna, Beaver Lake Prairie State Nature Preserve, Willow Slough Fish and Wildlife Area) into a single management unit. TNC purchased over 32 km^2 of agricultural land to reconnect these three preserves. Past conservation efforts focused on efforts to protect, manage and restore the preserves themselves. In contrast, the Efroymson Restoration is designed to heal the intervening landscape that isolates the sites and create a single conservation area. Habitat fragmentation is the biggest threat to the long-term survival of Indiana prairie and oak barrens. Small isolated prairies and oak barrens lose species with time, especially the rare, vulnerable and area-sensitive species. The lack of new colonists to re-populate these sites means that these remnants will become mere shadows of themselves -- species poor relicts of a once species rich ecosystems. The Efroymson Restoration is also intended to alleviate the threat of habitat isolation. The strategy is to create connections through restoration that will allow these remnants to ecologically communicate with one another and initiate an ecological recovery trajectory that will transform the site into a seamless mosaic of native communities. To date, nearly 25 km^2 of former row crop agricultural land has been sown with a botanically diverse seed mix of over 600 species of vascular plants. The tour will visit restorations of various ages, the 0.5 km^2 native plant seed nursery, greenhouse and seed facility. We have many valuable experiences to share and will present both our successes and setbacks.

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Photos by Deanna Rokich

Restoration of a quarry in Perth, Australia through the partnership of Rocla Quarry Products and the Science Directorate of Kings Park and Botanic Garden.

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Kings Park Master Gardeners monitoring a site in Beenup, Australia

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