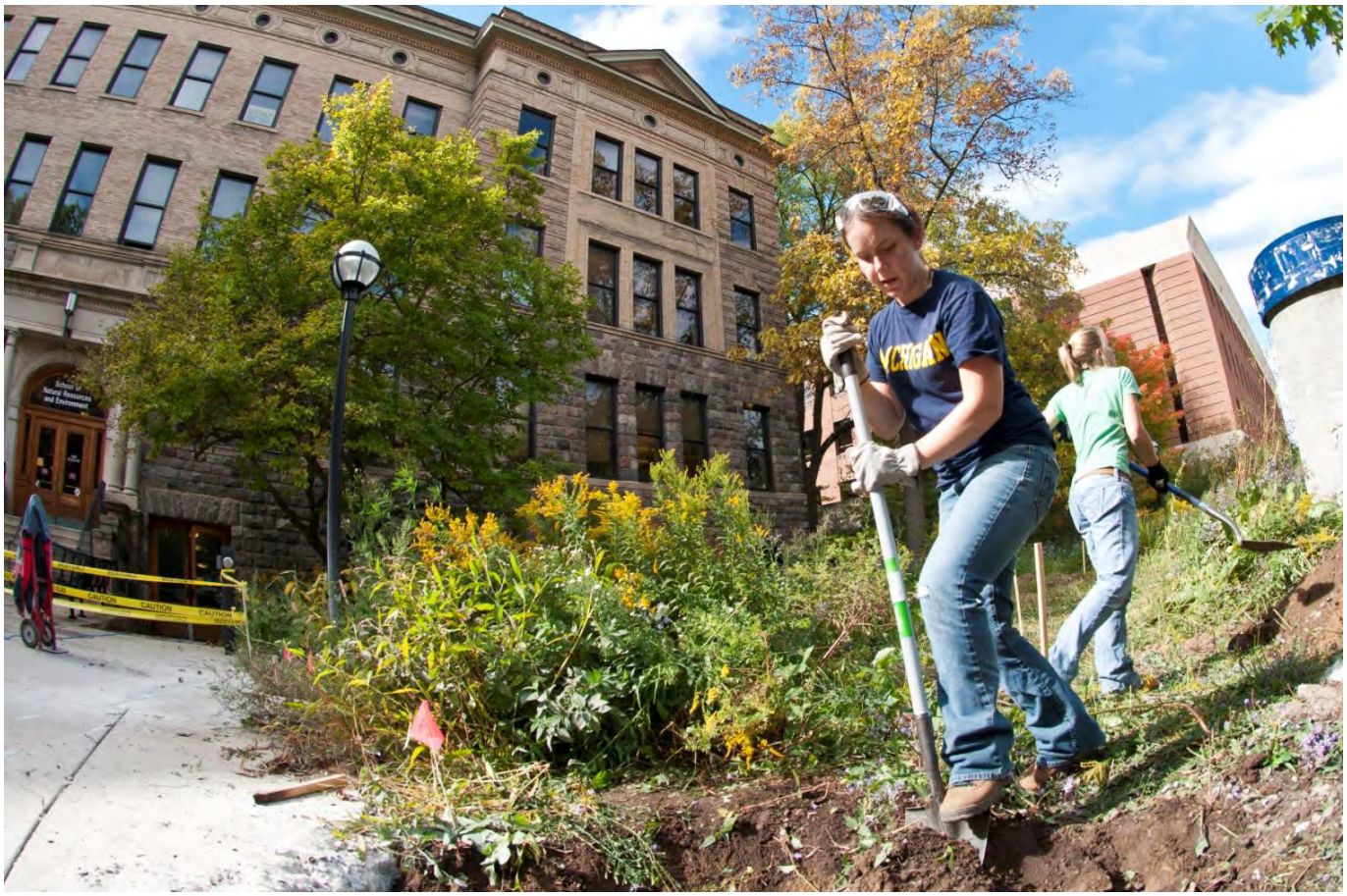
CONNECTING PEOPLE AND NATURE WITH RESTORATION

FOURTH MIDWEST-GREAT LAKES SER CHAPTER MEETING

May 4 to 6, 2012 University of Michigan

ABSTRACT BOOK

Edited by: Peter C. Smiley Jr., Young Choi, David P. Benson, Hua Chen, Cody Fleece, Robert Grese, Jennifer Lyndall, Pamela Rice, and Donald Tilton



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PREFACE

The Fourth Annual Meeting of the Midwest-Great Lakes Chapter of the Society for Ecological Restoration was held May 4 to May 6, 2012 at the University of Michigan in Ann Arbor, Michigan. We had 138 attendees from nine states (Illinois, Indiana, Maryland, Michigan, Minnesota, Ohio, Pennsylvania, Utah, Wisconsin) in attendance for this three day conference. Our goal for this meeting is to explore the critical linkages among people, nature, and restoration and to consider the implications of these relationships for fostering healthy communities, preserving diverse ecosystems, and improving our ability to repair and restore damaged ecosystems. Our scientific agenda consisted of a keynote presentation, a plenary session on restoration of urban and suburban habitats, a plenary session on conservation and restoration of eastern massasagua rattlesnake, two workshops, two symposia, 20 contributed poster presentations, 32 contributed oral presentations, a guided tour of the Matthaei Botanical Gardens, and three offsite field trips to visit restoration projects within southeastern Michigan. Additional meeting events included: 1) a sponsorship reception held in conjunction with the poster session; 2) the annual Chapter business meeting; 3) an awards ceremony that recognized the Best Student Poster Presentation, Best Student Oral Presentation, the Student Presenter Who Traveled the Farthest Award, and outgoing Board members and Committee Chairs. This abstract book contains the abstracts from all meeting presentations, workshops, and offsite field trips.

ACKNOWLEDGEMENTS

We are very grateful for the tremendous support provided by our generous meeting hosts (University of Michigan's School of Natural Resources and the Environment and the Matthaei Botanical Gardens & Nichols Arboretum) and our generous meeting sponsors (Genesis Nursery, Grand Valley State University Biology Department, Stantec, Environmental Consulting and Technology Inc., Environ, Prairie Restorations Inc., The Nature Conservancy, Applied Ecological Services, Island Press, King & MacGregor Environmental Inc., Cardno JFNew, Davey Resource Group, Streamside Ecological Services) sponsors that 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. Robert Grese, Jeff Plakke, Steven Parrish, Laura Palm, Connie Crancer, Dave Brenner, and Kevin Merrill of the University of Michigan assisted greatly with the planning the meeting and providing onsite assistance. Roger Anderson, Troy Anderson, David Benson, Hua Chen, Rocky Smiley, and John Shuey served as judges for the Best Student Presentation Awards. We are also thankful for the participation of the meeting presenters, moderators, tour leaders, field trip leaders, volunteers, and attendees for making our Fourth Annual Chapter Meeting a success.

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KEYNOTE PRESENTATION ABSTRACT

Taylor, Helen*. **A Great Lakes strategy: embracing people, the economy, and nature**. The Nature Conservancy, Lansing, Michigan. Email: htaylor@tnc.org

The Great Lakes ecosystem is the largest freshwater ecosystem on Earth that consists of a highly complex mosaic of habitats, species and processes. We all depend on this globally significant natural system for the countless goods and services it provides, not the least of which is the drinking water for 40 million people. Over the last 60 years, The Nature Conservancy has protected more than 1 million acres in the Great Lakes region along with thousands of inland lakes and hundreds of river miles. Yet, today's complex world of demands on lands and waters can no longer be addressed through a site-based approach. I will introduce The Nature Conservancy's Great Lakes Project, a bi-national collaboration that approaches the management and restoration of the Great Lakes as a whole system and focuses on protecting and restoring the most critical natural systems within the region (i.e., watersheds, coastal systems, northern forests, native fisheries). This collaborative effort also focuses on combating the threats of aquatic invasive species and climate change. This collaboration involves universities, agencies, corporations, private institutions, public institutions, and decision-makers and is reaching beyond the long history of building networks of protected areas to take a whole system approach to "working" lands and water and developing and sharing science, knowledge, and solutions. I will also share examples of this work underway in the region in the areas of sustainable forestry, sustainable agriculture, watershed health, and coastal health. Our region's incredible natural assets—our forests, soils, and waters—are the foundation of the essential industries of manufacturing, agriculture, forestry, transportation, energy and tourism. As the region struggles in a changing economy, one thing remains the same throughout history: Nature provides the ingredients for both the products we make and depend on and the quality of life we enjoy. The ecological well-being and economic health of the Great Lakes are inextricably linked—both must be nurtured so that both can survive. Additionally, I will focus on sharing highlights from The Nature Conservancy's Great Lakes Project as it works with partners to restore and maintain the Great Lakes to support the needs of both people and nature.

OPENING PLENARY SESSION ABSTRACTS

RESTORATION OF URBAN AND SUBURBAN HABITATS

Brush, Lisa*. **The Stewardship Network: creating a network for conservation in the Great Lakes region**. The Stewardship Network, Ann Arbor, Michigan. Email: lbrush@stewardshipnetwork.org

The Stewardship Network was established to fill the gap in natural area conservation. Land managers felt isolated within the boundaries of their park and like they were the only people fighting the good fight. Individuals who wanted to steward their own lands or just learn more about how to care for nature did not know how to access the information they needed. The Stewardship Network set out with the goal to bring these people together and build the capacity - of organizations, individuals, and businesses - to care for natural lands and waters. The Network works with private property owners, nonprofits, governmental agencies, and private businesses to achieve that goal. Every day, we're out on the land and on the web - making connections, providing hands-on training, building relationships, and sharing information and tools. We work diligently to strengthen the effectiveness of the people and groups that protect our natural areas. As John Curry from the National Fish & Wildlife Foundation has recently said: "The Stewardship Network has the reputation as the up and coming conservation organization with the right trajectory."

Hartig, John*. **Extreme makeover: Brownfield edition**. Detroit River International Wildlife Refuge, Grosse Ile, Michigan. Email: john_hartig@fws.gov

The Detroit River International Wildlife Refuge is expanding the ecological buffer of Michigan's only Ramsar "Wetland of International Importance" (i.e., Humbug Marsh) by: 1) cleaning up and capping an 18 ha industrial brownfield; 2) daylighting a creek and constructing a storm water pond and emergent wetland to treat storm water prior to discharge to the Detroit River; 3) achieving a net gain of 6.5 ha of wetlands within a river corridor that has lost 97% of its coastal wetlands to development; 4) restoring 10 ha of upland buffer habitat; 5) controlling *Phragmites* along 4 km of shoreline; and 6) removing other invasive plant species in over 20 ha of forested lakeplain habitat. This industrial brownfield is also being restored as the gateway to the International Wildlife Refuge and future home of the Refuge's visitor center. The project has been described as transformational for the region by reconnecting nearly seven million residents within a 45-minute drive with nature.

Williams, Lisa*. **Restoration in the context of natural resource damage assessments.** U.S. Fish and Wildlife Service. East Lansing, Michigan. Email: lisa_williams@fws.gov

The US Fish and Wildlife Service (FWS) serves as a natural resource trustee on behalf of the US Department of Interior. The FWS has been involved in the natural resource damage assessment (NRDA) and restoration and many of these projects involve restoration within urban habitats. As part of her presentation Lisa will share her experiences as a contaminants specialist and the urban restoration issues she has encountered that arise as part of NRDA related issues within the Midwestern United States.

VOLUNTEER PROGRAM SYMPOSIUM ABSTRACT

Byrd, Shana[1], Kurt Dreisilker[2], and Erin Mittendorf[3]. **Growing volunteer conservation programs and building connections between our place in nature and the role of habitat restoration**. [1] The Wilds, Cumberland, Ohio. [2] The Morton Arboretum, Lisle, Illinois, [3] The Stewardship Network, Ann Arbor, Michigan. SB Email: sbyrd@thewilds.org, KD Email: kdreisilker@mortonarb.org, EM mail: emittendorf@stewardshipnetwork.org

As the influence of humans on our landscape increases, the protection, restoration and creation of wild habitats and our role in conservation becomes even more important to the well-being of the planet. Understanding our dependence on healthy ecosystems is a fundamental step towards growing conservation values and a sense of respect for the environment. Volunteer opportunities that promote hands-on experiential learning through habitat restoration can provide an appreciation for nature that inspires ownership in sustainability of natural areas and backyard habitat. While volunteer programs vary, many organizations have the common goal of growing stewardship and can share similar experiences to help others implement successful projects. During this symposium, a variety of perspectives will give insight on volunteer involvement within focused preserve management to landscape scale restoration strategies. Shana Byrd of the Wilds conservation center will provide a snapshot of volunteer opportunities within the 40.5 km^2 preserve that create healthy habitat locally, while inspiring action to restore regional biodiversity through service-learning projects and academic internships fostering careers in ecological stewardship. Erin Mittendorf of the Stewardship Network will present a perspective of landscape scale management efforts on the Garlic Mustard Challenge, demonstrating the collective impacts of engaging a broad array of volunteers and partner organizations. Kurt Dreisilker of The Morton Arboretum will present a view of targeted preserve management efforts through the Woodland Stewardship Training Program with strategies for developing dedicated volunteer leaders through formalized classroom and field-based instruction. Jeff Plakke of Matthaei Botanical Gardens and Nichols Arboretum will join the panel discussion to share experiences on the following topics: 1) volunteer motivation to preserve natural areas: helping people connect with nature 2) stewardship training, coordination & logistics: how to ensure positive experiences; and 3) leadership development: how to inspire volunteers to stay involved.

VOLUNTEER PROGRAM SYMPOSIUM PRESENTATION ABSTRACTS

Byrd, Shana M.*. **Growing volunteer conservation programs at the Wilds Conservation Center: our place in nature and role in habitat restoration**. The Wilds, Cumberland, Ohio. Email: sbyrd@thewilds.org

As the influence of humans on our landscape increases, the protection, restoration and creation of wild habitats and our role in conservation becomes even more important to the well-being of the planet. Understanding that we are dependent on healthy ecosystems is a fundamental step towards growing conservation values and a sense of respect for the environment. Volunteer opportunities that promote hands-on experiential learning through habitat restoration can provide an appreciation for nature that inspires ownership in sustainability of natural areas and backyard habitat. At the Wilds non-profit conservation center, a variety of opportunities are available for the public to actively restore ecological integrity to the land. Within the context of a reclaimed coal mine, volunteers gain the necessary skills to create healthy habitat and increase their capacity to restore biodiversity throughout the landscape. Participation ranges from dedicated volunteer staff coordination and organizing day-long student programs to service-learning projects and academic internships that foster careers in ecological stewardship. Given the possibilities for volunteer engagement within organizations, academia, land trusts and public preserves, many conservation groups encounter some of the same challenges and

opportunities. While each institution has varying needs, capacity and programming to encourage volunteer participation, most programs have the same essential elements. A variety of perspectives will be presented through this presentation with an overview of important considerations for implementing successful volunteer restoration projects. Topics will include: engaging diverse audiences, adapting to volunteer abilities, planning alternative activities, liability, safety, project funding and ensuring volunteers receive a meaningful experience in exchange for their service. All groups working to engage volunteers in habitat conservation share the common goal of making the connection between people and the environment and to highlight our shared responsibility to do our part in giving balance to our place in nature.

Mittendorf, Erin*. **The Garlic Mustard Challenge: creating and engaging volunteer stewards through low-barrier events.** The Stewardship Network, Ann Arbor, Michigan. Email: emittendorf@stewardshipnetwork.org

Finding ways to form connections between volunteers and local natural areas is the best way to ensure long term stewardship of those places. However, people have limited time and many commitments pulling them in multiple directions. It is easy to forget that "Nature" is not something far away and hard to get to, but is the neighborhood park, the backyard, or even the undeveloped lot around the corner. There are ways of caring for those areas that don't require an advanced degree, specialized training, and specialized tools. People need ways of engaging with natural areas that fit into their schedules, that are rewarding, and that make them feel appreciated for their efforts. These elements reduce barriers to participation, increase individuals' emotional ties to an area, and create stewards who will return to work there year after year. The Stewardship Network's Garlic Mustard Challenge was designed to be an easy way to introduce individuals to the concept of stewardship and invasive species management. Over the past four years, it has built a tremendous following. We have engaged thousands of people from Missouri to Pennsylvania and Michigan to West Virginia in removing hundreds of tons of garlic mustard. Along the way, we've also educated them about best practices for dealing with invasive plants. We will use the Garlic Mustard Challenge as a case study for engaging individuals in natural areas stewardship, and the successes that come when we share our passion for restoration with others.

Dreisilker, Kurt M.*. **Reaping rewards: how does *significant growth* in volunteer capacity impact volunteer engagement, natural areas management, and staff oversight and planning?** The Morton Arboretum, Lisle, Illinois. Email: kdreisilker@mortonarb.org

The Morton Arboretum's Woodland Stewardship Training Program (WSTP) is connecting people with regional woodlands, prairies, and wetlands through formalized classroom and field-based instruction. Graduates of this program come from the highly developed suburbs of Chicago and are now taking on significant responsibilities within these natural areas. As more and more graduates of this training program are produced, they are implementing their work within local public and private natural areas. People from various backgrounds are participating: students, professionals, novices – but they only need one key trait to participate, motivation to improve natural areas! Since the Arboretum enhanced volunteer engagement within its natural areas in 2008, significant annual increases in volunteer stewardship have been realized in the Arboretum. Annual increases of 20%, equaling thousands of hours, are revolutionizing how these natural areas are managed. Volunteer stewards are taking on responsibility managing Arboretum's natural areas, *local* natural areas, connecting with different audiences, and inviting their participation. Their impact has been profound, but how does a program with 20% growth operate? The Natural Resources program has had to revamp planning activities and

reorganize crew structure to keep up with the growing volunteer participation in everyday activities. It's full steam ahead in these natural areas!

DEAD WOOD SYMPOSIUM ABSTRACT

Fleece, William C.[1], Peter C. Smiley Jr.[2], R. Gregory Corace III[3], Jessica Hickey[4], and Jennifer L. Tank[5]. **Dead wood management for ecological restoration: stream and forest ecosystem perspectives**. [1] Stantec Consulting, Cincinnati, Ohio. [2] USDA-Agricultural Research Service, Columbus, Ohio. [3] U.S. Fish and Wildlife Service, Seney, Michigan. [4] Davey Resource Group, Stow, Ohio. [5] University of Notre Dame, Notre Dame, Indiana. WF Email: cody.fleece@stantec.com, PS Email: rocky.smiley@ars.usda.gov, GC Email: Email: greg_corace@fws.gov, JH Email: Jessica.Hickey@davey.com, JT Email: tank.1@nd.edu

Dead wood (i.e., snags, fallen trees, instream wood, log jams, etc.) serves as critical habitat resource in both terrestrial and aquatic ecosystems. Restoration and management practices that alter the amount and types of dead wood within terrestrial and aquatic ecosystems can influence community structure and ecosystem function within and across these ecosystems. The importance of dead wood in aquatic and terrestrial ecosystems has been established, especially in the Western United States. There appears to be a lack of information on the availability of dead wood and its management for the restoration of aquatic and terrestrial ecosystems in the Midwestern United States (Midwest). Five 20-minute presentations will be given to provide insights on what we know about the availability of dead wood, its management within stream and forested ecosystems, and the how this information can contribute to restoration efforts in the Midwest. The first presentation will provide an introduction to the symposium and insights on the amount and types of wood present in a sand bed stream in Texas and the resulting recommendations for this stream and potential applications to similar streams in the Midwest. The second presentation will discuss how the addition of large instream wood influences the retention of organic matter, nutrient cycling, and macroinvertebrate secondary production within forested headwater streams in the Upper Peninsula of Michigan. The third presentation will provide an overview on the amount of available information on instream wood within channelized agricultural headwater streams in the Midwest and the results of a Ohio field study conducted to compare the amounts and types of instream wood between channelized and unchannelized agricultural headwater streams. The fourth presentation will summarize research conducted to quantify benchmark states of snags in virgin mixed pine forests and determine the influence of different management actions on the longevity and decay class development of trees made into snags within these forests in the Upper Peninsula of Michigan. The fifth presentation will provide an overview of how the invasive emerald ash borer has increased the amount of dead wood in the Midwest and potential management options on the use of this dead wood for wildlife habitat, especially bats that have been impacted by habitat loss and disease outbreaks. The symposium will conclude with key recommendations from the five speakers and a question and answer session.

DEADWOOD SYMPOSIUM PRESENTATION ABSTRACTS

Fleece, William C.*, Scott Peyton, Nathan Jean, and Michael Geenen. **Instream habitat and wood loading for restoration design in sand-bedded channels**. Stantec Consulting, Cincinnati, Ohio. Email: cody.fleece@stantec.com

Buffalo Bayou is an incised unstable sand-bedded channel in Harris County, Texas with a drainage area of approximately 466 km^2. Instream habitat and wood loading were assessed along nearly 2.1 km of channel as part of an effort assess aquatic habitat quality and to develop recommendations for

structural habitat modifications that could be implemented in the restoration design and construction. Observations and data were recorded on 102 wood pieces at 6 different study sites within the project area. Mean wood piece length was 4.6 m and mean large diameter was 0.3 m. Over 70% percent of the wood pieces (n = 73) were oriented parallel to the direction of flow. Of the wood pieces with parallel orientation, 55 (75%) were oriented with the large diameter on the upstream end and the small diameter on the downstream end. Only 7 of 102 wood pieces appeared to cause bank scour. Fourteen percent of the perpendicular wood pieces caused bank scour versus only 40% of the pieces parallel to the direction of flow. Nearly half of the wood pieces were found to influence bed topography through scour or deposition. The frequency of wood pieces with advanced decay classes was much higher in Buffalo Bayou (74%) than in Harris County as a whole (45%) suggesting little new recruitment of wood pieces. Wood was the dominant form of instream cover and was an important part of the food web due to minimal invertebrate production in the sand-dominated substrates. The data collected were used to make recommendations regarding the size, orientation, and means for placement of wood in the restored channel.

Tank, Jennifer L. *[1], Emma J. Rosi-Marshall[2], Timothy J. Hoellein[3], Sally A. Entrekin[4], and Gary A. Lamberti[1]. **Experimental addition of large wood influences ecosystem function in three headwater streams**. [1] University of Notre Dame, Notre Dame, Indiana. [2] Cary Institute for Ecosystem Studies, Millbrook New York. [3] Loyola University Chicago, Chicago, Illinois. [4] University of Central Arkansas, Conway, Arkansas. Email: tank.1@nd.edu

Large wood is increasingly used in stream and river restoration projects and previous research has shown that wood addition influences stream habitat and community structure. We investigated how wood addition influenced ecosystem function by quantifying retention of organic matter, the cycling of nutrients, and macroinvertebrate secondary production – elements that are rarely quantified in stream restoration projects. After one year of pre-treatment data collection, we added 25 large aspen logs (0.5 m diameter x 2.5 m length) to a 100-m reach in three forested headwater streams in the Upper Peninsula of Michigan. A non-treated upstream reach served as the spatial and temporal control. These wood-poor streams drain forests that were clear-cut over a century ago with selective logging for the past 50–60 years. Based on four years of post-treatment monitoring, we found that log-associated sediment sorting resulted in discrete areas of cobble and sand habitat in formerly homogeneous sand-dominated reaches and an increase in organic matter accumulation associated with added logs. Significant seasonal variation was detected in reach-scale nutrient demand, but phosphate uptake was generally higher in the treatment reaches following wood addition. Increases in phosphate uptake were positively related to community respiration, suggesting a heterotrophic pathway for phosphate uptake via organic matter biofilms elicited by added wood. Changes in main-channel macroinvertebrate production were related to small changes in substrate composition. Secondary production was highest in debris accumulations, suggesting that increased leaf litter retention increased overall macroinvertebrate production, especially in autumn. Our results suggest that measurable changes in geomorphology, organic matter retention, nutrient uptake, and macroinvertebrate production may exhibit a predictable succession. Therefore, monitoring programs incorporating ecosystem functional metrics should be designed carefully. We conclude that understanding how the addition of large wood influences ecosystem function is an integral component for quantifying long-term restoration success.

Smiley, Peter C., Jr.[1]*, and Eric Gates[2]. **Characteristics of instream wood within channelized agricultural headwater streams in the Midwestern United States**. [1] USDA-ARS, Soil Drainage Research Unit, Columbus, Ohio. [2] Ohio State University, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

Channelized agricultural headwater streams are a common feature within agricultural watersheds of the Midwestern United States. These small streams have been impacted by the physical and chemical habitat alterations incurred to facilitate agricultural drainage. Quantitative information on the instream wood characteristics within channelized agricultural headwater streams is lacking and needed to assist with designing stream restoration projects for these small streams. We conducted a literature review to quantify the amount of available information on instream wood within channelized agricultural headwater streams within the Midwestern United States. We also conducted a field study in twelve headwater streams within the Upper Big Walnut Creek watershed to determine if the amounts and types of instream wood differ between channelized and unchannelized agricultural headwater streams. Preliminary results from our literature review indicate that only a limited amount of information on instream wood characteristics is available from channelized agricultural headwater streams. Our field study quantified that the diversity of instream wood, density of instream wood, and density of large (i.e., > 1 m length and > 0.10 m diameter) log jams was greater in unchannelized than channelized streams. Channelized streams contained mostly small simple wood pieces, small branching wood pieces, and large overhanging vegetation. Unchannelized streams possessed mostly small simple wood pieces, large rootwads, and large log jams. Our results suggest that restoration designs for channelized agricultural headwater streams should use practices that increase the amount of instream wood and alter the proportion of different types of instream wood.

Corace, R. Gregory, III[1] and P. Charles Goebel[2]. **Snag management in pine forest types in northern Michigan.** [1] U.S. Fish and Wildlife Service, Seney, Michigan. [2] The Ohio State University, Wooster, Ohio. Email: greg_corace@fws.gov

Snags (standing dead trees) are biological legacies retained after natural disturbances in many forest types. The goal of this work was to enhance the ecological underpinnings of snag management within the context of jack pine (*Pinus banksiana* Lamb.) and mixed red pine (*P. resinosa* Ait.) and eastern white pine (*P. strobus* L.) forest conservation and restoration in northern Michigan. We followed the fate of 335 snags over 2.5 yr. to compare the longevity of mechanically girdled trees to that for natural snags in a jack pine clearcut. After 2.5 years, 41% of snags snapped or uprooted, with most snapping or uprooting occurring within the first year. We also quantified characteristics of live trees and snags within 85 500-m^2 plots established at Seney National Wildlife Refuge (NWR) and related these patterns to potential ecological drivers. Plots at Seney NWR represented both reference/benchmark conditions and altered conditions. We also compared three treatments (girdling, prescribed fire, and topping) for forming snags from live trees. Snags were found in 86% of the plots overall. Snag size and density did not differ between reference and altered conditions (Student's *t*-test, $p > 0.05$), but snag composition did, with the former comprised primarily of long-lived species and the latter comprised more of shorter-lived species. Four years after treatment, the percentage of snags that developed into the most advanced decay class differed among treatments ($\chi^2 = 16.49$, $p = 0.003$), with 26% of girdled trees, 3% of prescribed fire trees, and zero topped trees reaching the most advanced class. Mean decay class differed among girdled tree species ($p = 0.008$), with aspen (*Populus* spp.) and jack pine trees experiencing the most advanced decay. The findings from this study, past published studies, and ongoing projects are being directly applied to present restoration treatments at on National Wildlife Refuge System lands.

Hickey, Jessica*. **Beneficial re-use of Ash trees and areas devastated by emerald ash borer as bat habitat.** Davey Resource Group, Stow, Ohio. Email: Jessica.Hickey@davey.com

Emerald ash borer (*Agrilus planipennis*) is an exotic, invasive wood-boring insect that infests and kills native North American ash (*Fraxinus* spp.) trees. This insect has spread and has affected millions of trees nationally, including trees in Michigan, Ohio and neighboring states. The costs of removing dead and dying ash trees have overwhelmed state and municipal budgets in many of the affected regions. Dead or dying ash trees may consist of significant amounts of deadwood and loose bark which provide additional habitat for some bat species. We will present options to manage this deadwood including re-use for wildlife habitat. Many bat species, in particular, have been threatened by habitat loss and devastating population crashes due to white-nose syndrome (WNS). Dead trees provide summer roosting habitat and are an important habitat feature.

WORKSHOP ABSTRACTS

Williams, Robert*. **Practical *Phragmites* control**. Phragmite.org, Harsens Island, Michigan. Email: xharpspah@aol.com

Common reed (*Phragmites australis*) has taken over many of our natural areas. It out-competes native plants and creates a monoculture. This plant species also reduces the biodiversity of plants and therefore the biodiversity of animal life. It limits visual views and access to lakes, rivers and canals for recreational purposes, reduces property values and increases the risk of fire. This workshop will present practical aspects of *Phragmites* control on a cost efficient small-scale for property owners and volunteer groups. Topics covered will include identifying native and non-native haplotypes, setting control goals, treatment options, when to treat, supplies and tools needed, basic herbicide safety, permits, and protecting the native plants.

Allison, Robert*. **Securing local genotype seed and plant materials – everything you ever wanted to know A-Z.** Cardno JFNew Native Plant Nursery, Walkerton, Indiana. Email: bob.allison@cardno.com

Native local genotype seed and plant materials can be effectively and efficiently collected for use in restoration projects. This workshop will focus on site and area mapping and plant identification, securing access to sites and relationships, proper timing, techniques, and methods that should be used in the process of collecting native seed materials. The workshop will also present collection, handling, cleaning, testing, and storage of high quality native seed and plant materials. We will also discuss plant extraction, sub-dividing and re-installation timing, methods, and techniques to maximize survival while maintaining great efficiency.

POSTER PRESENTATION ABSTRACTS (ALPHABETIC)

Aten, Nancy M.* and Dan Collins. **A participatory 100-year plan for a wild place in Milwaukee's Menomonee Valley.** Landscapes of Place LLC, Mequon, Wisconsin.
Email: nancyaten@landscapesofplace.com

In designing an ecological restoration plan for an urban site following SER guidelines, we asked the following questions: Can participatory restoration be multiplicative, to strengthen and amplify the results (for both nature and humans) in a significant way, and can the design of an ecological restoration plan enable this? (Or, what are the mutual feedbacks, and can they be incorporated within the restoration design?). The resulting landscape restoration plan for 0.1 km^2 in the urban Menomonee Valley values wildness, delight, and learning with a strong ecological heart, demonstrating the opportunity to strengthen both urban and ecological qualities. The site along the river has been both invisible and inaccessible to people for decades. From the perspective of the river and of wildlife, it is also a place that has also been mistreated for a hundred and sixty years. The linear pocket of former industrial land is bordered on one side by the urban Menomonee River, in its last stretch before confinement downstream by sheet pile walls, and on the other side by the railroad. These 0.1 km^2, 3.2 km from the heart of downtown Milwaukee, anchor an idea that has emerged with much time, conversations, partnerships and eager neighborhoods: to make a significant wild place in this valley. The goal of this restoration project is to transform the irreversibly altered land and hydrologic conditions to a mosaic of biodiverse landscapes, including forest, prairie, and ephemeral wetland, native to Milwaukee and ecologically appropriate for new conditions, with systemic and meaningful engagement of the community. We will illustrate how analysis led to plan details that are incremental, adaptive, deal with challenging conditions, and think 100 years out -- and particularly focus on the questions of how to develop a restoration plan that enables deeply participatory restoration on such a scale and scope.

Benson, David P.*[1], Jody Nicholson[1], Samuel Jordan[1], and P. Roger Sweets[2]. **The impacts of invasive shrub removal on an urban avian community**. [1] Marian University, Indianapolis, Indiana. [2] University of Indianapolis, Indianapolis, Indiana. Email: dbenson@marian.edu

Invasive shrubs are a common part of the Midwestern landscape, especially in urban natural areas. The removal of these shrubs has been shown to increase the diversity and coverage of native vegetation. Less is known regarding the effects of invasive shrub removal on avian communities in urban environments. In this 11 year case study, we use breeding season point counts to describe the changes in avian community in a small urban natural area on the campus of Marian University in Indianapolis, Indiana before and after removal of invasive shrubs. We found 1816 birds during the 10 years of point count data from 2001-11 including 62 species with Northern Cardinal, Song Sparrow, and Baltimore Oriole having the largest populations. With the removal of invasive shrubs, canopy species such as Eastern Wood Pewee, Indigo Bunting, Tufted Titmouse, and Warbling Vireo increased while the shrub layer and frugivore species American Goldfinch, Cedar Waxwing, Gray Catbird, Northern Cardinal, and Wood Thrush decreased. Brown-headed Cowbird also increased substantially after shrub removal. We found no evidence that birds that decline with invasive shrub removal become more abundant in a decade of understory revegetation following invasive shrub removal. Although Brown-headed Cowbird increases and Wood Thrush decreases, with the removal of honeysuckle, the fact that invasive shrubs act as an ecological trap may outweigh those negative changes for the avian community.

Briddell, Benjamin J.* and Hua, Chen. **Carbon and nitrogen storage in natural Illinois wetlands: comparing marshes and sedge meadows.** University of Illinois at Springfield, Springfield, Illinois. Email: bbrid3@uis.edu

Wetland ecosystems have been identified as natural sinks for carbon (C) and nitrogen (N) due to their high productivity and low decomposition rates over long time periods. However, few studies have addressed the long-term effects of plant diversity on C and N storage in natural wetlands. Our goal is to determine and compare C and N storage in natural marshes and sedge meadows in Illinois. The specific objectives are to determine the aboveground and belowground C and N storage capacities for two wetland types, estimate which type has a better storage ability, and compare plant diversity between wetland types. Using two replicate sites per type, 0-20 cm and 20-40 cm deep soil samples were collected every 10 meters along a 50 m transect using a soil corer. Plant samples were collected from ten 20 cm by 20 cm subplots arranged along two 25 m transects at each site. Species diversity was calculated using the Shannon-Wiener index. A CHN analyzer was used to determine the C and N concentrations of soil and plant samples. This study indicates that in the sedge meadows (top 40 cm) the soil organic C (SOC) storage was 131.81 Mg/ha and total N storage was 10.47 Mg/ha. In contrast, in the marshes the SOC storage was 50.06 Mg/ha and total N storage was 4.06 Mg/ha. The SOC and total N storage in sedge meadows were significantly greater than the SOC and total N storage in marshes ($p < 0.001$). Plant diversity between the two wetland types was not significantly different ($p = 0.26$), indicating that it did not contribute to storage differences. Our results demonstrate that natural wetlands, especially sedge meadows, sequester large amounts of carbon. The SOC storage of these two natural wetlands have the potential to act as benchmarks for restored wetlands with regard to SOC storage over time.

Byrne, Caitlin M*[1]. Jenise M. Bauman[1,2], Shiv Hiremath[3], and Keith E. Gilland[4.] **Ectomycorrhizae associated with American chestnut in the reforestation of mine lands**. [1] The Wilds Conservation Science Training Center, Cumberland Ohio. [2] Miami University, Oxford, Ohio. [3] USDA Forest Service, Delaware, Ohio. [4] Ohio University, Athens, Ohio. Email: cmbyrne@falcon.bgsu.edu

The American chestnut (*Castanea dentata*) has historically been an important tree species to the forest ecosystem of the United States. The species once covered 25% of the eastern deciduous forest, but was eliminated by chestnut blight. Hybrids have been produced by backcross breeding methods resulting in chestnut-blight resistant seed lines. Because of its fast growing rate, prolific nut production, and valuable timber, the American chestnut is an excellent species for reforestation projects on coal mind landscapes. The American chestnut, as well as many other tree species relies on a mutually beneficial root fungi called ectomycorrhizae (ECM). The ECM grows inside the roots and transfers nutrients and water to the plant via external hyphae. This fungal symbiont may be essential for healthy seedling establishment. Previous studies have shown that proper soil preparation methods may enhance the initial tree fungal interaction resulting in increased plant biomass. Soil methods such as "end-dumping" may provide a more suitable medium for tree growth during reforestation projects. "End-dumping" involves piles of loosely spread soil over the site. However, availability of ECM fungi from these sites is not known. This current study quantified ECM colonization and community composition. We calculated that the total average percent colonization was 43%. This is a much greater percent when compared to other restoration plantings. From that we observed the most abundant ECM was *Cortinarius* spp., which colonized over 27% of the seedlings sampled. Other common ones found included *Cenococcum* spp., *Scleroderma* spp., *Thelephora* spp., and *Geomyces* spp. With this study we hope to gain a better understanding of ECM interactions during early establishment for improved chestnut survival.

Carson, Brendan D.*. **The ecology and management of spotted knapweed and associated pollinators.** Michigan State University, Lansing, Michigan. Email:brendandcarson@gmail.com

Spotted knapweed (*Centaurea stoebe*) and diffuse knapweed (*Centaurea diffusa*) are exotic invasive plants that have become increasingly prevalent in Michigan. Many conventional methods have been used to try to suppress knapweeds, but these tend to be costly and generally ineffective at controlling the plant's spread. Because of this, biological control is viewed by many to be an attractive alternative. Field trials in the Western United States and Minnesota have shown the seedhead weevils (*Larinus minutus, Larinus obtusus*) and the root weevil (*Cyphocleones achates*) to be the most effective knapweed biocontrol agents. In 2010, Michigan State University conducted releases at six Michigan sites to test the effectiveness of combining knapweed biocontrol with native plant re-seeding. In addition, biocontrol releases have been made by other organizations in 2007. Data from 2011 indicate that all three species are beginning to establish populations in Michigan, with populations beginning to spread from the sites of earliest release.

Damm, Mary C.* and Alex M. Clem. **Soils matter: native and reconstructed prairies differ in plant species composition and soil carbon and nutrients.** Indiana University, Bloomington, Indiana. Email: mdamm@indiana.edu

The eastern tallgrass prairie is a highly diverse ecosystem. Reconstructed prairies do not have the same pattern of plant species composition as native prairie remnants. Hobbs and Norton suggest a conceptual model of a restored ecosystem as it transitions from a degraded to an intact state. A restored ecosystem encounters abiotic then biotic thresholds that must be crossed for the system to become fully functional. We hypothesized that soil characteristics act as an abiotic filter in tallgrass prairie reconstructions. We sampled two pairs of native and reconstructed tallgrass prairies (Cayler Prairie and Lakeside Lab; Hayden Prairie and Borlaug Farm) and one additional native prairie (Steele Prairie) in Iowa. We established five 70 cm x 70 cm (0.5 m^2) plots stratified randomly in mesic prairie. We estimated plant cover using the point-intercept method and collected random soil samples for soil analyses in each plot. We analyzed plant data with non-metric multi-dimensional scaling and soil data with correlation analyses and paired t-tests. The three native prairies differ in plant species composition. Both pairs of native and reconstructed prairies differ in plant species composition. Average dissimilarity between Cayler and Lakeside Lab was 80.4% and between Hayden and Borlaug 86.5%. The paired native-reconstructed prairies also differ in soil characteristics. Though total carbon and total nitrogen were highly correlated for both native ($r = 0.998$) and reconstructed ($r = 0.985$) prairies, the paired prairies differ in total carbon and total nitrogen. Digest phosphorous was more strongly correlated with total carbon in the native ($r=0.913$), than the reconstructed prairies ($r = 0.643$). Calcium was also more strongly correlated with total carbon in native ($r=0.832$) than reconstructed prairies ($r = 0.100$). Cayler and Lakeside Lab differed in digest phosphorous. Hayden and Borlaug differed in calcium. Differences in soil carbon and nutrients may explain differences in plant species composition between native and reconstructed prairies.

Duke, Shawn T.* and Kristi E. Judd. **Effects of *Phragmites* invasion on decomposition in a freshwater marsh: Influence of vegetation, environmental characteristics, and plant litter leachates**. Eastern Michigan University, Ypsilanti, Michigan. Email: sduke2@emich.edu

Invasive plants can influence nutrient and carbon cycling by altering the physical and chemical environment. The invasive wetland grass *Phragmites australis* is a large, fast-growing plant that produces large amounts of biomass and can alter environmental conditions (e.g., light, water depth, O_2

availability). *Phragmites* may also inhibit soil microbial processes by exuding secondary metabolites. As part of a study aimed at understanding how *Phragmites* invasion and subsequent restoration efforts affect wetland ecosystem services, the goals were to determine baseline plant litter decomposition rates in soils of invaded and non-invaded (*Typha*) sites and the mechanism(s) responsible for any differences in decomposition. We hypothesized that both litter decomposition and soil respiration would be slower in *Phragmites* than *Typha* stands because of higher carbon to nutrient ratios in plant litter and repression by secondary metabolites. A reciprocal plant litter transfer study was conducted to separate out effects of litter chemistry and environmental factors on decomposition rates. Mass loss of *Phragmites* litter was significantly ($p < 0.05$) less than *Typha* litter in both invaded and non-invaded sites during the first 144 d (fall-winter). After 344 days there was a significant effect of site ($p < 0.05$), with litter in the *Phragmites* site decomposing faster but no effect due to plant species. A second reciprocal study was used to compare soil respiration and the effect of plant litter leachates. Soil samples from invaded and non-invaded freshwater marshes were incubated with *Phragmites* and *Typha* whole plant leachates to determine rates of soil microbial CO_2 and CH_4 production. There was no significant difference in soil respiration or CH_4 production between *Phragmites* and *Typha* soils and *Phragmites* leachates did not significantly inhibit respiration in either soil type. These results suggest that increased internal nutrient cycling within invaded wetlands may contribute to the sustained dominance of invasive plants.

Glaeser, Lilyan*[1], Penelope Richardson-Bristol[2], and Kristi E. Judd[1]. **Seed bank diversity in Great Lakes coastal wetlands invaded by *Phragmites australis*.** [1] Eastern Michigan University, Ypsilanti, Michigan. [2] U.S. Fish & Wildlife Service, Grosse Ile, Michgan. Email: lglaeser@emich.edu

Wetlands can support high biodiversity, but invasion by *Phragmites australis* has reduced wetland plant diversity throughout the Great Lakes region. In southeastern Michigan, *Phragmites* often replaces *Typha* spp., including another invasive, *Typha x glauca*. While *Typha* is also a large, fast-growing plant, *Phragmites* is thought to have more negative impacts on ecosystem services, such as providing water fowl habitat. Thus wetland managers often attempt to restore *Phragmites*-invaded wetlands by applying herbicide and burning to promote germination from dormant seeds in the seed bank. Because restoration success depends in part on the seed bank, we conducted a study to examine the composition and diversity of seed banks at sites where restoration activities were planned. We collected soils from three open coastal wetlands and one diked wetland located within the Detroit River International Wildlife Refuge and incubated soils in a greenhouse. Seed bank species richness and Shannon-Wiener diversity indexes were higher than existing plant community diversity in both *Phragmites* dominated sites and nearby uninvaded wetland communities (mainly *Typha* spp. or *Typha* spp. and *Scirpus fluviatus*). Our results suggest that viable seed banks exist to at least partially support restoration of pre-invaded plant communities, but that some invaded coastal wetlands may require additional seeding to improve floristic quality.

Hinz Jr., Leon C.*[1], Brian A. Metzke[1], and Andrew Hulin[2]. **Updating the status of Illinois' fish species in greatest need of conservation**. [1] Illinois Natural History Survey, Springfield, Illinois. [2] Illinois Department of Natural Resources, Springfield, Illinois. Email: leon.hinz@illinois.gov

The Illinois Comprehensive Wildlife Conservation Plan and Strategy was accepted by the U.S. Fish and Wildlife Service in 2005. State Wildlife Action Plans (SWAP) were established to provide a common vision for wildlife and habitat conservation that would assist with preventing the listing of threatened and endangered wildlife and to reduce costs for restoration and recovery efforts. These

SWAPs identified species in greatest need of conservation (SGNC) using criteria related to rarity, vulnerability of habitat, and broad scale patterns of diversity. Eighty species of fish were selected as SGNC during Illinois' SWAP development based on eight assessment criteria. To prepare for the mandated 10 year SWAP revision process we have initiated a status revision and update for Illinois fish species. Fisheries data from four long-term monitoring programs, two collections databases, and the state's Natural Heritage database were compiled for Illinois fish species (>200 spp.). Statewide maps were developed for each species and used to evaluate temporal shifts in distribution at multiple spatial scales based on the dates of collection. Changes in relative abundance were assessed using site based changes in CPUE using the long-term monitoring data. SWAP identified stressors were evaluated by regional fisheries professionals with an online survey and via a literature review. Draft revisions for Illinois fish SGNC list, an evaluation of selection criteria, and identification of stressors for these species has been completed. Results of these efforts are being used for SWAP revision, conservation planning, threatened and endangered species review, and assessment of monitoring gaps.

Judd, Kristi E.*, Steven N. Francouer, Jennifer K. Kirk, Shawn T. Duke, Josh Goldberger, and Jerry Tyrrell. **Ecosystem impacts of *Phragmites australis* invasion and removal on Great Lakes coastal wetlands.** Eastern Michigan University, Ypsilanti, Michigan. Email: kjudd2@emich.edu

Invasive species can dramatically alter ecosystem structure and function through direct and indirect pathways. *Phragmites australis* is an invasive plant of great concern in Great Lakes coastal wetlands because it severely degrades wetland ecosystem services. In an attempt to restore these services, managers often treat *Phragmites* with herbicides (e.g., a glyphosate and imazapyr mixture) followed by burning to remove dead plant biomass. In this study, we examine the impacts of *Phragmites* invasion and subsequent removal on ecosystem structure and function in wetlands located in the Detroit River International Wildlife Refuge. We compared plant and soil microbial communities, surface and soil water chemistry, and ecosystem processes related to carbon and nutrient cycling in pre-invaded *Typh*a stands and stands of *Phragmites* and before and after *Phragmites* removal. Plant diversity, biomass production, and annual rates of carbon and nutrient uptake were measured along with soil and surface water concentrations of dissolved nutrients, organic carbon, CO_2, and CH_4. We also characterized soil microbial community composition with qPCR and t-RFLP and function using enzyme assays. After a year of baseline monitoring, *Phragmites* plots were sprayed with herbicide in fall 2010 and then burned in spring 2011. We plan to continue monitoring these sites over the next 5 to 10 years to document the degree to which ecosystem services are restored and the time frame over which restoration occurs. Here, we present baseline conditions (compared to pre-invasion *Typha* stands) and the short-term impacts of *Phragmites* removal. Our results indicate that wetlands invaded by *Phragmites* may become sinks for carbon and nutrients. These effects are likely dominated by direct effects of *Phragmites*, but we also detected differences in soil community structure and function, suggesting a role of plant-mediated indirect effects. Despite strong impacts on plant communities, spraying and burning had no strong effects on soil characteristics.

Kogge, Stu and Brian Majka*. **Wetland and stream restoration techniques following emergency response actions to the line 6B oil leak in Marshall, Michigan.** Cardno JFNew, Marshall, Michigan. Email: brian.majka@cardno.com

On July 26, 2010, Enbridge Energy, Limited Partnership (Enbridge) responded to a leak on the line 6B pipeline near its Marshall, Michigan pump station. An estimated 3159 m^3 of crude oil was released from Line 6B and an estimated 1277 m^3 reached Talmadge Creek and the Kalamazoo River.

Additionally, recent rains had put the creek at flood stage and caused it to overtop its bank. Thus, oil entered the creek and the adjacent floodplain and wetland areas. Emergency response actions were implemented and upon completion of preliminary remediation efforts, restoration of wetland resources commenced in accordance with federal and state consent orders and directives. Within a day of being contacted Cardno JFNew conducted ecological assessments of existing biota and resources of the wetlands and floodplain areas affected along Talmadge Creek. Draft restoration plans were prepared and approved for more than 3.2 km of stream and wetland impact. Plans were finalized, federal and state agency approvals were obtained, restoration materials were shipped, and wetland restoration efforts commenced within days. Use of experienced staff with an understanding of local geology, soils, plant communities, groundwater, material suppliers, and agency concerns were important in getting the restoration work started quickly. We used standard and unique restoration techniques to address the high volume of groundwater moving through these wetlands to the creek. Subsurface rock chutes, layering of various textured soils, and various erosion and sedimentation control materials were used to control groundwater flow and maintain prior wetland hydrologic regimes. Remediation efforts required the removal of soils up to 0.9 m in depth and the removal of a seed bank containing non-native and invasive species. Restoration efforts to date have been effective and coupled with planned additional plantings, monitoring, and maintenance activities will increase in native plant diversity and reduce non-native and invasive species.

Lettow, Mitch C.*, Lars A. Brudvig, and Doug A. Landis. **Flowering plant and pollinator responses to oak savanna restoration**. Michigan State University, East Lansing, Michigan. Email: m.c.lettow@gmail.com

Temperate savannas are among the earth's least conserved ecosystems. High quality remnant oak savannas and barrens are largely absent in Michigan. The lack of information on reference conditions creates uncertainty regarding the best methods for restoring degraded oak savanna remnants. In 2010 we initiated a long-term restoration study on a closed-canopy fire-suppressed oak savanna remnant at Michigan State University's MacCready Reserve in Jackson County, Michigan. Specifically, we are comparing approaches of gradual cutting of non-oak, fire-intolerant woody species coupled with fire (cut+burn), fire alone (burn), and unmanaged reference plots. In doing so, we hope to better understand how restoration approaches affect pollinator communities and their floral interactions. Here we present data on initial responses of ground-level light availability, vertical cover, native bee abundance, and floral abundance. The plant community is responding to increased light availability in cut+burn plots, with formerly light-suppressed species blooming for the first time. These results help us begin to better understand how restoration approaches affect pollinators that could alter plant community trajectories and overall restoration success.

MacDonald, Neil W.*, Laurelin M. Martin, Corey K. Kapolka, and Timothy F. Botting. **Three years of hand pulling controls spotted knapweed on a degraded site in western Michigan**. Grand Valley State University, Allendale, Michigan. Email: macdonan@gvsu.edu

The objective of our study was to examine the effects of initial site preparation treatments (mowing, clopyralid, or glyphosate) combined with hand pulling on spotted knapweed (*Centaurea maculosa* Lam.) control as part of a study of native plant establishment on a degraded 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. Commencing in 2009, we collected soil seed bank samples from each plot in March, and hand pulled mature knapweed and determined residual

knapweed densities on all plots in July. Hand pulling appears to be reducing knapweed seed bank densities on mowed and glyphosate-treated plots. In contrast, the seed bank appears to be resurging on the unpulled mowed and unpulled glyphosate-treated plots, but not on any of the clopyralid-treated plots. Hand pulling has effectively controlled mature knapweed densities regardless of initial site preparation treatment, as only one pulling treatment per year has kept residual mature knapweed densities to less than 0.5 plants per m^2 in these treatment combinations. Densities of seedling and juvenile knapweed also have declined to low levels on hand-pulled plots. In contrast, both mowed-only and glyphosate treatments without hand pulling as a follow-up treatment were experiencing resurgence of all life stages of knapweed by 2011, while clopyralid-treated plots without hand-pulling still displayed an acceptable degree of knapweed control resulting from the residual herbicide effects. Reductions in mature, juvenile, and seedling knapweed densities on the pulled plots demonstrate the pronounced impacts that hand pulling can have on knapweed recruitment after only three years of treatment, suggesting that hand pulling can be an effective practice for treating small knapweed infestations in areas being restored to native vegetation or as a follow-up to initial herbicide treatments where knapweed infestations are more extensive.

May, Liana N.* and Ines Ibanez. **Assessment of forest regeneration across land tenure regimes in southeastern Tanzania**. University of Michigan, Ann Arbor, Michigan. Email: lnm@umich.edu

In miombo woodlands of sub-Saharan Africa, an estimated 100 million urban and rural people rely on forest productivity and reproductive success of select tree species for food, medicine, fuel, shelter, and livelihoods. At the same time, forest clearing for small-holder slash and burn cultivation, cooking fuel, and timber harvest result in the loss of an estimated half-million hectares of forest per year necessitating reliance on the regenerative capacity of forests for their future provision of goods and services. An empirical understanding of how land use and governmental structures of land tenure effect forest population dynamics, particularly during establishment, is necessary to guide management decisions towards local and global sustainable livelihood goals. To research this I surveyed tree species composition, biomass, and size class across fifty 1000 m^2 nested plots in both locally- and centrally-managed timber, charcoal, and reserve zones in the Kilwa District of coastal Tanzania. Bayesian generalized linear models were used to model the effect of land use and governmental structure on regeneration while taking into account fire history and abiotic site characteristics that determine plant growth. The best model to fit the data was chosen using deviance information criterion. Forests in village general lands with an open-access management structure possessed significantly lower amounts of regeneration when compared to areas that were within CBFM (community-based forest management) regimes. Areas with more intense land use histories, particularly charcoal and timber, have less regeneration than comparable forested areas in reserves. Forest management structures in which there is more localized control (CBFM) and less intensive land uses have the highest regenerative capacities.

Peugh, Corine M*[1], Rebecca A. Fehn[2], Shana M. Byrd[1] and Jenise M. Bauman[1]. **Creating healthy pollinator populations through healthy landscapes**. [1] The Wilds, Cumberland, Ohio. [2] The Ohio State University, Columbus, Ohio. Email: cpeugh@thewilds.org

Creating public interest and involvement in habitat restoration is critical to preserving ecosystems and biodiversity. *The Wilds,* an innovative research center, is working to advance conservation through science, education and personal experience. In 2010, a 0.2 km^2 wetland restoration was initiated to support this goal. Wetlands are unique and valuable ecosystems that are quickly disappearing at the

cost of reduced water quality, increased flooding, and decreased biodiversity. Through the removal of invasive species, restored hydrology, and a large scale planting with native vegetation, *the Wilds* is able to provide a "living laboratory" for student researchers and interns to have an interactive learning experience while restoring degraded wetland habitat. Open access trails allow visitors to be immersed in the wetland by observing wildlife first-hand, while learning about the importance of restoring ecosystems to increase biodiversity and connect with nature. Several surveys were conducted in the wetland to determine the presence of plant and animal species, as well as ecosystem health. The lepidopteron survey is the primary focus of this study. Habitat loss and degradation have contributed to decreasing butterfly populations worldwide. Pollinators play a critical role in most ecosystems, therefore it is essential that these habitats are preserved and restored. Four transects, in different habitats were monitored for Lepidoptera during the 2011 season. Transects were established in the restored wetland habitat, a young oak savanna habitat, and within an old field dominated with invasive cool season grasses as a control. A transect established through a 0.05 km^2 restored prairie in 2003 was also monitored. Monitoring took place over 21 weeks in accordance with methodology used by The Ohio Lepidoptera Society's long-term monitoring program. Our results indicate that with one year of recovery following restoration, the wetland showed equivalent increases in butterfly diversity and abundance to that of the nine-year-old restored prairie.

Simmons, Matthew E.*. **Patch-burn grazing as a restoration tool in a Minnesota tallgrass prairie**. [1]University of Minnesota, Crookston, Minnesota. Email: msimmons@umn.edu

Prairies are diverse ecosystems composed of herbaceous vegetation, streams, riparian corridors, shrub islands, and wetlands. These systems offer important functions including wildlife habitat, carbon sequestration, nutrient cycling, water filtration, and water storage. Conversion of prairies to agriculture, suppression of fire, and the near extirpation of bison have significantly altered prairie structure and function. Currently, less than 1% of native tallgrass prairie remains in North America. In recognition of the importance of these diverse ecosystems, recent efforts have attempted to restore prairie structure and function in part by reestablishing historic disturbance regimes. One such restoration approach is patch-burn grazing (PBG) that integrates prescribed burning and large herbivore grazing within the same paddock. In PBG, it is assumed that large herbivores will graze primarily on the recently burned patches due to regrowth of more nutritious and palatable vegetation. In summer 2011, PBG was initiated in northwest Minnesota at Glacial Ridge National Wildlife refuge, the site of the largest prairie and wetland restoration in the United States. Twelve burn patches were established in an 8 km^2 unit that was stocked with 200 cow/calf pairs. Three patches will be burned during different seasons each year for four years (2011 – 2014). Objectives include assessing and comparing responses of prairie plant communities between PBG and traditional burn-only management approaches. Initial results indicate that while cattle use was greatest on recently-burned patches, fence lines and areas near water sources were also heavily grazed. Vertical plant structure was more heterogeneous in the PBG unit than the control. Litter depth was less and frequency of bare ground was greater in the burned patches than in either the unburned patches or the ungrazed control. PBG may increase diversity of ground-nesting birds by increasing structural heterogeneity, but the increased amount of bare ground raises concerns about the risk of soil erosion.

Tallant, Jason and Lara Treemore-Spears*. **Volunteer bird and amphibian inventories and natural area management in Ann Arbor, Michigan**. City of Ann Arbor, Ann Arbor, Michigan. Email: LTreemore-Spears@a2gov.org

Volunteers have been collecting data about bird, butterfly and amphibian species present in Ann Arbor natural areas for over fifteen years. Many inventory volunteers develop a close relationship with their survey site, and have participated in the program for many years. Their presence in the parks provides not only valuable data, but serves as a watchful eye over special habitats such as vernal pools. The Natural Area Preservation program of the City of Ann Arbor uses this information in the development of vision plans for public lands in the context of the surrounding urban matrix. Vision planning takes place in cooperation with volunteer park stewards, who dedicate natural area restoration effort to invasive species removal, revegetation using native plants, and serving as ambassadors and liaisons to the neighborhoods surrounding our parks. Management decisions about practices such as mowing and prescribed burning are re-evaluated and adjusted in response to new information. This poster presents several case studies of the ways in which biological inventories conducted by volunteers have contributed to management of natural areas in the City of Ann Arbor, Michigan.

Tsang, Byron Y.*[1], James F. Steffen[2], and Daniel J. Larkin[1,2]. **Environmental and biotic factors affecting woodland legume restoration**. [1] Northwestern University, Evanston, Illinois. [2] Chicago Botanic Garden, Glencoe, Illinois. Email: byron.tsang@u.northwestern.edu

Prolonged wildfire suppression and invasion by *Rhamnus cathartica* (common buckthorn) have degraded Chicago-area woodlands. While restored woodlands often have diverse plant communities, we have found it difficult to reestablish native woodland legumes like *Desmodium glutinosum* (pointed-leaf tick trefoil) and *Lespedeza violacea* (violet bush-clover). Although transplanted seedlings typically survive to reproductive maturity, autumn seed dispersal yields seedlings that do not survive their first growing season. Proposed factors affecting seedling survival include habitat changes associated with invasive plants, a lack of appropriate *Rhizobium* symbionts, and reduced utility of nitrogen fixation due to eutrophication. We are testing these possible constraints using coupled field and greenhouse studies. To determine environmental effects on seedling survival and plant productivity, seedlings were transplanted into five areas within a 0.4 km^2 managed oak woodland (i.e., remnant woodland; buckthorn-dominated areas; and areas where restoration began 1, 9, and 15 years prior to our study). Light availability and percent sky openness ($p < 0.001$) and nitrate/nitrite ($p = 0.030$) were correlated with restoration status, but ammonium ($p = 0.097$), orthophosphate ($p = 0.365$), and pH ($p = 0.296$) were not. *Desmodium glutinosum* relative leaf growth was higher in remnant and 1-year restoration sites ($p = 0.012$). *Lespedeza violacea* fruit set was higher in 1- and 15-year restoration sites ($p = 0.019$). Regression tree analysis indicated that lower orthophosphate and higher nitrate/nitrite concentrations were associated with growth in *D. glutinosum*, and that increased pH, nitrate/nitrite, and light availability were associated with vegetative growth and fruit set in *L. violacea*. Greenhouse experiments testing generic and species-specific *Rhizobium* inoculant found that root nodules did not form on seedling roots after six weeks of growth. Pending greenhouse experiments will test the effects of nitrogen availability and competition with the robust native woodland grass *Elymus villosus* on seedling growth and productivity.

Vine, Marissa L.* and James E. Cook. **Assessment of vegetation responses to restoration in a small floodplain**. University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: mvine895@uwsp.edu

Riparian wetlands provide many unique and essential ecosystem services. Restoration of these ecosystems is paramount to improving and maintaining watershed health. In 2010, approximately 500 m of previously-ditched stream channel and 0.07 km^2 of adjacent wetlands were restored in central Wisconsin. Initial restoration methods involved stream channel naturalization, and removal of all woody vegetation and the upper 0.6 to 0.9 m of soil. Approximately 25 cm of topsoil was later re-distributed, native trees and shrubs were planted, and the floodplain was seeded with a mix of grasses, sedges, and forbs. Objectives of this study were to evaluate restoration progress via initial vegetation response, and to lay the groundwork for long-term study. In early fall 2011, less than one year after project completion, 23 transects were established 30 m apart throughout the floodplain. Transects contained two to six, 1 m x 0.5 m quadrats spaced 20 m apart. Vegetative cover by species and amount of bare mineral soil was visually estimated for each quadrat. We documented that the mean number of species per quadrat was 7.2 and percent vegetative cover was 37.0. Wetland obligates typically made up 36.1% of total plant cover per quadrat. Thirty four plant species were identified, of which three were exotic. Occurrence of these exotic species was rare, and their percent plant cover was minimal (< 1.0%). A Wilcoxon paired-sample signed-rank test indicated that richness and abundance per plot were significantly greater ($p < 0.01$) for non-sown species than sown species, suggesting lesser ecological importance of sown species. The floristic quality index value was 16.6, indicating moderate quality of the native plant community. The mean coefficient of conservatism (C-value) was 3.8, which is consistent with mean C values found in comparable studies. In conclusion, the results are roughly consistent with the characteristics of similar, recently restored wetlands.

Zueger, Michael J.* and Donnie L. Peterson*. **Seed bank analysis of composition and density for a wetland restoration site with reapplied topsoil**. University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: mzueg687@uwsp.edu.

We are currently examining the seed bank of the restored Moses Creek wetland in the university-owned Schmeeckle Reserve, Stevens Point, Wisconsin. The 0.7 km^2 project, completed in 2010, converted the forested area to the historic wetland floodplain and stream meanders that existed prior to channelization for farming in the 1930s. Roughly 25.4 cm of topsoil was saved prior to restoration and reapplied after wetland construction. The effectiveness and value of this technique has rarely been evaluated for wetland restorations. The prospect of the topsoil harboring remnant wetland species in the seed bank is being examined to provide insights on the effectiveness of this technique. Soil cores were taken at multiple quadrats located on perpendicular transects spanning the entire restoration project area and into adjacent upland. Seed bank species composition and density was determined by greenhouse propagation. Preliminary investigations show that a minimum of two obligate and one facultative wetland species may have persisted in the seed bank, while others present were those that were not seeded as part of the restoration, but were observed pre-treatment. Total species richness was 19, which includes various weedy and generalist species. Natural seed dispersal from upstream, wind, and animals may play an important role. Seed bank density varies greatly overall and significantly between upland and wetland areas most likely due to this recent disturbance. Upland seed banks averaged 2,921 seed germinants per m^2 and wetland seed banks averaged 1,300 seed germinants per m^2. *Juncus tenuis* was the dominant taxa and *Carex spp.* displayed the most evenness. Stratified samples will soon be evaluated and should provide another dimension to the study. This continuing research provides insight to benefits of topsoil reapplication in regards to seed bank resiliency over a large span of time in an altered habitat.

ORAL PRESENTATION ABSTRACTS (ALPHABETIC)

Anderson, Roger C. Anderson *[1], Jonathan Bauer[2], and M. Rebecca Anderson[1]. **Garlic mustard's (*Alliaria petiolata*) effectiveness as an invader of Eastern North American deciduous forest groundlayers**. [1] Illinois State University, Normal, Illinois. [2] Indiana University, Bloomington, Indiana. Email: rcander@ilstu.edu

Recent studies suggest garlic mustard is an opportunist rather than a problematic invasive species and its abundance and effectiveness as an invader has declined. To determine garlic mustard impact on native species, we established 240 2.5 x 2.5 m treatment plots in 2004 and annually removed second-year garlic mustard plants from 2005 to 2011. Plots were randomly assigned to control, and early (mid-March) or late (early-May) removal of second-year garlic mustard. First- and second-year garlic mustard density and aerial cover was estimated for all vascular plants in a 50 x 50 cm sampling plot in each treatment plot. We used repeated measures MANOVA to examine change in first-year garlic mustard cover in treatments from 2004 to 2011. Nonmetric multidimensional scaling (NMS) axes scores and native species total cover from 2004 (pre-treatment) and 2011 samples were used in MANOVA to determine treatment effects. First-year garlic mustard percent cover did not differ significantly among treatments in 2004 or 2005 and was greatest in 2005. Garlic mustard percent cover was 33.5±3.0 (mean±SE) in the control, 35.8±3.4 in the early removal treatment, and 28.7±2.7 in the late removal treatment. After 2006, early and late removal treatments did not differ significantly, but both had significantly ($p < 0.001$) less first-year plant cover than the control. First-year plant cover declined after 2007 reaching lows of 1.1±0.2 in the control, 0.2±0.1 in the early removal treatment, and 0.1±0.04 in the late removal treatment during 2011. For 2004, there were no significant treatment effects on native species total cover and NMS axes scores did not differ in 2004 or 2011. However, in 2011 early (66.8±1.8) and late (65.3±2.2) treatments had significantly ($p < 0.001$) greater cover than the control (55.1±1.9). Our results suggest garlic mustard's decline in abundance occurred over a short time and even at low abundances this invader's legacy persists.

Anderson, Troy C.*. **Converting turf to prairie. Saving money while re-connecting to our restored ecosystems, a practical approach**. Applied Ecological Services, Brodhead, Wisconsin. Email: troy@appliedeco.com

Keeping our children as well as many urban and even suburban citizens interested and aware of the value and beauty of our native ecosystems is a critical step to ensure what little remains is protected. If this connection is lost, who will care for these natural areas a generation from now? Who will notice if these ecosystems are removed or simply fade away due to neglect and lack of funding? What makes this even more of a challenge is that many of our natural areas are maintained by public entities that are facing increasingly tighter budgets. One simple idea is to use the challenging budget outlook as an opportunity to do ecological restoration. Many of our parks from the local municipal parks to our National Parks contain substantial amounts of manicured turf grass. The operational expense required to perform basic maintenance (mowing) of these turf areas can be quite substantial. Additionally, there are often turf areas that are too wet or too steep to be used in a traditional sense many times of the year. If these areas were converted to some kind of appropriate low maintenance ecosystem we could connect people and nature while reducing maintenance expenses. Using real life cost comparisons we can demonstrate the benefits of converting some select manicured turf areas into appropriate and functioning ecosystems. These cost comparisons indicate the opportunities are real. Site selection, public process, and non-monetary ecosystem values are critical points that need to be discussed in order to make this a success story.

Bart, David[1]*, Tara Davenport[1], Patricia Perez-Bonilla[2], and Quentin Carpenter[1]. **Effects of interacting agricultural legacies on unaided recovery in a Wisconsin fen complex: implications for restoration**. [1] University of Wisconsin-Madison, Madison, Wisconsin. [2] University of Puerto Rico-Arecibo, Arecibo, Puerto Rico. Email: dbart@wisc.edu

Unaided recovery is often patchy in post-agricultural wetlands, with monocultures of invasive grasses sometimes emerging in close proximity to relatively healthy patches. Understanding why patches recover in such different ways could ultimately improve our restoration designs. Here we present a case study examining how interactions among localized agricultural legacies, site-scale legacies, and non-legacy-impacted conditions alter vegetation recovery in a Wisconsin fen complex 12 years after cessation of agricultural activities. We compared land-use history, hydrology, nutrient availability, soil compaction, shading, and herbaceous communities among patches within four farmed fens and a never-farmed on-site reference fen. Our results indicated that: 1) plowing-induced internal eutrophication increased available P, which is associated with the loss of native graminoids and an increase in clonal forbs; 2) clonal forbs shifted from wetland generalists to mesic-weedy species with lower groundwater influence and increased distance from tile lines; 3) a shade tolerant forb community dominated where available P and shade interacted; and 4) *Phalaris arundinacea*-dominated communities emerged within 10 m of tile lines, but only if available P was elevated and soil compacted. These results suggest that: 1) increased nutrient availability alone predicts a variety of recovery outcomes; 2) other legacies interacting with nutrient availability are better predictors of patch-level recovery; and 3) understanding these interactions could be critical to predicting restoration outcomes.

Berg, Joe[1*], Suzanne Hoehne[2], and Keith Underwood[3]. **Integrating stream and wetland restoration through an innovative approach.** [1] Biohabitats, Inc., Baltimore, Maryland. [2] Biohabitats, Inc. Cleveland, Ohio. [3] Underwood & Associates, Annapolis, Maryland. Email: jberg@biohabitats.com

Naturally occurring and undisturbed aquatic, wetland, and upland habitats work together to recharge groundwater, maintain baseflow, process sediments and nutrients, and attenuate flood flow by retaining water on the landscape. A design approach has been developed based on the idea that the longer the water is retained on the landscape the greater the ecological and social benefits. This approach involves reconnecting a stream baseflow channel with the surrounding landscape through the construction of a series of pools and riffle/weir grade control structures, along with shallow floodplain pools behind low sand and wood chip berms. Water is retained on the floodplain behind the sand and wood chip berms, through which it must seep to be returned to the baseflow channel or groundwater flow. By retaining water longer on the floodplain, surrounding wetland features are rehydrated, hydric soil chemistry is supported, and groundwater/surface water interactions are prolonged. Research has documented that greater denitrification occurs in restoration projects that integrate stream and wetland features over unrestored or streams restored using other channel design methodologies. Also, research has indicated that a base flow channel connected with the surrounding riparian floodplain ecosystem is comparable to the geological record based on work focusing on legacy sediments where transects excavated across stream valleys provide information on the presettlement conditions.

Bird, Eric J.E.* and Young D. Choi. **Comparing biomass accumulation and soil chemistry of diverse, restored native prairie vegetation with that of abandoned agricultural field in order to determine carbon sequestration potential**. Purdue University Calumet, Hammond, Indiana. Email: ejbird@purduecal.edu

Recent studies have suggested that diverse, restored native prairie ecosystems may serve as a viable means for sequestering carbon from the atmosphere. Taltree arboretum in Valparaiso, Indiana contains over 0.16 km^2 16 hectares of restored native prairie vegetation alongside abandoned agricultural land (old field), and pasture field. Taltree therefore provides a natural setting for investigating such claims. Restored prairie also had a significantly greater ($p < 0.05$) diversity (H'=1.60) relative to old field (H'=1.20) and pasture field (H'=0.92). Production of standing biomass was significantly less ($p < 0.05$) in the pasture (above ground 5,365 + 460 kg ha-1; below ground 2,087 + 460 kg ha-1) than the restored prairie (above 7,297 + 595 kg ha-1; below ground 3,106 + 208 kg ha-1) and the old field (above ground 8,820 + 594 kg ha-1; below ground 3,863 + 269 kg ha-1). Our results suggest that areas with greater species diversity may produce greater mass, and thus sequester more carbon than areas exhibiting less diversity. The greater vegetation mass was likely due to the presence of forbs with lignified stems in the old field and the restored prairie. There was no significant difference between the prairie and the old field in both above and below ground biomass production. The carbon-sequestration capacity of our 12-year old restored prairie has probably not been established fully yet.

Brush, Lisa* and Erin Mittendorf . **Creating collaborative conservation communities.** The Stewardship Network, Ann Arbor, Michigan. Email: emittendorf@stewardshipnetwork.org

People come and go. They enter and leave jobs, they move in, and move away. How do we ensure that stewardship persists beyond the work of individual stewards? The answer is by building community. As individuals and partner organizations come and go, elements of the community may change, but the community itself will continue to be a dependable source of tools and resources in caring for natural areas. A primary goal of The Stewardship Network is to help build collaborative conservation communities or Clusters. Clusters connect individuals with organizations that can help them get involved in stewardship through educational workshops and hands-on volunteer opportunities. These Clusters also provide a framework for organizations to set and achieve greater goals (like being awarded major grant funding, developing a multi-county invasive management plan, etc.) by partnering with each other. We will use our Clusters as case studies on project partnerships and community organizing, and provide takeaways of how to build and maintain important connections to further stewardship efforts.

Burmeister, Matt S.*. **Using geospatial analysis to monitor ecological restoration**. MWH Americas, Inc., Chicago, Illinois. Email: matt.burmeister@mwhglobal.com

Practitioners often collect data in order to monitor ecological restoration success. Performance criteria typically calculated in order to monitor the success of ecological restoration projects include diversity indices, species richness, floristic quality index (FQI), and mean conservation value (C-value). When performing a wetland mitigation regulated by the United States Army Corp of Engineers (USACE) Chicago District, the performance criteria used to judge the success of the project are mean native FQI, C-value, wetness coefficient (W), and relative importance value (RIV_n). MWH was tasked with performing wetland mitigation at a DuPage County Forest Preserve District property in Bartlett, Illinois. To achieve the values dictated by the USACE Chicago District, specific management activities will be performed over a five-year period that ends in 2015. The permit requires the creation

of approximately 0.01 km^2 of native wetland and approximately 0.11 km^2 of native prairie. Geospatial analysis is an effective way to monitor and manage various ecological and environmental projects. MWH performed geospatial analysis using ESRI ArcGIS software to isolate the locations for management activity. This should lead to more efficient use of limited management budgets to achieve permit requirements. MWH created thiessen polygons using summarized field data collected at permanent sampling locations throughout the restoration site. The thiessen polygons will isolate proposed management activity locations based on low performance criteria values. This approach may help manage and maintain restoration and mitigation projects. It may also provide a meaningful way to communicate restoration related information to regulators, stakeholders, and other interested parties.

Chamberlain, Susan[*1], Laura Paine[2], and Randall Jackson[1]. **Grazing native warm-season grasses – effect of defoliation timing and seed source on persistence and productivity in the upper Midwest**. [1] University of Wisconsin-Madison, Madison, Wisconsin. [2] Wisconsin Department of Agriculture, Trade and Consumer Protection, Madison, Wisconsin. Email: schamberlain@wisc.edu

The use of native warm-season grasses in the pasture systems of the upper Midwest has potential to increase the ecosystem services associated with agricultural lands since native grasses provide wildlife habitat, increase landscape diversity, and can improve soil quality. Farmer interest in the use of native grasses as a source of forage has been documented for the region, yet native pastures remain largely absent from the landscape, as minimal region-specific information is available to farmers concerning how to manage native pastures for persistence and productivity using rotational grazing. This lack of information also prohibits natural resource professionals in the upper Midwest from using rotational grazing as a management tool for prairie remnants and restorations. Further, uncertainty exists regarding the source of seed, ecotype or cultivar, to be used when establishing pastures. A field experiment was initiated in collaboration with grass-based farmers and university researchers to assess how the timing of grazing rotations affects the cover, vigor, and yield of native grass pastures seeded with either ecotype or cultivar seed sources. Grazing rotations were designed to reflect contrasting management objectives – livestock based (grazed in June and July) and wildlife habitat based (grazed in July and September). We found that native grass cover and vigor was maintained, irrespective of when defoliations occurred throughout the growing season, but native grass yields were greater in paddocks managed with the July-September rotations. No consistent effect of seed source was detected. Overall, our project demonstrates that native warm-season grasses are tolerant to a variety of defoliation timings and can be used as forage in the rotational grazing systems of the upper Midwest. This information can contribute to increased use of native warm-season grasses in pasture systems, which has the capacity to increase the ecosystem services offered by grazing lands in the region.

Chen, Hua* and Ben Briddell. **Carbon sequestration potential of soil organic matter 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. In this study, the overall goal of this study was to estimate C sequestration potential of soil organic matter in the restored wetlands at Emiquon and Spunky Bottoms in Illinois. One wetland was restored from croplands in Emiquon in 2007 and one wetland was restored from cropland in Spunky Bottoms in 1997. We estimated soil organic C (SOC) storage in these two sites in 2010. In addition, we have examined SOC

and total N storage in two natural wetlands (Marsh and Sedge Meadow) in 2011. The SOC storages in the two natural wetlands provide good references for C sequestration potential of soil organic matter in restored wetlands. In 2010 the mean SOC storage of restored wetland at Emiquon was 33.7 Mg/ha and was 37.9 Mg/ha in Spunky Bottoms. In 2011 mean SOC storage of natural Marsh was 75.2 Mg/ha and in Sedge Meadow was 128.6 Mg/ha. These results suggest that the restored wetlands have the potential to sequestrate more C in future. Using an annual SOC accumulated rate of 0.42 Mg C/ha/yr, Emiquon is expected to take between 99 and 226 years to reach SOC storage levels observed in the two natural wetlands. Similar estimates for Spunky Bottoms indicate that it is expected to take between 88 and 216 years to reach the SOC storage level observed in the two natural wetlands. These results suggest that the SOC storage at these two restored wetlands will take centuries to reach the SOC storage level observed in the two natural wetlands in Illinois.

Chongpinitchai, Angela R.* and Roger Williams. **The effects of fire and other disturbances on the invasive tree *Paulownia tomentosa* and the impacts of this species on native vegetation**. The Ohio State University, Columbus, Ohio. Email: chongpinitchai.1@osu.edu

Many ecosystems today are experiencing an increase in number and spread of invasive species. It is often assumed that invasive plants negatively impact the ecosystem to which they are introduced without a clear understanding of how they interact with the native vegetation community. *Paulownia tomentosa*, a tree native to China and once used strictly as an ornamental in the United States, has spread extensively throughout the eastern United States and is commonly found in disturbed or degraded areas. Shawnee State Forest, Ohio, which experienced a large wildfire in 2009 and extensive canopy damage from an earlier ice storm, is regularly subjected to logging. Throughout the forest there are both mature stands of *P. tomentosa* and dense seedling patches within the burn area. We are investigating the effects of the various disturbances on *P. tomentosa* establishment and growth, as well as the impacts of the invasive tree on the native vegetation. Preliminary canonical correspondence analyses indicate that, when considering the aforementioned disturbances and multiple environmental factors, *P. tomentosa* growth, as measured by tree height, is influenced by the presence of fire, the percent of vegetative ground cover, and canopy density. Additionally, there is a significant difference in herbaceous and woody species composition of unburned areas where *P. tomentosa* has invaded compared to areas where the tree is absent (multiple response permutation procedure - herbaceous species $p = 0.029$; woody species $p = 0.0006$). Although *P. tomentosa* appears to be a species of significance in the mature stands beyond the fire boundary, the tree exhibits no compositional dominance in the seedling community, suggesting an inability of the invasive tree to self-replace and persist long-term in an introduced habitat. Our results have the potential for changing the approach for controlling invasive plant species within forested ecosystems in Ohio.

Ela, Julia M.*, Katie J. Baumann, and John A. Harrington. **Integrated livestock production and conservation: the viability of managed goat grazing in oak savanna and woodlands for shrub and sapling control**. University of Wisconsin-Madison, Madison, Wisconsin. Email: ela@wisc.edu

Oak savannas and woodlands are some of the rarest ecosystems in the Midwestern United States due to the removal of fire and native grazers after European settlement. Without fire, shrubs and saplings engulf these communities. Oak savanna and woodland restoration is a priority for many natural resource agencies to protect unique landscapes, plants, and animals. Typically the restoration process includes prescribed fire and mechanical removal of invading woody plants. These tools have disincentives, particularly for private landowners on whose properties the majority of remnants occur.

Fire has an associated liability, and clonal woody species produce little ignitable fuel making fire difficult to reintroduce. Mechanical methods are also costly and time consuming. Thus, alternative tools are needed. Managed cattle grazing, one alternative to fire, has been shown to reduce shrub numbers. However, cattle are difficult to transport, require robust fencing, and prefer grasses to woody species. Meat goats present a viable alternative as they prefer woody species and require less infrastructure due to their smaller size. This on-going study asks if the use of goats in a managed grazing regime can be used as a tool to: 1) restore natural composition and structure of native vegetation; 2) expand grazing land opportunities for private landowners; 3) provide landowners with a potentially advantageous tool to manage overgrown oak communities; and 4) support conservation efforts without adverse environmental effects. We are comparing two different grazing regimes (light and heavy) in five replicate blocks of 0.006 km^2 paddocks under a rotational grazing regime. Changes in cover, density and height of shrubs, saplings and herbaceous species are measured, along with litter depth, soil compaction, and dietary preference. Our results from the first year of data collection suggest potential for mutually beneficial livestock production and ecosystem management.

Fleece, William C.*[1], Lindsay Conley[1], Thomas Simon[2], and Nathan Ober[3]. **Little Coal River fisheries surveys and habitat restoration planning guidance**. [1] Stantec Consulting, Cincinnati, Ohio. [2] Indiana University, Bloomington, Indiana. [3] Stantec Consulting, Nashville, Tennessee. Email: cody.fleece@stantec.com

Stantec is currently under contract to the West Virginia Conservation Agency (WVCA) Guyan District to assess conditions and develop restoration designs for approximately 24 km of the Little Coal River in Boone and Lincoln Counties, West Virginia. The objectives of this study were to complete fish and habitat surveys to aid in: 1) determining appropriate design parameters and construction techniques; and 2) establish baseline conditions for fish populations prior to construction. Runs, pools, eddies, and backwaters were dominated by fine grained substrates (i.e., silt and sand). Sand was observed at 73 of 86 locations assessed. Some form of cover was observed in 55 of 86 physical habitat stations. Deep habitats were uncommon and deep-fast habitats were not observed. Fast habitats were less common that other hydraulic habitat types and mid-channel velocities were greater than those on the channel margins. Over 500 fish comprising 29 species were collected in the sampling effort. Over 300 of the fish were collected from glide and backwater habitats. Variegate darter (*Etheostoma variatum*) and banded darter (*Etheostoma zonale*) were the most abundant species captured. Species density and richness was greatest in coarse-grained substrates. Fish were most frequently associated with large wood (n = 170) and boulder (n = 141) cover types. Fish densities were high in mid-channel units sampled with backpack electrofisher but species per unit effort was low suggesting the presence of a small number of specialized species. Species richness was greatest in the margin habitats and 14 of the 29 species collected were found exclusively in margin habitats. These observations guided elements of the restoration design within the Little Coal River.

Gilhouse, Earl*. **Evaluating aquatic mechanical vegetation harvesting as an alternative to chemical lake and pond management**. ANG Water Technologies, Manitou Beach, Michigan. Email: angwatertech@yahoo.com

Chemicals are used within over 1,000 Michigan lakes to kill aquatic vegetation. Aquatic chemical permits are also being issued to more than 1,000 Michigan ponds. While chemicals are being used for lake and pond management, there is an environmentally friendly option. Aquatic harvesters are able to cut and remove aquatic vegetation 1.8 m below the water surface, putting the vegetation out of the

reach of boat motors and jet skis. The idea that harvesting fragments milfoil is a misnomer. Boat motors and jet skis probably leave more fragments than harvesters that collect and remove the cut vegetation. The removed vegetation is composted and applied to fields as a valuable soil nutrient. Our hypothesis was that aquatic harvesting which is eco-friendly, poses no risk to humans, pets or wildlife who may swim in or depend on the water for drinking, requires no re-entry interval, poses no risk to well owners who depend on safe water is a viable means of aquatic lake and pond vegetation management. Preliminary analysis of the first four years of data indicated that harvesting was effective in managing aquatic vegetation on Iron Creek Mill Pond. We plan to evaluate the effects of harvesting aquatic plants on Michigan lakes in the future.

Hasle, Erika M.* and Alison Paul. **A model of restoration and community engagement at Beaubien Woods Forest Preserve in Chicago**. The Field Museum, Chicago, Illinois. Email: ehasle@fieldmuseum.org

Beaubien Woods Forest Preserve is a 0.6 km^2 site owned and managed by the Forest Preserve District of Cook County (FPDCC) which is an independent governing body with the mission to acquire, restore and manage lands for public use. Beaubien is one of the few district owned properties in the City of Chicago, Illinois and is surrounded by industry, landfills, and a sewage treatment plant as well as being adjacent to Altgeld Gardens, a Chicago Housing Authority property. Beaubien has lacked a strong community constituency and has received limited resources from the FPDCC. Since 2005, management of the site for conservation has occurred through a partnership between the FPDCC and The Field Museum. In the absence of regular management, open wet prairies and oak savannas have been filled with woody invasive species. The communities surrounding Beaubien face challenges of unemployment and increasing high school dropout rates. After unsuccessful attempts to engage the community at large, the museum offered environmental education programs through local grammar schools in the Altgeld Gardens housing project and later with Carver High School, which has now adopted the site. Through the museum's work, the site now has 165 identified birds and 192 native plant species with an FQI=52.68. In part due to The Field Museum's environmental education programs and community engagement model, the site now has a stronger community presence that has encouraged the FPDCC to allow the museum and other partners to secure funds for contractor restoration work. The museum has started to use this project as a model for other urban natural sites, as it is instructive on how to engage diverse communities in local restoration work and build a positive community presence in underused sites.

Holzheuer, Martha R.* and Tonya S. Hunter. **People, places, and power lines: habitat restoration and education in utility rights-of-way**. Environmental Consulting & Technology, Inc., Ann Arbor, Michigan. Email: mholzheuer@ectinc.com

Utility corridors are often stereotyped as sterile environments devoid of biodiversity and infested with invasive species. As a member of the ITC Environmental Team, Environmental Consulting & Technology (ECT) has been working to dispel this misconception through habitat restoration and environmental education within high voltage transmission line corridors. ITC's corridors have proven to be effective places for reconnecting people to natural areas in urban, suburban, and agricultural landscapes. ITC partners with government agencies, local communities, conservation groups, universities, and landowners to establish and restore native vegetation and wildlife habitat, control invasive species, and restore and protect rare species and ecosystems within their corridors. ITC actively participates in the Wildlife Habitat Council's *Wildlife at Work* program, which recognizes

collaborations between management, employees, and communities to conserve and restore wildlife habitats on corporate lands. Corridors at ITC's Corporate Headquarters and two Huron-Clinton Metropark Authority properties have been successfully certified, involving ITC Green Team formation to oversee habitat restoration projects, community volunteer installations of pollinator and butterfly gardens, native planting area expansions, species baseline surveys with Oakland Community College science students, invasive species control, and construction and installation of bluebird nesting boxes by a local Girl Scout Troop. Environmental outreach activities also include installation of rain and corridor-appropriate demonstration gardens and interpretive signage. An invasive species management plan has been adopted to enhance high quality natural areas at ITC's Headquarters. To protect rare species and ecosystems, the Environmental Team partnered with numerous state agencies to create a GIS database of prescription zones where specialized vegetation management techniques and timing restrictions are utilized during corridor maintenance and commenced a field-based staff training program about rare species and habitat identification.

Lampe, John K.*. **Subterranean rhizome injection of herbicides for knotweeds and other invasive species**. Green Shoots, LLC, St. Paul, Minnesota. Email: john@greenshootsonline.com

I developed a new method for controlling various kinds of invasive plants possessing rhizomes. It is especially suited for knotweeds including Japanese knotweed (*Fallopia japonica*). The method uses an injector to deliver a concentrated dose of herbicide through the hollow stem of the plant into the below-ground rhizome. The method has several potential advantages. First, injections are directly into the rhizome, which is the part of the plant that needs to be killed for long-term control. Second, injections can be made when aerial shoots are dead thereby lessening the vexing problem of disposal of green aerial shoots. Third, the amount of herbicide used can potentially be decreased. Fourth, injections can be made at many different times of the year including in the winter.

Ludwig, Mark P.*. **The Flushing Bar Project - designing wildlife protection for 21st century forage mowers.** Allegan Conservation District, Allegan, Michigan. Email: mark.ludwig@macd.org

Grassland nesting birds and other wildlife are frequently killed or injured in hay fields by forage mowing equipment. Many conservation practices suggested for the benefit of grassland nesting wildlife involve the delay of harvest that causes reduced feed quality and limits their appeal. Recent high commodity crop prices increased a long term loss of hay and fallow grassland in favor of row crops. Some practices do not require the delay of harvest. The Flushing Bar Project is an ongoing effort to raise awareness of these low cost methods by promoting flushing bars and providing grassland conservation planning. The proven bar designs mounted on the front of tractors for trailed mowers is a primary focus. These trailed mowers allow substantial distance between the flushing bar and the mower. As the project matures it will build on the basic concept of the flushing bar, the chain dragged ahead of mowers, and mounting flushing bars on mower technologies such as front mounted and multi deck mowers. A display has been constructed, including a sample of a flushing bar which has been a great conversation starter. This outreach has been very gratifying in that once the concept of the flushing bar is introduced many farmers have declared that they could easily build this tool for themselves. The project seeks to restore some degree of safety for grassland wildlife in situations which all too often become ecological sinks that lead to killing off of the young and breeding adults. The effort to keep these animals alive on the over 4047 km^2 of hay in Michigan is apropos the old saying, "Don't let the perfect be the enemy of the good."

Martin, Laurelin M.*, Neil W. MacDonald, Corey K. Kapolka, and Timothy F. Botting. **Community establishment in a native prairie restoration: assessing the impacts of *Centaurea maculosa* control.** Grand Valley State University, Allendale, Michigan. Email: lanninla@mail.gvsu.edu

The objective of this study is to determine the most effective treatment combination for increasing native plant diversity and reducing spotted knapweed (*Centaurea maculosa* Lam.) on an infested site in Ottawa County, Michigan. Factorial combinations of treatments, including three initial site preparations (i.e., mowing, glyphosate application, clopyralid application) and hand-pulling of adult knapweed were applied to 48 plots in a randomized complete block design starting in 2008. In 2009, all plots were seeded with 22 native grasses and forbs. Knapweed response was quantified each year, and the composition of the entire plant community was determined in 2011. Using this information, we calculated floristic quality, mean C (average coefficient of conservatism), Simpson's diversity, and Shannon diversity for each plot. Our results indicate that seeding with a diverse mix of native forbs and grasses, in combination with hand-pulling, will result in higher quality restoration of knapweed-infested sites. Knapweed relative percent cover was significantly reduced on all clopyralid-treated or hand-pulled plots, and clopyralid in combination with hand-pulling resulted in the greatest mean C and floristic quality. Surprisingly, the mowed treatment without hand-pulling also had a mean C similar to all other treatments and provides evidence that native forbs and grasses were able to establish successfully within knapweed-dominated plots without intensive knapweed control. No significant impacts on native grass percent cover occurred among treatments. In contrast, native forbs had significantly greater percent cover on plots that were hand-pulled, indicating greater success following establishment. Non-native forbs percent cover, not including knapweed, was significantly greater on glyphosate-treated plots, while non-native grasses had the greatest cover on plots that were treated with hand pulling or clopyralid. The presence of native and non-native grasses will provide fuel for prescribed fires in 2012, and we anticipate that differences among these communities will continue to become more pronounced.

Miller, Nick*[1], Tom Bernthal[2], John Wagner[1], Mike Grimm[3], Gary Casper[4], and Joanne Kline[5]. **Prioritizing opportunities to restore wetland services for people and wildlife in Great Lakes watersheds**. [1] The Nature Conservancy, Madison, Wisconsin. [2] Department of Natural Resources, Madison, Wisconsin. [3] The Nature Conservancy, Sturgeon Bay, Wisconsin. [4] University of Wisconsin-Milwaukee Field Station, Saukville, Wisconsin. [5] Department of Natural Resources, Milwaukee, Wisconsin. Email: nmiller@tnc.org

Along the wetland-rich west shore of Green Bay, a diverse group of partners in the Duck-Pensaukee watershed developed an approach to locate and prioritize wetland restoration opportunities. Opportunities were mapped using a combination of wetland, soils, and land-use data. To aid partners in setting goals, changes in wetland services (e.g., flood abatement, water quality maintenance) due to wetland loss and alteration were assessed across the watershed. Individual sites were then prioritized according to their relative potential to contribute to ecosystem service goals. This framework builds from methods developed throughout the Great Lakes region and addresses state-level priorities (e.g., Wildlife Action Plan), wetland regulatory concerns, and local watershed conservation goals. Partners include The Nature Conservancy, Environmental Law Institute, Wisconsin Department of Natural Resources, St. Paul District of the Army Corps of Engineers, and other local, state, tribal, and federal conservation interests. While results are being applied locally, this project also provides Great Lakes coastal representation within a suite of pilot projects nationwide to develop a formalized "watershed approach" for compensatory mitigation under the Clean Water Act §404 Program. The aims of this larger project are to improve the integration of ecological information and proactive planning into the

mitigation site selection process, and to align §404 mitigation actions with local, watershed-specific conservation priorities. With $2.9 billion spent annually, nationwide, on compensatory mitigation, the "watershed approach" presents a major opportunity to restore watershed health by establishing priorities for regulatory compensatory mitigation in a manner that complements and bolsters non-regulatory efforts.

Nagarkar, Mita J.*. **A life history analysis of invasive behavior in native and naturalized species: *Rubus occidentalis* and *Rubus allegheniensis* in the Nichols Arboretum**. University of Michigan. Ann Arbor, Michigan. Email: mitan@umich.edu

Invasive species are defined broadly as "non-indigenous species or strains that become established in natural plant communities and wild areas and replace native vegetation." Based on recent research results, I argue that this definition is limiting in the context of climate change and globalization. Human disturbances have already changed ecosystem composition to such an extent that the original location of plant origin, although still extremely important, plays less of a deciding factor in the invasive capacity of the species. The native and naturalized species selected for this study display many of the same life history characteristics often attributed to non-native species. Research was carried out through two field studies in the University of Michigan's Nichols Arboretum in Ann Arbor, Michigan. This study used life history theory as a framework to assess the role environmental factors can play in shaping an organism's traits. Tradeoffs between seed quantity and seed size, as well as cane growth and fruit production were examined. Lastly, a test was done to replicate the effect of increased atmospheric nitrogen, thereby removing the limiting effect of nitrogen on plant growth. My results indicated that the two species use two different life history strategies that lend them a similar potential for invasive behavior. Understanding the tradeoffs present in these species informs management decisions on how to most effectively keep population numbers in check.

Roley, Sarah S.*, Jennifer L. Tank, Robert T. Davis, and Ursula H. Mahl. **The influence of two-stage ditch floodplain restoration on nitrogen removal, turbidity reduction, and benthic habitat in agricultural streams**. University of Notre Dame, Notre Dame, Indiana. Email: sroley@nd.edu

Conventionally-managed streams of agricultural landscapes in the Midwestern United States are often disconnected from their floodplains and characterized by unstable banks, elevated sediment export, and elevated nutrient export. Fertilizer inputs to the landscape increase stream nitrogen (N) concentrations, while minimal water residence time limits the potential for instream N processing. Steep stream banks may also fail during storm events and contribute to elevated sediment loads. In the two-stage ditch restoration, small floodplains are constructed alongside incised stream channels. During storms, water flows onto the floodplains, where it slows down and promotes particle settling. In addition, floodplains increase the time and space over which N processing and removal can occur. We examined the influence of floodplain restoration on water column turbidity, sediment denitrification rates, whole-stream metabolism, and benthic habitat in five two-stage ditches that had been constructed one to 10 years prior. We found that during floodplain inundation, turbidity was 2 to 9 times lower in the two-stage reaches, relative to their upstream controls. There was also an increase in benthic exposure of gravel and cobble in 4 of 5 streams, where the stream bottom was previously dominated by fine sediments. Floodplain restoration also increased reach-scale nitrogen removal via both denitrification and assimilatory uptake. Denitrification is the microbial conversion of nitrate to nitrogenous gases, and represents permanent N removal. Floodplain denitrification rates were greater in older two-stage ditches, coincident with organic matter accumulation. Assimilatory uptake of N

occurs when primary producers incorporate N into their tissues, and transformation to particulate N can buffer dissolved N export. Assimilatory uptake, estimated using primary production, was greater in all two-stage ditches, likely resulting from decreased water column turbidity. Overall, it appears that two-stage ditch restoration can reduce sediment and nitrogen export from agricultural streams, and that these water quality benefits are sustained through time.

Shartell, Lindsey M.*[1], R. Gregory Corace III[2], and Andrew J. Storer[1]. **European earthworms: a potential constraint to forest restoration and conservation on National Wildlife Refuges**.
[1] Michigan Technological University, Houghton, Michigan, [2] U.S. Fish and Wildlife Service, Seney, Michigan. Email: lmsharte@mtu.edu

The invasion of exotic earthworms into forested ecosystems in the Great Lakes region threatens to cause detrimental changes to the forest understory and soils, and these changes are expected to have cascading negative impacts within these ecosystems. This research examines patterns of earthworm abundance and community composition across six National Wildlife Refuges to identify potential stand and landscape level environmental correlates. In addition, the impact of earthworms within forests is assessed in relation to earthworm community composition. Four stand level variables (high soil pH, high basal area of earthworm preferred species, high percent anthropogenic cover, low conifer dominance) were found to be associated with increased earthworm biomass. In addition, canonical correspondence analysis indicated that these variables, along with proximity to agriculture, influence earthworm community composition. At the landscape level, increasing earthworm abundance was correlated with increasing mean patch area of anthropogenic cover. Increased earthworm abundance was also linked to more altered forest floors and decreased litter depth. Grouping earthworms into functional groups revealed differences in the influence of anthropogenic landscape patterns with epi-endogeic species found to be most closely associated with anthropogenic land cover. Epi-endogeic species were also found to be associated with more altered forest floors, decreased litter depth, decreased woody understory cover, and increased invasive plant presence. While there are few management options for removing European earthworms from forests after invasion, prevention, early detection, and understanding the potential effects of earthworms are important considerations. The results of this study improve our understanding of the invasion patterns, habitat preferences, and potential impacts of exotic earthworms in Great Lakes forests. This knowledge, in turn, can drive forest management decisions to limit spread into uninvaded sites and mitigate negative impacts in invaded sites.

Schaeffer, Jeffrey S.*[1], James Larson[2], William Richardson[2], Kurt Kowalski[1], Martha Carlson-Mazur[1].
Restoration of Great Lakes river mouth zones - freshwater estuaries in inland seas.
[1] USGS Great Lakes Science Center, Ann Arbor, Michigan. [2] USGS Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin. Email: jschaeffer@usgs.gov

River mouth ecosystems are a focal point for human and wildlife interactions in the Great Lakes. These aquatic ecosystems have been altered highly via human activities and many are listed as Areas of Concern due to contaminants. While river mouth ecosystems are often the focus of restoration efforts, surprisingly little is known about how these systems function and how anthropogenic processes have altered processes. Our work seeks to create a scientific framework that will guide restoration of these habitats. We hope to connect river mouth services, such as fish production, to important ecosystem processes (i.e., hydrogeomorphic influences, habitat distribution, etc.). To understand these processes, we mapped and characterized river mouths using GIS. We also conducted an extensive

survey of river mouth food-web structure and water chemistry. Finally, we conducted intensive surveys at three river mouths that range from pristine to highly altered sites. Data collected during 2011 revealed that Great Lakes river mouths function like marine coastal estuaries. They displayed complex mixing with frequent backflushing that was related primarily to physical characteristics of the river mouth. Analysis of food web biomarkers revealed that river mouths process N and P from the watershed, but that backflushing from the lake imported labile C. As a result food quality in river mouths is greater than surrounding habitats. Intensive sampling at three river mouths revealed that larval fish densities were orders of magnitude higher in pristine river mouths compared to more degraded habitats and that pristine habitats supported more native species. Ultimately, we plan to integrate this information into a decision tool for managers so they can engage in effective restoration actions. We have already identified several important restoration sites and several restoration techniques that are likely to achieve present goals, especially in Areas of Concern where habitat restoration is a prerequisite for de-listing.

Shuey, John*. **Climate change adaptation at the site level – restoring the hydrological gradient in Indiana oak barrens mosaics.** The Nature Conservancy, Indianapolis, Indiana. Email: jshuey@tnc.org

Climate change will have a dramatic impact on biodiversity and conservation in Indiana. Consensus models agree that Indiana will be warmer with an annual increase in precipitation. Precipitation will increase primarily during the cooler months with a tendency for extreme events. Models consistently predict that increased summer temperatures combined with annual patterns of precipitation will significantly increase drought stress during the late growing season. From an ecological standpoint, these changed climatic patterns will create "winners and losers". Our strategies capitalize on "winners", while mitigating against the predictable changes that will degrade the "losing" ecosystems. Using an oak barrens complex in northwest Indiana as an example, we discuss how the Indiana Chapter of The Nature Conservancy "places our bets" with adaptation strategies designed to anticipate future predicted climate regimes. Based on modeling and expert opinion, climate change will like have two primary impacts in these systems (in addition to the preexisting stressors at the site): 1) drought induced plant mortality; and 2) altered near surface hydrology impacting mesic and hydric habitats. To increase resiliency in uplands, we are emphasizing "managed transformation" of fire suppressed woodlands towards open oak barrens habitats. Open oak barrens are assumed to be drought resistant relative to mesic closed canopy (fire suppressed) oak and forests. Our target transitional state is a natural assemblage that once characterized xeric dunes supporting oak barrens in the region before fire suppression. Water table restorations in agricultural fields adjacent to the conservation area are designed to lessen the impact of severe drought on mesic grasslands and wetlands, especially relative to breeding habitats for amphibians and reptiles. Together these two simple strategy adjustments are designed to increase internal resilience to predicted future environmental perturbations – an important first step towards a more resilient future.

Smith, Lisa L.* and Steve Manning. **Web-based tools for invasive species management**. Invasive Plant Control, Inc., Nashville, Tennessee. Email: wildflower@ligonierweb.com

IPC Web Solutions was developed to integrate invasive plant control activities with land managers through web-based invasive control species management decision tools, site/project management reports and work order tracking with the use of a private personalized web interface. IPC's new web based tools offer applications that allow practitioners to more effectively and efficiently restore

ecosystems that have been degraded by invasive species infestations. Using these tools, land managers and 'citizen scientists' can track invasive species occurrences and detailed management activities information on both mobile devices and a web-based interface. Three tools [IPC Web Solutions, IPC Connect.com (tracking and monitoring) and IPC Logic (invasive species management smart tool)] integrate directly into the existing nationwide effort of EDDMapS, allowing occurrence information to be publicly available while restricting management information to local managers. These resources provide local on-the-ground tools with national implications thus minimizing effort required by local managers to track and share their accomplishments. For organizations focused on empowering 'citizen scientists' in their on-the-ground efforts, these tools will make that effort more meaningful by creating an easy way to collect and input data from the field. IPC Web Solutions was developed by Invasive Plant Control, Inc. to make available over 15 years of on-the-ground invasive plant control and restoration experience on natural lands to a broader audience.

Tallant, Jason M.*, William Welsh, and Eugene Jaworski. **Application of temporal image fusion to enhance invasive species detection in remote sensing**. Eastern Michigan University, Ypsilanti, Michigan. Email: Jason.tallant@gmail.com

Remote sensing technologies and associated image classification techniques have been identified as a potential method for completing large scale and low cost identification, monitoring, and assessment of invasive species. The repeatable, synoptic abilities of remote sensing have made it an ideal tool for the study of invasive species at the landscape scale. However, consistent classification of individual species in small to medium size populations is still not fully operational or standardized. A potential method for increasing the accuracy of remotely sensed target species is to exploit the temporally distinct physiological characteristics a target species exhibits throughout the growing season with advanced remote sensing analysis. To test the validity of this technique, our study uses high resolution, 4-band aerial imagery to locate discrete populations of *Phragmites australis* (common reed) in the Detroit River International Wildlife Refuge, which is a 77 km stretch of river with open water, islands, coastal wetlands, and marshes serving as a major avian diversity hotspot in the Great Lake Basin. Aerial photography collected in the spring and summer of 2009 was used in conjunction with 24 transects surveyed in 2010 to locate and monitor populations of *Phragmites.* A linear spectral unmixing process was used for classification of the imagery. Our results suggest that fusion of temporally distinct data sets can enhance classification of target species.

Thomforde, Steve L.*. **An alternative perspective on invasive species theory: new ideas to inform Midwest Great Lakes ecological restoration**. University of Wisconsin-Madison, Madison, Wisconsin. Email: thomforde@wisc.edu

Restoration of Midwest Great Lakes terrestrial and aquatic ecosystems often involve control of invasive species. However, our success in controlling invasive species is questionable. My research begins by identifying our current invasive species theory, how it informs restoration design and management, and how this translates to project outcomes that often fall short of desired objectives. I propose a different invasive species framework which employs nutrient regulation mechanisms to achieve desirable plant communities, increase biodiversity, alter trophic structure, and increase ecosystem function. This framework shifts the emphasis in restoration design away from site preparation towards an emphasis based long-term management strategies that are sustainable, offset costs, provide food, fiber, fuel, aesthetic and recreational services, and add to our social ecological

systems by creating jobs. In conclusion, the many positive social ecological benefits derived from this type of land management makes it feasible for large-scale restoration in urban and rural landscapes.

Ting, Tih-Fen.*. **Woody composition and structure of upland forest at Carpenter Park Nature Preserve: implications for management**. University of Illinois Springfield, Springfield, Illinois. Email: tting1@uis.edu

Sitting nearly in the geographical center of the state of Illinois and along the north bank of Sangamon River, Carpenter Park Nature Preserve has one of the largest contiguous swaths of high quality old-growth, oak-hickory forests in central Illinois. Every fall from 2004 to 2011, the upland forest of Carpenter Park was sampled by using the point-quarter method. While *Quercus alba*, *Q. velutina*, and *Q. rubra* still dominate the canopy layer according to their respective importance values throughout the eight year sampling period, they were almost non-existent at the subcanopy level. Although they had lower importance values than oaks, *Sassafras albidum*, *Carya cordiformis*, and *Celtis occidentalis* were relatively common at the canopy level. *S. albidum* was the dominant species in the subcanopy layer while other subcanopy species of significance included *C. cordiformis*, *C. occidentalis*, *Prunus serotina*, *Ulmus americana*, and *Asimina triloba*. *A. triloba* shows growing dominance which almost rivals *S. albidum* in the subcanopy level during the sampling period. The increasingly highly shaded environment in the subcanopy level creates difficult conditions for oak regeneration. Prescribed burns, coupling with selective thinning, have been considered necessary to restore the quality of upland forest of Carpenter Park by improving the lighting conditions conducive to oak recruitments. Burning alone can lead to re-sprouting of *A. triloba*, and hence its growing dominance. The sampling results from the past eight years suggest that selective thinning is critical for a successful restoration of upland forest of Carpenter Park.

Vaccaro, Lynn E.*[1], Jennifer Read[1], Bruce Manny[2], Greg Kennedy[2], Ed Roseman[2], James Boase[3], Michael Thomas[4], Matthew Child[5] and Rich Drouin[6]. **Restoring fish spawning habitat in the Great Lakes connecting channels**. [1] Michigan Sea Grant, Ann Arbor, Michigan. [2] USGS Great Lakes Science Center, Ann Arbor, Michigan. [3] U.S. Fish and Wildlife Service, Alpena, Michigan. [4] Michigan Department of Natural Resources - Fisheries Research, Harrison, Michigan. [5]Essex Regional Conservation Authority, Essex, Ontario. [6] Ontario Ministry of Natural Resources, London, Ontario. Email: Lvaccaro@umich.edu

The international rivers connecting lakes Huron and Erie have been greatly altered over the last 150 years, resulting in beneficial use impairments. Much of the Detroit and St. Clair River channels have been blasted, dredged and straightened to accommodate large freighters. This process removed or covered rocky areas that once were fish spawning grounds. Despite these habitat losses, the connecting channels remain the largest free flowing rivers in the Great Lakes basin and some fish continue to migrate into these rivers to spawn, including lake sturgeon which is threatened in Ontario, Michigan, and other Great Lakes states. Over the past ten years, a broad coalition of organizations has constructed two rock-rubble, fish spawning reefs near Belle Isle and Fighting Island in the Detroit River. Extensive sampling of adult fish using the reefs, fish egg deposition and larval fish dispersal revealed that fish use of the constructed spawning habitat was almost immediate. Fourteen species of native fish, including lake sturgeon, lake whitefish and walleye, have spawned on the new reefs. These positive results have helped project partners secure funding to construct additional fish spawning reefs in the St. Clair River. Differences between the two existing reef projects have been examined, including fish preferences for different rock substrates and the impact of water velocity on fish use of

the spawning habitat. Post construction assessments have led to several reef placement and design innovations that are being incorporated into upcoming fish habitat construction projects. One on-going challenge is to help residents in southeast Michigan understand the habitat degradation and remarkable diversity that lies beneath the water surface of the connecting channels. Michigan Sea Grant has found that the recovery of lake sturgeon in these channels is a powerful story that helps people connect with the rich aquatic life in the Great Lakes.

Wodrich, Carl J.*[1], Anne Remek-Kominowski[2], and James R. Smith[2]. **Restoring the Grand Calumet River – east Chicago and Hammond, Lake County, Indiana.** [1] Indiana Department of Natural Resources, Indianapolis, Indiana. [2] Indiana Department of Environmental Management, Indianapolis, Indiana. Email: cwodrich@dnr.in.gov

The Grand Calumet River and Indiana Harbor Canal were identified in 1987 as an Area of Concern (AOC) by the International Joint Commission (IJC). The area within and surrounding the AOC is one of the most heavily industrialized areas in the United States and efforts have been underway for decades to reduce the amount of pollutants discharged to the Grand Calumet River and improve water quality. Even with these efforts, legacy contaminants in the sediment continue to be the most significant contributing factor for impairment of most beneficial uses in the AOC. With this in mind, dredging and capping of these legacy contaminants is the recommended course of action that will significantly contribute towards delisting of the AOC. The state Natural Resource Trustees have partnered with the U.S. EPA Great Lakes National Program Office through the Great Lakes Legacy Act to begin the dredging and restoration of river segments and adjacent shelf wetlands within the Grand Calumet River. Currently under this partnership, the first project in the West Branch has been dredged and restored with a second project underway. A third project is in design phase with a fourth project proposed by the Natural Resource Trustees to U.S. EPA.

Wolf, Samantha M.* and Inés Ibañéz. **Forest diversity and plant-soil feedback: the effects of mature trees on seedling survival.** University of Michigan, Ann Arbor, Michigan. Email: sammwolf@umich.edu

Plant-soil feedbacks (PSFs) are mechanisms by which plants alter the structure, chemistry, and biology of soil and then subsequently influence plant survival and growth. PSFs also have the ability to alter forest composition because the PSFs associated with adult trees could differentially affect the establishment of conspecific or heterospecific seedlings. PSFs are facilitated by a variety of microbiota functioning beneficially or deleteriously. One type of PSF is performed by soil fungal pathogens. However, heterospecific seedlings can remain unaffected allowing for the establishment of different species. We seek to answer three main questions: 1) is seedling survivorship is affected by conspecific canopy species-specific soil pathogens?; 2) what are the effects of heterospecific adults?; and 3) what is the relative degree of the effect of soil pathogens influence on seedling survival? We conducted a multi-faceted field study in southeastern Michigan last summer comparing seedling mortality under five types of adult tree species which are dominant members of temperate forests. Half of the seedlings were treated with fungicide that excluded specific soil fungal pathogens and the other half were treated with water as the control. Results indicate that some species of seedlings treated with fungicide survived better under heterospecific adult trees than others when treated with water. For other species, survivorship was greater when fungicide was applied depending on the canopy species. Additionally, other seedlings experienced greater mortality under conspecific adult trees when treated with fungicide. These trends suggest that the effect of fungal pathogens may

influence tree species diversity and spatial dynamics as they relate to seedling mortality under conspecific or heterospecific fungal pathogens. Thus, pathogenic PSFs may have the potential to shape future forests. Our results will help to increase understanding of the impacts of PSFs and to assist with predicting forest response to human disturbance, invasive species, and climate change.

Young, Christopher L.*. **Response of the Franklin's Ground Squirrel to recreational trail development in Springfield, Illinois**. University of Illinois Springfield, Springfield, Illinois. Email: cyoun4@uis.edu.

The Franklin's ground squirrel (*Poliocitellus franklinii*) is a state threatened species and has been designated a species in greatest need of conservation in Illinois. At the southern range of its distribution (i.e., Illinois and its adjacent states), the number of Franklin's ground squirrel is declining. Habitat loss and fragmentation is considered the primary cause for the population decline of Franklin's ground squirrel. Nonetheless, to this date, the habitat requirements of this small mammal species are still poorly understood. Specifically, there is little information in the literature describing the response of Franklin's ground squirrel to increased urbanization. Franklin's ground squirrel is also considered difficult to survey because of its burrowing and secretive nature. The Franklin's ground squirrel is found to persist on the rapidly developing southwest side of Springfield, Illinois. In June 2010, I located a population of Franklin's ground squirrel living along an abandoned railroad corridor scheduled to be converted to a recreational bike and hike trail on the southwest side of Springfield. My study includes surveying the extent of the distribution of the Franklin's ground squirrel along the abandoned railed track both before and after the start of construction. I documented changes to Franklin's ground squirrel habitat, including types of vegetation present, location of burrows, topography, and soil conditions. The purpose of my study is to determine whether or not Franklin's ground squirrel continues to occupy the same areas altered by construction. Grading caused the destruction of some burrows, and Franklin's ground squirrel is now restricted to a smaller area of suitable habitat within the study area. Lost habitat could be replaced by opening up other portions of the trail canopied by trees. Results of my study can guide future trail construction to minimize habitat loss for this threatened species.

OFFSITE FIELD TRIP ABSTRACTS

Hartig, John H. and Allison Krueger. **Detroit River International Wildlife Refuge: extreme makeover-brownfield edition.** Detroit River International Wildlife Refuge, Grosse Ile, Michigan. Email: john_hartig@fws.gov

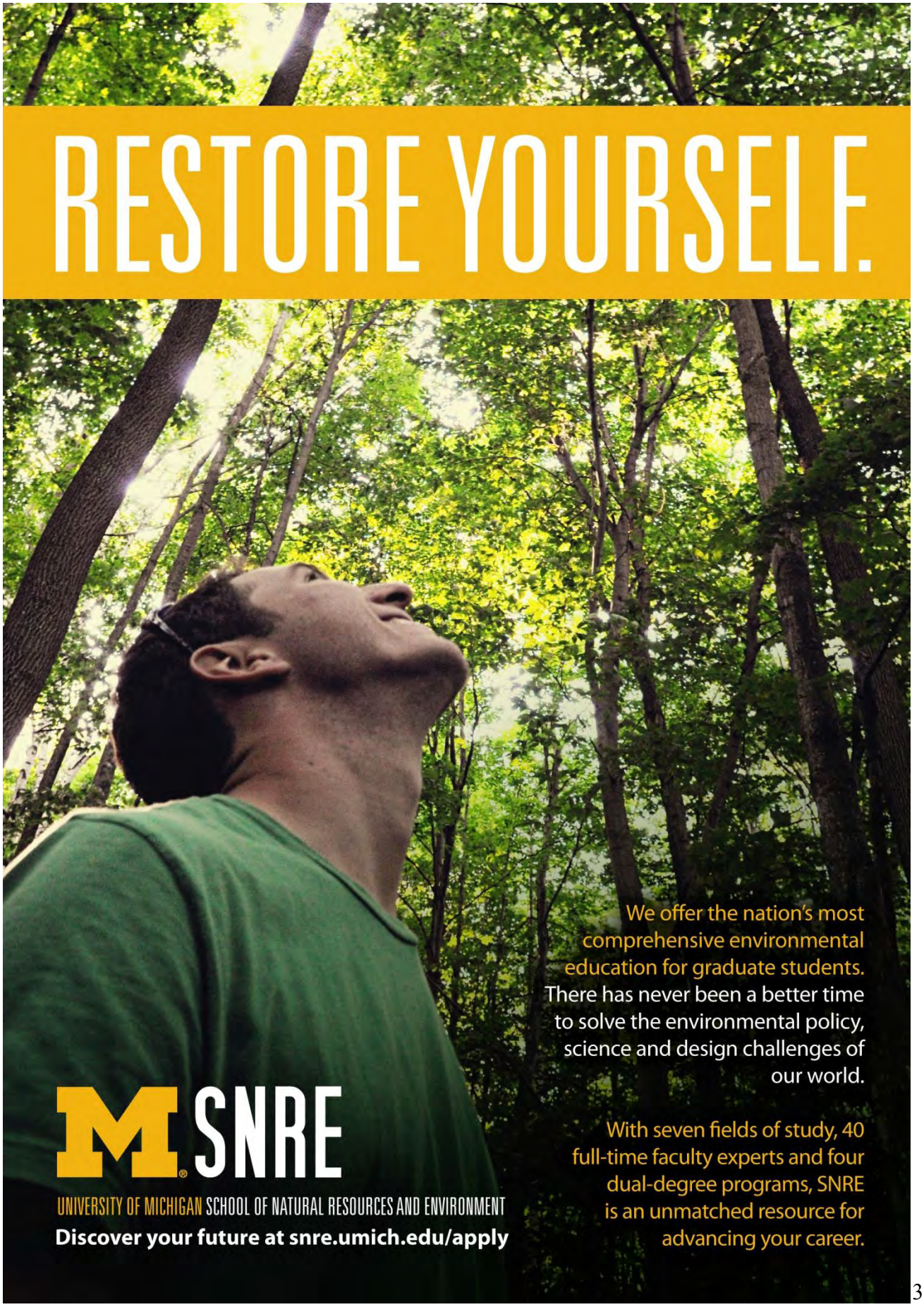
The Detroit River International Wildlife Refuge spans 77 km along the Detroit River and western Lake Erie, and is the only international wildlife refuge in North America. A key unit of the refuge is the 1.7 km^2 Humbug Marsh that represents the last kilometer of natural shoreline on the U.S. mainland of the river and is Michigan's only Ramsar Wetland of International Importance. It is considered an internationally important wetland because of its ecological importance in the Detroit River corridor and the Great Lakes Basin Ecosystem. Humbug Marsh serves as a vital habitat for 51 species of fish, 90 species of plants, 154 species of birds, seven species of reptiles and amphibians, and 37 species of dragonflies and damselflies. Adjacent to Humbug Marsh is an 0.2 km^2 former industrial manufacturing site that is being remediated and restored as an ecological buffer for Humbug Marsh, and the future home of the refuge's Visitor Center. The site was operated as an automotive brake and paint plant facility for 44 years. The facility was closed in 1990 and remediated to Michigan criteria for industrial/commercial use. It sat vacant for 12 years before it was acquired in 2002 as the gateway to the international wildlife refuge. In 2006, Wayne County and many partners adopted a Master Plan to guide cleanup and restoration. Restoration activities included: 1) cleanup and capping of contaminated lands; 2) daylighting a creek; 3) stormwater pond and wetland construction; 4) restoration of upland buffer habitat; and 5) removal of invasive plant species. This project has been described as transformational for the region by restoring an industrial brownfield into high quality wildlife habitat that expands the ecological buffer of a Ramsar site. Further, this Refuge Gateway is being restored as a model of environmental sustainability for nearly seven million residents within a 45-minute drive.

May, Chris[1] and Gary Crawford[2]. **Coastal Wetlands Restoration Projects in Erie Marsh, Michigan.** [1] The Nature Conservancy, Lansing, Michigan. [2] Environmental Consulting and Technology, Inc., Ann Arbor, Michigan. Email: cmay@TNC.org

Erie Marsh Preserve and the surrounding landscape contain some of the last remaining expanses of coastal wetlands and associated nearshore bottomlands in the highly urbanized and agricultural landscape between Detroit, Michigan and Toledo, Ohio. However, the existing wetlands have been degraded due to changes in hydrology, nutrient inputs, sedimentation, and invasive species. This field trip will focus on work at the Conservancy's Erie Marsh Preserve in Monroe County, Michigan, which is the site of a 3.9 km^2 coastal wetland restoration project. This collaborative project will re-establish a hydrologic connection between Lake Erie and a diked wetland, provide fish access to 1 km^2 of wetland that has been segregated from the lake for over 60 years, and improve the water control infrastructure at the site to allow independent management of 10 wetland units. The project includes extensive monitoring of abiotic and biotic components to evaluate restoration success. We will also discuss plans for future restoration of bottomlands and emergent marsh in North Maumee Bay, including challenges associated with altered sediment budget, nutrients, and hydrology in the open water environment. The projects presented during the field trip are components of a landscape-scale effort by the Conservancy and partners to plan, prioritize, coordinate, and implement restoration projects cooperatively at a "whole system" scale. Future plans include the integration of ecological goals and socio-economic considerations into conservation planning in this landscape.

Spears, Lara[1], Jason Tallant[1], Harry Sheehan[2], Shawn Severance[3], and Jeff Dehring[3] **Ann Arbor Wilds.** [1] City of Ann Arbor Natural Areas Preservation, Ann Arbor, Michigan. [2] Washtenaw County Water Resources, Ann Arbor, Michigan. [3] Washtenaw County Parks, Ann Arbor, Michigan. Email: LTreemore-Spears@a2gov.org

This field trip will include visits to three restoration sites in Ann Arbor, Michigan. The first stop will be the *Scarlet-Mitchell Area*. Volunteers have been working to protect and restore Scarlett-Mitchell Nature Area since the early 1970's. Volunteers now devote over 300 hours per year at Scarlett-Mitchell. The adjacent schools are also actively involved in the management of the area too. We will see oak-hickory forest, ponds, old field, and open marsh during the tour. The overall plant inventory includes 284 species of native plants. A prescribed burn was conducted in spring 2012, and we will discuss urban prescribed burn methods, burn timing, and engagement of volunteers in burning. This park illustrates many examples of our volunteer biological inventory and monitoring and we expect the wildflower display to be enjoyable! The second stop will be the *Mary Beth Doyle Park and Wetland Preserve*. This park and preserve is located along Malletts Creek. The facility is a complete re-design of a flood control impoundment built 30 years ago. The site is leased to the City for park use. The preserve includes a sediment capture pool, low flow channel, and created wetlands. It provides water quality treatment for upstream urban runoff, reduces downstream channel velocities, and flood control. Construction involve: 1) contaminated sediment removal; 2) a temporary stream diversion, sediment forebay, embankment dam, weirs, and wetlands; 3) modifying the existing outlet structure; and 4) landscaping. Park enhancements include a new pedestrian path and bridge, native landscaping, parking lot improvements, and recreation-related modifications. Ongoing post-construction activities include wetland mitigation monitoring, vegetation monitoring, and water quality sampling. The third stop will be the *Malletts Creek Stream Restoration*. Malletts Creek and its tributaries flowing through County Farm Park are being restored to improve water quality, reduce flow volumes, and channel stabilization. This is part of the restoration plan established by the Malletts Creek Restoration Plan and is a partnership between the City of Ann Arbor, Washtenaw County Water Resources, and Michigan Department of Environmental Quality. The Malletts Creek Stream Restoration project is focused on reducing erosion and annual phosphorus loads entering the Huron River. Malletts Creek is the largest waterway in Ann Arbor and transports the greatest share of pollutants to the Huron River. Treatment features includes creek bank stabilization, stone check weirs, and wet meadow stormwater mitigation basin construction.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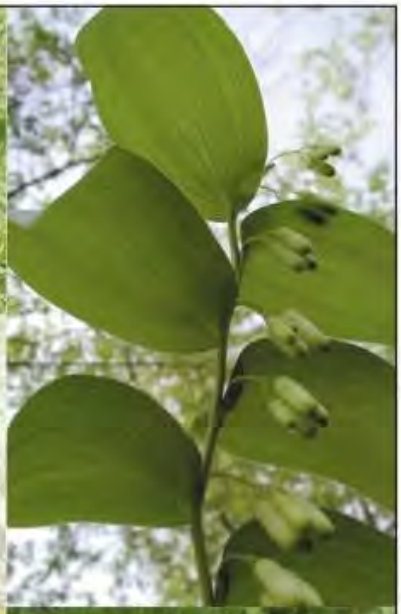

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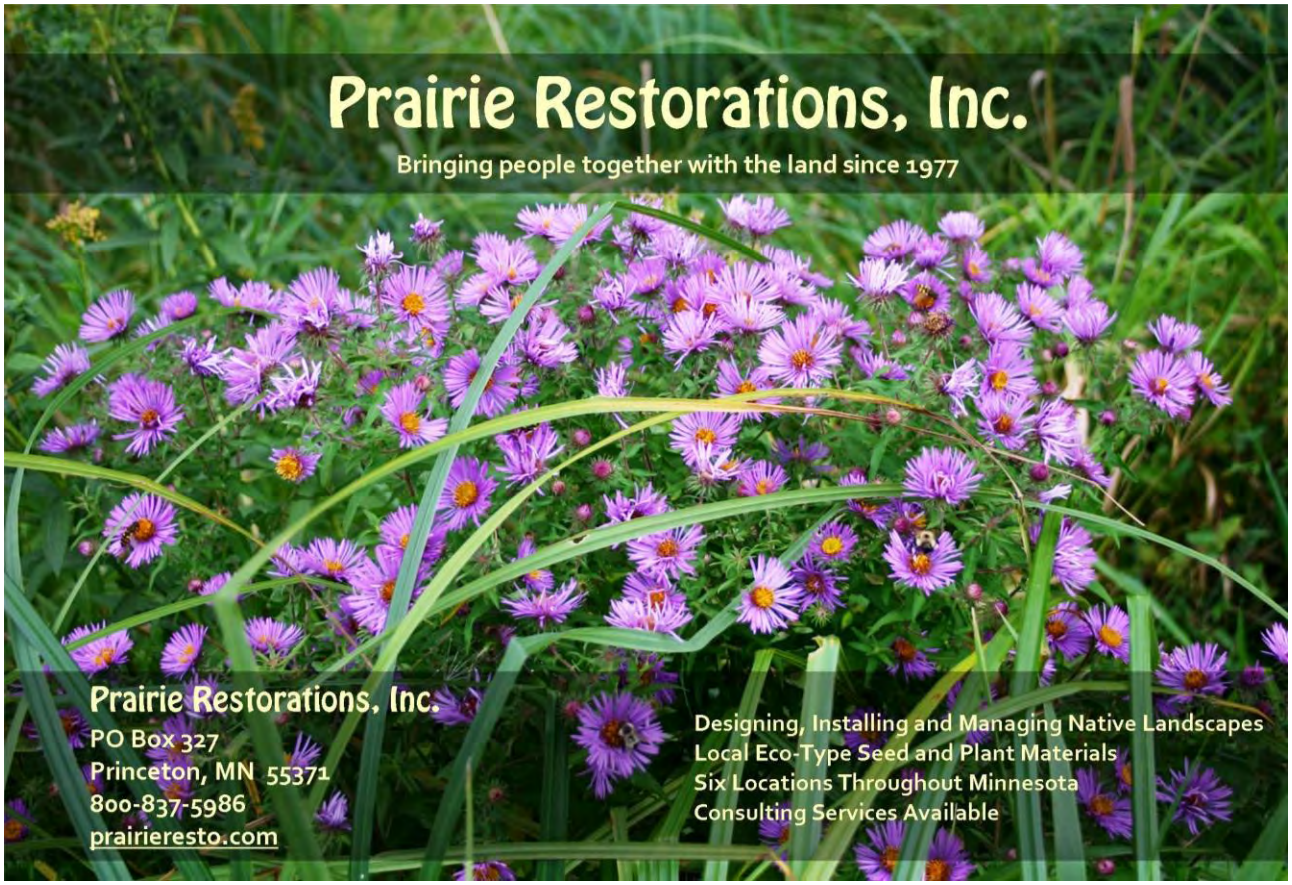

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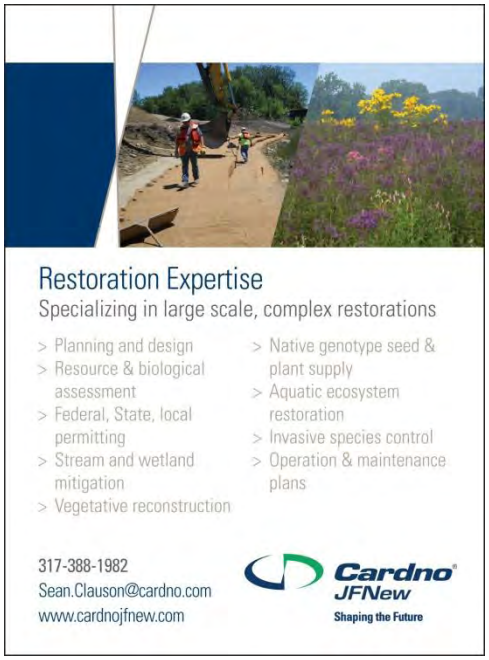

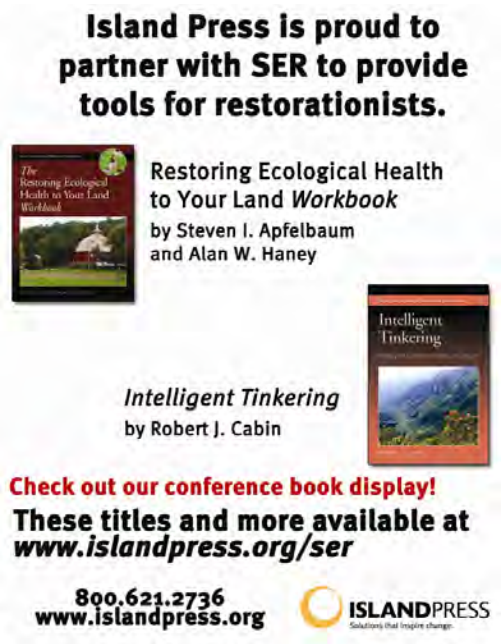

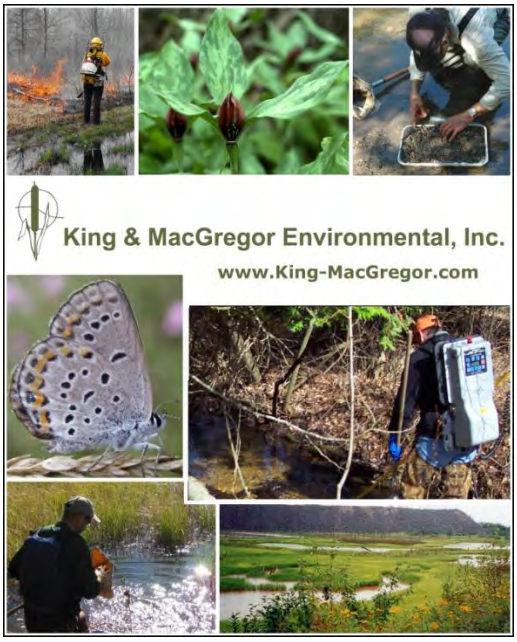

DAVEY RESOURCE GROUP

A Division of The Davey Tree Expert Company

For more information, contact:

Jessica Hickey
Project Manager/Biologist
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330-673-5685, ext 8027
www.davey.com/drg

Davey is a proud sponsor of the *2012 Midwest-Great Lakes Chapter Society for Ecological Restoration—Fourth Annual Chapter Meeting*! We have been providing ecological and environmental services for the Midwest Region for over 18 years:

- Wetlands and stream restoration, design, monitoring
- Grant writing services and educational outreach
- Natural resource and open space inventories
- Preparation of planting plans
- Native vegetation seeding and planting
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Mike Nurse and Aaron Snell are excited to introduce Streamside Ecological Services, Inc. Mike and Aaron, formerly of Wetland and Coastal Resources and Fishbeck, Thompson, Carr & Huber, have worked together for nearly ten years and share a goal of providing high-quality ecological consultation, based on sound-scientific principles, at an affordable price.

Streamside will offer services that Mike and Aaron have always been known for, including:
- Wetland delineation, assessment, mitigation, monitoring and permitting
- Aquatic assessment, including fisheries, macroinvertebrates and physical habitat
-Threatened and Endangered Species assessment
- Watershed management and planning
- Stream stabilization and habitat restoration

Mike Nurse, PWS- Mike has over 23-years of experience managing ecological projects as a state employee and private consultant. Mike has a wide range of experience with aquatic ecosystems from a local and landscape perspective. He has worked with MDNR Fisheries Research Division and DEQ Land and Water Management Division where he was the lead analyst and manager for the most complex and controversial wetland projects in the district. He is very familiar with wetlands, inland lakes and streams, and Great Lakes regulatory permitting programs.

Aaron Snell, M.S. - Aaron earned a Master of Science degree from Michigan State University in 2001. Since that time, he has been actively involved in all aspects of ecological consulting. He has completed over 600 hours of stream assessment and restoration training courses, and was one of the first people in Michigan to complete the four part series offered by Dr. Dave Rosgen. Aaron is intimately familiar with grant writing and administration, having secured over $1 million in project funds. He has worked on hundreds of projects, focusing on stream restoration, aquatic and threatened and endangered species assessments, and many others.

Macomb County Office - (586) 764-9366; mnurse@streamsideeco.com
Grand Rapids Office - (616) 238-7372; snell@streamsideeco.com

www.streamsideeco.com

SER SOCIETY FOR ECOLOGICAL RESTORATION

Celebrating 25 years of leadership in the field of ecological restoration



About SER

The Society for Ecological Restoration (SER) is a non-profit, membership-based organization whose mission is to *promote ecological restoration as a means of sustaining the diversity of life on Earth and re-establishing an ecologically healthy relationship between nature and culture.*

Since its founding in 1988, SER has given voice to the field of restoration and has become an important leader within this emerging discipline. With members in over 70 countries and 14 regional chapters around the world, SER is a dynamic global network that fosters the exchange of knowledge and expertise among ecological restoration practitioners and scientists from diverse discplines.

SER promotes restoration and helps disseminate best practices by establishing regional chapters, hosting a biennial World Conference, informing international policy discussions, and publishing a number of restoration-related resources. The Society's publications include the peer-reviewed journal ***Restoration Ecology***, the SER-Island Press book series *The Science and Practice of Ecological Restoration*, and the *SER Internationl Primer*. SER also maintains an active online Member Directory and networks such as the Global Restoration Network (GRN).

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