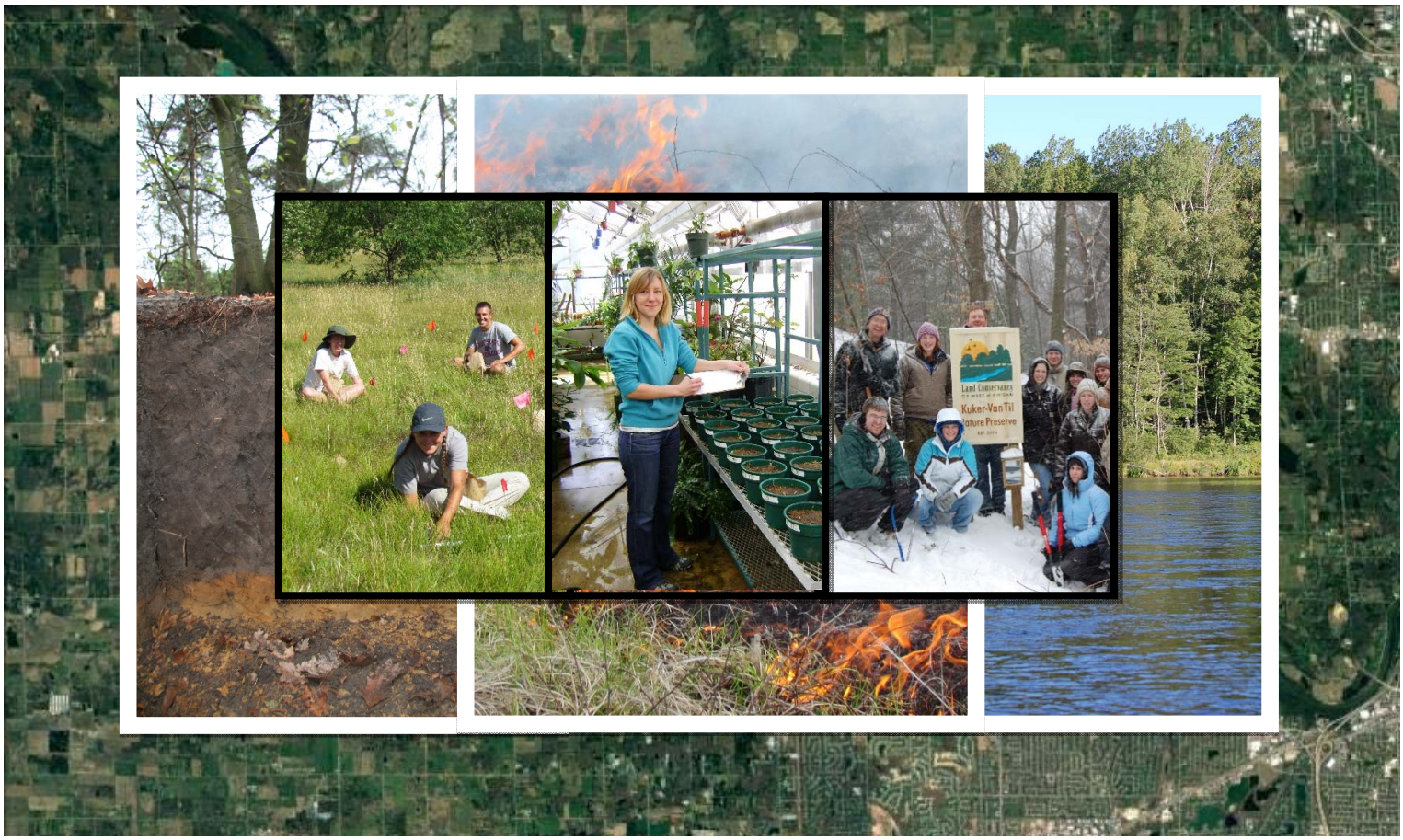
# ASSEMBLING THE RESTORATION COMMUNITY



# 3/17/2017 DRAFT ABSTRACT BOOK

## NINTH SER MIDWEST-GREAT LAKES CHAPTER MEETING

**March 24 to 26, 2017**

**Grand Valley State University, Grand Rapids, Michigan**

SER MIDWEST GREAT LAKES SOCIETY FOR ECOLOGICAL RESTORATION

GRAND VALLEY STATE UNIVERSITY BIOLOGY DEPARTMENT www.gvsu.edu/biology

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# WELCOME

Welcome to Grand Rapids and the Ninth Annual Meeting of the Society for Ecological Restoration's Midwest-Great Lakes Chapter. Our goal for this meeting is to explore how restoration as a human guided community assembly process assists with the recovery of degraded ecosystems and to highlight the importance of promoting the involvement of a diversity of individuals and organizations within restoration efforts in the Midwest. Our scientific agenda for this three day meeting features two plenary sessions, a keynote address, two symposia, two workshops, 20 contributed poster presentations, 42 contributed oral presentations, and three offsite field trips on a range of topics that reflect our meeting theme. This year represents the second year we are able to offer meeting attendees continuing education credits. Our Meeting Hosts (The Grand Valley State University Biology Department) will offer a special plenary session as part of the meeting. This plenary session will provide an overview of the research, teaching, and community outreach related to ecological restoration underway at Grand Valley State University. We hope you will enjoy another outstanding chapter meeting.

# 2017 ANNUAL MEETING COMMITTEE

The Chapter extends its sincere appreciation to the members of the Annual Meeting Committee for their time and effort in coordinating and developing the Ninth Annual Chapter Meeting: *Rocky Smiley (Chairperson), Todd Aschenbach, Erin De Vries, Mathew Dornbush, Steve Glass, Martha Holzheuer, Daniel Larkin, and Jessica Miller.*

# ACKNOWLEDGEMENTS

We are very grateful for the generous support provided by our meeting hosts and sponsors that enabled us to hold a sponsorship reception, support student participation, defray food costs, and make our Annual Meeting as environmentally friendly as possible. We greatly appreciate the contributions of the members of the Local Planning Committee *(Todd Aschenbach (Chairperson), Neil MacDonald, and Priscilla Nyamai)* who assisted with planning the meeting and provided onsite help. We thank Rebecca Dolan and Martha Holzheuer for their work in enabling us to offer continuing education credits through International Society of Arboriculture and the Society of American Foresters. We thank Jennifer Lyndall for her help with setting up the online registration page. We also thank Island Press for their book donation in support of our student award program. We are also thankful for the participation of the meeting presenters, moderators, tour leaders, field trip leaders, volunteers, and attendees at our Ninth Annual Meeting.

# SPONSORSHIP RECEPTION

Enjoy drinks and snacks while examining poster presentations, viewing sponsorship exhibits, and socializing with colleagues.

# MEETING HOSTS

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# KEYNOTE PRESENTATION

Weiher, Evan*. **Community assembly theory may help inform both ecological restoration and assembling the restoration community.** University of Wisconsin-Eau Claire
Eau Claire, Wisconsin. Email: WEIHER@uwec.edu

A unified science that joins community ecology with ecological restoration has been a long sought goal of theoretical ecologists, empirical ecologists, restoration practitioners, and land managers. Even though such unification has not occurred, there has been significant progress over the last 10 years. There is some consensus that basic theory in community ecology should be and actually is the core science of ecological restoration. What is this core theory? Community assembly theory is based on three fundamental processes: dispersal, selection, and drift and their influence on functional trait distributions especially in terms of functional similarities and differences, and their proxy, phylogenetic distributions. It is also about recognizing simple linear-gradient variation versus non-linear hysteresis. Ecological restoration is reliant on manipulating these same fundamental processes with a keen eye on critical aspects of community structure and/or ecosystem function within an adaptive, iterative outcome-oriented management. Ecological restoration of basic ecosystem structure and function is sometimes a simple matter that can be easily achieved because the solutions are well-established. Restoration of highly detailed structure, such as populations of endangered species, requires specific biological knowledge and there may be no general theory for guidance. Application of assembly theory may help in the middle ground, and there are some fine published examples. Community assembly theory can be applied to the practice of ecological restoration and to the development of teams involved in ecological restoration. The challenge is essentially to understand how dispersal, selection, and drift processes influence the functional community structure of teams. Comparing the assembly of ecological communities and restoration teams may lead to insights that can facilitate the application of community theory to ecological restoration.

# WORKSHOP ABSTRACTS

Aschenbach, Todd*[1], Paul Charland*[2], Justin Heslinga*[3], Brian Majka*[4], Melanie Manion*[5], and Paul Rogers*[5]. **Preparing for professional success in ecological restoration**. [1]Grand Valley State University, Allendale, Michigan. [2]U.S. Fish and Wildlife Service, East Lansing, Michigan. [3]Land Conservancy of West Michigan, Grand Rapids, Michigan. [4]GEI Consultants, Allendale, Michigan. [5]Ottawa County Parks, West Olive, Michigan. [6]Michigan Department of Natural Resources, Plainwell, Michigan. TA Email: aschenbt@gvsu.edu; PC Email: paul_charland@fws.gov; JH Email: justin@naturenearby.org; BM Email: bmajka@geiconsultants.com; KM Email: kmahoney@fs.fed.us; MM Email: mmanion@miottawa.org; PR Email: RogersP5@michigan.gov

This workshop will provide job seekers with information and advice on how to best prepare for a rewarding career in ecological restoration. Topics include acquiring appropriate skills and knowledge, professional communication, and gaining pertinent field experience. Handouts on preparing résumés and cover letters will be provided. This workshop will also include a panel of professionals from private, public, local, state, and federal organizations that will provide unique insight on how to find employment in the field of ecological restoration.

Evans, Timothy*. **DNA barcoding: employing DNA sequences to aid in plant identification.** Grand Valley State University, Allendale, Michigan. Email: evanstim@gvsu.edu

DNA barcodes are sequences of particular genes that allow unambiguous identification of organisms, in a manner similar to the function of Universal Product Codes (UPCs). DNA barcodes are being developed for all types of organisms, and they can be effective on any stage of an organism's life cycle and from fragmentary tissue. A database for the barcodes has been active since 2007 (Barcode of Life Database, or BOLD). This database links each DNA barcode with a particular species, and it provides links to numerous data repositories for each species. DNA barcodes have been used for a wide range of applications, including taxon identification, finding cryptic species, forensic studies, and community structure, just to name a few. In this workshop we will discuss uses and limitations of DNA barcodes, methods for obtaining them from field-collected organisms, and their specific utility to various aspects of conservation. We will implement some of the lab procedures required to obtain a DNA barcode (i.e. extraction of DNA from fresh or preserved tissue) and we will explore some of the online resources using DNA barcodes that have been collected from local organisms.

# OPENING PLENARY SESSION ABSTRACTS

## *DESIGNING ECOLOGICAL RESTORATION PROJECTS FOR PROMOTING PUBLIC ENGAGEMENT*

Harrington, John A. **The Historical Role of Landscape Architecture in the Promotion of Conservation and Ecological Restoration in the Upper Midwest.** University of Wisconsin-Madison, Madison, Wisconsin. Email: jaharrin@wisc.edu

In 1915, a University of Illinois Agricultural Experimental Station Circular, The Prairie Style of Landscape Gardening, written by Extension Horticulturalist Wilhelm Miller, was published. This manuscript described a new approach to landscape design and emphasized an aesthetic based on the conservation of native scenery and the restoration of local vegetation. The document highlighted the work of two Chicago area landscape designers, O.C. Simonds and Jens Jensen, both advocates and practitioners of a relatively new approach to design that took its cues from the biological and physical materials and forms of the regional landscape. This approach to design moved away from the formal trends in landscape architecture to one based on current understanding of ecological concepts, human ties to nature, and a regional aesthetic. During this same time, the field of ecology as a specific research focus and discipline was emerging. As the two disciplines of ecology and landscape architecture matured, the science of restoration ecology and the practice of ecological restoration and design were also further defined. Collaborations arose between landscape architects and ecologists, including Jensen and Henry Cowles, G. William Longenecker and Aldo Leopold, and Edith Roberts and Elsa Rehmann and continue to be created today. These proponents of conservation and native landscape design sought to provide opportunities for public engagement with the native environment. The philosophies and activities of these pioneering individuals contributed to the practice of ecological restoration and the science of restoration ecology and are visible today at universities, in government, and in private practice across the country.

Grese, Robert E. **Restoration in Cities**. University of Michigan, Ann Arbor, Michigan. Email: bgrese@umich.edu

Restoring landscapes in urban areas presents a number of challenges. These challenges include varying levels of historical modification and change, typically a very fragmented context with a variety of adjacent land uses, and stakeholders who may not value wilder aesthetics or ecological processes such as flooding or fire. On the other hand, restoration in the urban context may provide opportunities such as readily available volunteers, the ability to weed and care for restoration sites much more intensively than in other contexts, and opportunities to educate and build relationships with large numbers of people. Restoration in urban contexts may require relaxing narrow definitions of what constitutes ecological restoration to embrace a continuum from rooftops to backyard gardens to more traditional restorations in urban parks and nature preserves. While such approaches may not be able to restore a full range of ecosystem services, they may collectively reduce the overall ecological footprint of our cities, make them much more livable, and help retain some unique natural qualities of the region.

Gobster, Paul H. **Restoring Urban Natural areas with People in Mind: Perception, Support, and Engagement.** U.S. Forest Service, Evanston, Illinois. Email: pgobster@fs.fed.us

Urban natural areas are often looked upon to provide a diverse range of ecosystem services, but their location within the urban matrix can also pose unique challenges to the success of ecological

restoration programs. In many cities of the Midwest-Great Lakes region, public and private natural areas are surrounded by a fragmented landscape of residential properties, the owners of which can affect and be affected by how natural areas are managed. A case study in Chicago examined the perceptions and uses of among residents who lived near eleven different natural areas, their support for eight common management practices used to restore oak ecosystems, and how engagement with their own residential landscape might contribute to or conflict with natural areas management goals. Nearby residents strongly agreed about the values of urban nature and the benefits of its restoration, but expressed varied support for management practices with herbicide use and lethal deer control receiving relatively low support compared to controlled burning and other activities. An analysis of residents' own home landscape practices identified three different styles of management, with "natural gardeners" expressing stronger preferences and support for restoration compared to "conventional gardeners" and "non-gardeners" as well as stronger engagement in activities that support restoration goals. Suggestions will be offered for how restoration and landscape professionals can use this information in their practice to build mutually supportive environments for people and nature.

Judd, Patrick J. **How Landscape Architects can Engage People to Influence the Design of Restoration and Naturalized Projects to Connect Them to the Land.** Environmental Consulting & Technology, Inc., Ann Arbor, Michigan. Email: pjudd@ectinc.com

For created landscape projects to be successful they must inspire people and in order to do this, it is first and foremost, the site have a purpose to connect people to the land and people to people. By engaging the client, the community, and stakeholders early in the design process, landscape architects can interpret both their input and a site's influences for a desired outcome of a restoration or naturalized landscape project on private and public lands. Through this early participation and contribution, the project success continues to inspire beyond the last seed sown or tree planted because the users take ownership – where people and everything in it are precious. It is important the site "speaks" to people, a user's passion is shared as a vehicle to promote environmental education, and the project helps to create emotional connections to these types of landscapes. A created and/or restored landscape needs to make that place of work, living, or recreation special and unique, to encourage exploration through an interactive process. This interaction could be the visual quality created through controlled viewsheds, a trail through the landscape allowing touch and experiencing the scents of wildflowers and seeing the wildlife. Three landscape project sites will be discussed: 1) Pfizer Global Research and Development Campus in Ann Arbor, Michigan; 2) Herman Miller's "GreenHouse" in Zeeland, Michigan; and 3) the River Terrace Trail segment of Washtenaw County's Border-to-Border Trail from Dexter Michigan to Dexter-Huron Metropark.

# SYMPOSIA ABSTRACTS

## Restoration Practices for Eastern Massasauga Rattlesnake Symposium Abstract

Holzheuer, Martha. **Restoration Practices for Eastern massasauga rattlesnake**. Environmental Consulting & Technology, Inc., Bay City, Michigan. Email: mholzheuer@ectinc.com

Depending on when, where, and how they are implemented, ecological restoration practices involving wetlands and adjacent upland habitats may affect, for better or worse, the declining eastern massasauga rattlesnake (*Sistrurus catenatus,* EMR). Recently listed as threatened by the U.S. Fish and Wildlife Service under the Endangered Species Act, this cryptic snake is widely distributed across Michigan—its last real stronghold—and occupies a wide range of habitat types including fens, prairies, wet meadows, marshes, swamps, scrub-shrub wetlands, and forests. So what does this mean for our ecological restoration projects? How do we know if EMR is a concern for our site? What steps can we take to make our restoration efforts beneficial to EMR and reduce the chance of adverse impacts? How do we educate our field crews and volunteers? Please join our herpetology, regulatory, and restoration experts to discuss: 1) the life history, ecology, and status of EMR across the Midwest; 2) recommended survey and monitoring methods pre- and post-restoration; 3) habitat restoration needs and specific actions at the landscape and site scales; 4) best management practices (BMPs) for enhancing habitat while minimizing adverse impacts; 5) permitting options and procedures; and 6) community education and outreach.

## Restoration Practices for Eastern Massasauga Rattlesnake Symposium Presentation Abstracts

Bird, Brittany*. **Eastern massasauga rattlesnake BMP implementation and community education in the Oakland County Parks System**. Oakland County Parks and Recreation, Waterford, Michigan. Email: birdb@oakgov.com

In 2016, the Oakland County Parks and Recreation Department spearheaded an effort to create The County of Oakland Eastern Massasauga Rattlesnake Implementation Plan (EMRIP) and sign onto the Michigan Department of Natural Resources' Candidate Conservation Agreement with Assurances (CCAA) for the species, thus, committing the parks department to upholding and implementing best management practices for the conservation of eastern massasauga rattlesnake (*Sistrurus catenatus*) on all managed lands. Integrating required CCAA practices into Oakland County Parks and Recreation Department's 10-year natural resources stewardship program will be discussed. Examples of how Oakland County Parks and Recreation Department uses prescribed fire, herbicide, and mowing techniques to enhance park habitat while minimizing adverse impacts to eastern massasauga rattlesnake will be reviewed. Managing the human element of eastern massasauga rattlesnake conservation through integration of public and staff education and outreach will also be discussed.

Lee, Yu Man*. **Eastern massasauga rattlesnake status, distribution, and ecology**. Michigan Natural Features Inventory, Lansing, Michigan. Email: leeyum@msu.edu

The eastern massasauga (*Sistrurus catenatus*), one of only four rattlesnake species in the Midwest/Great Lakes region, is a small, thick-bodied rattlesnake that occurs in a variety of wetland

habitats and adjacent uplands. The species was once considered common throughout its range, but its populations have severely declined. Historically, eastern massasaugas were known from western New York and Pennsylvania through southern Ontario, Michigan, and Wisconsin and northern Ohio, Indiana, and Illinois to eastern Iowa and Missouri. The species is listed as endangered or threatened in every state/province within its range except for Michigan, which is considered to be the last stronghold for the species. As a result of the species' rangewide decline, the eastern massasauga was listed as federally threatened by the U.S. Fish and Wildlife Service in September 2016. The primary factors that have contributed to the species' decline include habitat loss and fragmentation due to conversion to agricultural land, development, vegetative succession, exotic plant species invasion, hydrologic alterations, and other factors; management practices (e.g. prescribed fire and mowing); road mortality; persecution; and collection. Disease and climate change also pose additional threats to this species. Managing and restoring suitable wetland-upland habitat complexes are critical to conservation and recovery of this fascinating and vulnerable species. However, restoration activities designed to improve habitat for this species also can cause adverse impacts. This talk will provide information on the status, distribution, life history, and ecology of the eastern massasauga to help managers better understand this species, so restoration efforts can maximize benefits and minimize adverse impacts to this species.

Mifsud, David. **Eastern massasauga rattlesnake: threats, conservation, management, and monitoring needs of an imperiled reptile**. Herpetological Resource Management, Grass Lake, Michigan. Email: DMifsud@HerpRMan.com

The eastern massasauga rattlesnake (*Sistrurus catenatus*) is faced with several threats including habitat loss, persecution, disease, and incompatible timing of management activities. Best management practices have been developed to minimize threats to these and other herpetofauna to prevent or minimize negative impacts. A critical component to assessing impacts and evaluating response to BMP's involves inventory and monitoring. This presentation will discuss the known and potential threats to eastern massasauga rattlesnakes, their conservation and management needs, as well as monitoring components necessary to evaluate the potential for this species presence and gauge effectiveness of management activities.

Tansy, Carrie. **Eastern massasauga rattlesnake restoration conflicts, recommended best management practices, and permitting**. U.S. Fish and Wildlife Service, East Lansing, Michigan. Email: carrie_tansy@fws.gov

The eastern massasauga rattlesnake (*Sistrurus catenatus*) was recently listed as threatened under the Endangered Species Act. The most significant threats to eastern massasauga rattlesnake include habitat loss and fragmentation, road mortality, hydrologic alteration/water fluctuation, persecution, and collection. Loss of habitat was historically, and continues to be, the primary threat affecting this species either through development or vegetative succession. Habitat management is needed to provide habitat for eastern massasauga rattlesnake, but some management actions, including post-emergent prescribed fire and mowing, may result in adverse impacts. Best management practices can be incorporated into restoration projects to avoid or minimize adverse impacts and contribute to recovery of this rare snake. Permitting requirements under the Endangered Species Act will also be discussed.

# Ecological Restoration on Farmland Symposium Abstract

Damm, Mary C.[1,2] **Ecological restoration on farmland**. [1]Indiana University, Bloomington, Indiana. [2]Prairie Quest Farm, McGregor, Iowa. Email: mdamm@indiana.edu

With increased nutrient loading creating hypoxic zones in the Great Lakes and Gulf of Mexico, major flood events in the upper Mississippi River watershed, and continued decline in grassland bird and insect populations throughout the region, the need for repairing degraded habitat on some of the 550,373 $km^2$ of farmland in the Midwestern United States is greater than ever. Federal Farm Bill programs provide financial support to farmers for conservation and restoration practices on farmland. The programs are the main way most farmers think and make decisions about incorporating ecological restoration practices on their land. For example, the Conservation Stewardship Program (CSP) and the Conservation Reserve Program (CRP) support ecological restoration on farms. The Natural Resources Conservation Service (NRCS) and non-profit farmer advocate organizations (Practical Farmers of Iowa, Land Stewardship Project) work directly with farmers and have successfully communicated the need for ecological restoration through the broader objectives of improving soil health, improving water quality, and creating wildlife and insect habitat. Conservation organizations incorporate restoration practices on farmland by encouraging Federal Farm Bill conservation practices on currently farmed lands and restoring native plant communities on former croplands. In this symposium, an NRCS biologist, a farm owner, a restoration practitioner, and a restoration researcher will describe their work involving ecological restoration on current farmland and former croplands. The overall goal of the symposium is to facilitate better collaboration between the restoration and agricultural communities to implement more effective restoration efforts on farmland and highlight opportunities for restoration on Midwestern farms.

# Ecological Restoration on Farmland Symposium Presentation Abstracts

Damm, Mary C.[1,2] **Prairie Quest Farm: working land conservation and restoration**. [1]Indiana University, Bloomington, Indiana. [2]Prairie Quest Farm, McGregor, Iowa. Email: mdamm@indiana.edu

Prairie Quest Farm is a 120-acre farm in Northeast Iowa along the bluffs of the upper Mississippi River. The majority of the farm is planted in perennial cool-season grasses and forbs for rotationally grazed pastures and hay fields. The farm also has forest, savanna, and a 10 year-old restored prairie. Over the past two decades, the farm has been managed for the production of grass-fed beef and dairy cattle as well as habitat for breeding grassland birds. Grassland bird populations are in great decline due to habitat loss originally from plowing the prairie and more recently from the conversion of diversified farms with long crop rotations and livestock to intensively managed farms of corn and soybeans. I purchased Prairie Quest Farm in 2015 with the goal of continuing the established management of the farm. With the advice of my farm mentor and renter, I enrolled the majority of the farm in the Conservation Stewardship Program (CSP) to achieve my dual management goals of producing food and providing wildlife habitat. The CSP was first introduced in the 2002 Farm Bill to financially reward farmers for conservation practices on working farms. In 2015 the CSP offered 119 practices under the broad categories of improving soil and water quality, conserving energy, and planting diverse habitat for wildlife and insects. Within the CSP practices are provisions for restoring farmland for plant species diversity and ecosystem function. In my presentation I will describe how I selected 9 CSP practices to maintain the high quality pasture-grassland and restore farm borders to tallgrass prairie and savanna on Prairie Quest Farm.

May, Christopher A.[1]*. **Agricultural spectrum: ecological restoration of old fields, sustainable practices on existing fields**. [1]The Nature Conservancy, Lansing, MI. Email: cmay@tnc.org

The Nature Conservancy often acquires land that includes abandoned or active agricultural fields. In one case, land was being cleared for a housing development and all the topsoil had been removed. The Conservancy's long-term goal is to restore these fields to native plant communities – grassland, prairie fen, oak savanna. Conservancy ecologists assess past land use and current threats to develop a desired future condition for each field. Restoration may include removal of drainage tiles and other structures to restore hydrology, sowing diverse native seeds, transplanting oak trees, interseeding, planting plugs, and treating invasive plants. Intensive restoration action may be required for several years before a field is resistant to invasive plants and begins to provide quality habitat for native animals. Since 2009, The Nature Conservancy in Michigan has converted over 350 acres (over 40 acres/yr) of agricultural fields to native plant communities. Staff capacity and sources of native seed limit the number of acres that can be restored each year. Between acquisition of land containing a farm field and the initiation of restoration actions, the Conservancy often leases farm land to local farmers to work; this maintains the land as a clean slate, prevents invasive species from dominating sites, and provides a source of income to the Conservancy to invest in restoration and management of natural areas. The Conservancy also works with commercial farmers to adopt and implement conservation practices (cover crops, no till, mulch till, buffer strips, nutrient management) and track and quantify progress towards outcome-based conservation goals such as sediment and nutrient reduction. These practices are targeted in priority watershed areas that offer the highest return on investment.

Lenhart, Chris[1,3]*, Doug Kane[2], and Bradley Gordon[1]. **Tradeoffs between water storage, nutrient removal and plant community diversity in restored wetlands within agricultural watersheds**. [1]University of Minnesota, St. Paul, Minnesota. [2] Defiance College, Defiance, Ohio. [3]Maumee River Basin Center for Ecological Restoration, Defiance, Ohio. Email: lenh0010@umn.edu

Wetlands are often restored for multiple purposes; however, there are often tradeoffs between water storage, nutrient removal and plant diversity benefits. Using examples from several Midwestern wetlands restored in agricultural watersheds, the tradeoffs between water treatment and plant diversity as well as phosphorus vs. nitrogen removal are discussed. Water storage provided by two large restored prairie pothole wetlands in southern Minnesota was substantial; however, they were flashy and had low plant diversity. Nitrate removal was very effective in these basins, exceeding 80%; however, phosphorus was less effectively removed with high levels discharged in the summer. A small treatment wetland was built in 2013 in the same watershed to remove nitrogen and improve phosphorus removal rates via plant harvest. This small, edge-of-field basin used 0.5 acres of land. Although it was limited in water storage, about 68% of nitrate was removed over three years and 100% of inflowing phosphorus in the third year of establishment via plant harvest. In a study of three northwestern Ohio restored and created wetlands, water retention was found to be key to reducing phosphorus load to Lake Erie as there was little concentration reduction in the basins. The wet prairie at St. Michael's had the largest wetland-to-watershed ratio and retained all inflowing water during the relatively dry 2016. The two smaller marsh and pond basins were less effective at retaining water and nutrients. While all three effectively removed nitrate, the Blanchard Site with the smallest wetland-to-watershed ratio and the least plant coverage was least effective. Wetlands will play an increasing role in meeting nutrient load reduction goals in Midwestern agricultural watersheds; however, their design and site location need to be carefully considered in planning for hydrologic benefits and nutrient load

reduction. In addition, tradeoffs between nutrient load reduction and restored plant diversity need to be considered.

Zay, Daniel*. **Ecological restoration opportunities in the agricultural landscape**. Michigan Natural Resources Conservation Service, East Lansing, Michigan. Email: Dan.Zay@mi.usda.gov

The NRCS provides America's farmers and ranchers with financial and technical assistance to voluntarily put conservation practices on the ground. The goal is to not only help the environment but to promote sustainable farming practices. The modern agricultural setting is typified by intensive land management practices which, on the surface, suggest limited opportunities for ecological restoration. Some high quality natural communities require landscape characteristics that are not conducive for agricultural production yet may be in close proximity to productive farming operations. NRCS conservation programs and technical assistance can provide an important function in identifying and protecting high quality natural resources from the potential impacts of farm operations. Conservation planning can identify ecological restoration activities to protect and improve the function of those sensitive areas in concert with more conventional practices to protect soil, water and wildlife. A brief presentation of NRCS programs will be followed with a few short case studies demonstrating situations where site investigations uncovered opportunities for more involved ecological restoration.

# MEETING HOST PLENARY SESSION PRESENTATION ABSTRACTS

## *RESTORATION RESEARCH, TEACHING, AND COMMUNITY OUTREACH AT GRAND VALLEY STATE UNIVERSITY*

Aschenbach, Todd A*. **Assembling the community assemblers: restoration education at GVSU**. Grand Valley State University, Allendale, Michigan. Email: aschenbt@gvsu.edu

The Natural Resources Management Program at Grand Valley State University provides students with the scientific knowledge and practical skills necessary to become critical thinkers, engaged citizens, and creative and competent resource professionals. Our program prepares students for careers in ecological restoration and related fields through coursework, research, and internship experiences. Graduates of our program are employed in variety of local, state, and federal government agencies, non-governmental organizations, and the private sector. This presentation will showcase the diversity of courses and experiences that contribute to student success.

MacDonald, Neil W.*[1], Laurelin M. Martin[2], and Kaitlyn M. Emelander[1]. **Restoration of native-dominated plant communities on a spotted knapweed-infested site**. [1]Grand Valley State University, Allendale, Michigan. [2]Michigan Department of Environmental Quality, Kalamazoo, Michigan. Email: macdonan@gvsu.edu

Restoration of native-dominated plant communities on degraded, invasive species-infested sites requires the use of multiple management practices. We studied the effects of native seed addition, site preparation (mowing alone, clopyralid, glyphosate), hand pulling of spotted knapweed (*Centaurea stoebe* L.), and burning on native plant community restoration on a knapweed-infested site in Michigan. We used a factorial arrangement of treatments in a randomized complete block design, and quantified the development of the treated plant communities over eight years (2009 to 2016). Clopyralid treatment helped control knapweed for six years, but reduced native species richness. Glyphosate treatment provided only short-term knapweed control, but favored the establishment and persistence of seeded native species. Native-dominated plant communities also developed on seeded plots that were mowed only once, achieving similar native species richness and cover as the herbicide treatments. Annual hand pulling effectively controlled knapweed, burning increased relative cover of native graminoids, and the combination of hand pulling and burning increased relative cover of native forbs. The relative cover of non-native grasses, non-native forbs, and knapweed steadily decreased through time in the treated plant communities, while that of native graminoids and forbs steadily increased. After eight years, relative cover of native graminoids and forbs was only 12.7 ± 3.7% on untreated plots, but ranged from 59.1 ± 3.8% on seeded plots that received only site preparation to 89.9 ± 2.4% on seeded plots that received both hand pulling and burning. Burning non-hand-pulled plots tended to reduce the density of knapweed, and did not increase knapweed cover, further demonstrating that burning can be a useful restoration practice for knapweed-infested sites. The treated plant communities also had substantially greater numbers of native species and greater mean Coefficient of Conservatism, Floristic Quality Index, and Shannon's Diversity Index values than adjacent untreated areas, all indicators of a successful restoration trajectory.

Manion, Melanie*. **Utilizing service-based learning projects to accomplish meaningful restoration *work***. Ottawa County Parks, West Olive, Michigan. Email: mmanion@miottawa.org

Resource limitation, human and financial, is a challenge for any land manager. Meanwhile, educators are faced with finding methods to teach students complex concepts in a manner that relates to future employment. Successful service-based learning projects increase an organization's capacity to conduct restoration work by leveraging the prolific human capital within educational institutions, while accomplishing the educational goals of the instructor. This presentation will discuss a wide-spectrum of service-based learning projects from early elementary to more advanced restoration work with Grand Valley State University Natural Resource Management students.

Munson, Steven W.* and Neil W. MacDonald. **Competitive interactions between spotted knapweed and native grasses and forbs in restored plant communities in the Bass River Recreation Area**. Grand Valley State University, Allendale, Michigan. Email: munsons@mail.gvsu.edu

Spotted knapweed (*Centaurea stoebe*) is an invasive forb introduced to North America in the late 1800's and has since spread across a large portion of the United States and Canada. The success of spotted knapweed has been attributed to high seed production and allelopathy. Some research has suggested soil nitrogen may also play a role in spotted knapweed's dominance. Effective methods for controlling spotted knapweed are of importance for restoration of the grassland ecosystems it has infested. Our research was conducted to determine if treatments resulting in higher biomass of native grasses have less available nitrogen in the soil compared to treatments resulting in higher spotted knapweed biomass. This experiment was conducted on previously established experimental plots located at the Bass River Recreation Area, located in Allendale Township, Michigan. These experimental plots were established in July 2008 using a randomized complete block design with a factorial arrangement of treatments for control of spotted knapweed. Plots in each block were initially mowed and treated with clopyralid, glyphosate, or left untreated. Following the initial preparation, a subset of plots was annually hand-pulled of spotted knapweed, burned, both, or neither. To answer our research question, biomass was sampled based on plant groups (native grasses, native forbs, introduced grasses, introduced forbs, and spotted knapweed). During the same time frame, soil samples from each plot were taken and analyzed for available nitrogen. Preliminary analysis of the biomass data indicate the importance of prescribed burning for maintaining native grassland communities and the effectiveness of hand-pulling for reducing spotted knapweed populations. The results also indicate use of herbicides lack long term effectiveness in the control of spotted knapweed, with little difference between any of the initial site preparations. Results of the nitrogen data and its relationship with spotted knapweed are still pending at this time.

Nyamai, Priscilla A.* Todd A. Aschenbach, and Matthew J. Schuman. **Habitat restoration for the Karner Blue Butterfly (*Lycaeides melissa samuelis*): examining plant recruitment patterns and productivity in an Oak Barrens ecosystem**. Grand Valley State University, Allendale, Michigan. Email: nyamaip@gvsu.edu

Oak barrens are fire-dependent savanna-type ecosystems characterized by sparse tree canopies, with a diverse forb and grass understory. These ecosystems, when healthy, provide habitat for the federally endangered Karner blue butterfly (*Lycaeides melissa samuelis*) among other species. The herbaceous native perennial plant, wild lupine (*Lupinus perennis* L.), found in these ecosystems, is the obligate host plant for the Karner blue butterfly, being the only plant that the larvae of this butterfly can feed on. Despite their critical functions, oak barrens ecosystems have declined significantly from their

historic range, with remnants fragmented and existing in isolated patches that are characterized by a greater woody species component and little to no lupine recruitment. This study examines vegetation recruitment patterns, relationships, and productivity in a 0.16 $km^2$ oak barrens ecosystem where prescribed burns were implemented at various times between 2007 and 2011, but where no post-treatment studies have been conducted since the last burn.

Pitman, Zachery* and Todd A. Aschenbach. **Effects of fire season and temperature on spotted knapweed (Centaurea stoebe) infested grasslands**. Grand Valley State University, Allendale, Michigan. Email: pitmanz@mail.gvsu.edu

Grassland ecosystems face imminent threat from a variety of sources, including invasive species. Chief among these invasive species is spotted knapweed (*Centaurea stoebe*), the success of which is due in part to a novel allelopathic weapon. Considering the major threat that spotted knapweed poses to imperiled grassland ecosystems, we devised a study to examine the effectiveness of fire as a control agent of spotted knapweed and the allelopathic chemical [(±)-catechin] it produces. We conducted our experiment in part of a restored prairie ecosystem at Pierce Cedar Creek Institute in Barry County, Michigan between May and August 2016. Our experiment consisted of burning established 1m² plots at high and low temperatures across spring and summer seasons, then planting six native prairie plant species as a bioassay for the presence of (±)-catechin. We found spring burns to be effective at spotted knapweed removal only at high temperatures. Overall, spotted knapweed removal was more effective with summer burns than with spring burns. Planted native species established slightly better in burned plots than unburned plots, suggesting that burning can reduce soil (±)-catechin levels. Our results suggest that prescribed burning may be an effective tool for removing spotted knapweed and may aid native species establishment through (±)-catechin removal. Further research will focus on longer-term monitoring of the site, as well as direct measurements of soil catechin using High Performance Liquid Chromatography.

Roos, Robb[1]* and Todd A. Aschenbach[2]. **Mediation of plant community dynamics using variable seeding densities in a Michigan sand prairie restoration**. [1]Cardno, Madison, Wisconsin. [2]Grand Valley State University, Allendale, Michigan. Email: robb.roos@cardno.com

Sand prairie was once an important component of Michigan's historic oak savanna-pine barrens ecosystem, but has largely has been eliminated in the state. Established in 2009, a research project in the Manistee National Forest examines how different seeding treatments affect certain community dynamics during the initial five years of a sand prairie restoration project. Seeding treatments were varied with respect to seeding concentrations (1,000 seeds/$m^2$ and 10,000 seeds/$m^2$); and the inclusion of grasses and/or forbs with diverse ecological characteristics, such as early flowering, late flowering, and nitrogen fixers (i.e., legumes). In general, results indicate that a high seeding concentration of early flowering species, and those including either low or high seeding concentrations of warm season grasses, have a positive impact on plant community development by increasing native species cover, richness, and diversity while also decreasing non-native species cover, richness, and diversity. High grass seed densities can also suppress other planted and resident native species. The inclusion of early season forbs and warm season grasses into seeding efforts may play a critical role in initial species establishment of a sand prairie restoration due to the facilitative and competitive advantages they may provide in these harsh, arid environments. However, it remains to be seen if these initially successful communities will have continued success over longer periods of time. Results from this study can be used to elucidate ecologically successful and economically efficient seeding approaches in plant community restoration.

# ORAL PRESENTATIONS – ALPHABETICAL ORDER

Allison, Ryan W.*, and Anthony St. Aubin. **Practical applications of wetland planting practices on large scale projects in the Great Lakes region**. Cardno Inc, Walkerton, Indiana. Email: ryan.allison@cardno.com

Contaminated sediment remediation continues to be a topic of significant importance particularly within the Great Lakes region. Significant time, money, and resources have been spent over decades to improve the sediment removal and containment portions of these projects while relatively few resources have been directed towards the habitat restoration component of these projects. Emergent and submerged vegetation re-establishment presents a variety of technical and budgetary challenges that the Cardno team has had to address on three large habitat restoration projects (Grand Calumet River, Buffalo River, Hudson River) related to contaminated sediment removal. The Cardno team will be presenting on lessons learned during these three projects including: specification challenges, budgetary issues, difficulties with installation, and maintenance requirements.

Bowen, Todd J., Brian R. Majka, and Connor C. Wojtowicz*. **Assessment to application: restoration efforts on a multiple-use site in Southern Michigan**. GEI Consultants, Inc., Allendale, Michigan. Email: cwojtowicz@geiconsultants.com

Ecological restoration is a broad practice composed of many interconnected facets. Oftentimes, the planning and strategizing process is overshadowed by subtle constraints such as short-term goals and a feet-on-the-ground approach. While ecological action is the means to an end, it is equally important to discuss long-term objectives and optimize the blueprint on which these goals are based. Pretty Lake Nature Preserve is a 120 acre site owned by the J. A. Woollam Foundation; it is also adjacent to 35 acres that, in conjunction with the preserve, comprise dry-mesic forest, shoreline, lakes, and mesic prairie which are also owned by the foundation and contained within a conservation easement. A coarse site assessment was conducted in 2012 followed by the development of a management plan and the subsequent treatment of invasive species over the next five years. Using an adaptive management procedure, we took lessons learned from the original restoration strategy and modified our approach to operations upon the addition of a bordering 220 acre camp. What followed was a comprehensive site survey accomplished by a team of botanists and the processing of data collected in the field, including a Floristic Quality Assessment performed at all ecological communities present along with an invasive species survey. This lead to a restructuring of previous management methodologies based upon zones prioritized by the quality of native vegetation and the quantity of undesirable species. This holistic perspective on habitat management was then succeeded by an implementation of newly formed objectives by field staff. The ongoing results of varied management techniques coupled with the numerous uses of this particular site tell us an interesting story of ecological restoration and how it relates to the public, best management practices, and what we consider a success.

Barak, Rebecca S.*[1,2]., Evelyn W. Williams[1] and Daniel J. Larkin[3]. **Tallgrass prairie restoration from seeds to communities.** [1]Chicago Botanic Garden, Glencoe, Illinois, [2]Northwestern University, Evanston, Illinois, [3]University of Minnesota, St. Paul, Minnesota. Email: BeckyBarak@u.northwestern.edu

Seeds and seed mixes provide the raw materials for restored plant communities, and are therefore critical for assembling diverse and functional restorations. We studied establishment of species from the seed mixes of 19 restored tallgrass prairies in northeastern Illinois to better understand the

relationship between planted seed mixes and the established plant community. From our field study, we found that richness of planted seed mixes ranged from 29 to 125 species (mean ± 1 S.E. = 63.3 ± 6.8). The proportion of planted species observed at each site (including both transect surveys and directed searches) ranged from 25 to 77% (44.6 ± 3.4%). Consistent with other studies, seed mix diversity was not a significant predictor of overall plant community diversity but was significant when volunteer species were excluded. We are currently studying how measured seed traits (mass, shape and embryo:seed size ratio) can be used to predict whether planted species are likely to germinate and persist at restored sites, and explain discrepancies between restoration seed mixes and restored plant communities. We will present results from this ongoing research. Lastly, we found that species included in restoration seed mixes showed significant phylogenetic signal, indicating that species included in seed mixes are more closely related than expected by chance. This finding demonstrates an opportunity to build restored prairies that are more similar to remnants, while also promoting conservation of species from clades that are underrepresented in restoration seed mixes.

Bassett, Tyler*[1,2], Lars Brudvig[1], Emily Grman[3], and Chad Zirbel[1]**. Determinants of restored prairie plant communities**. [1]Michigan State University, East Lansing, Michigan, [2]W.K. Kellogg Biological Station, Hickory Corners, Michigan, [3]Eastern Michigan University, Ypsilanti, Michigan. Email: basset17@msu.edu

The restoration of tallgrass prairie by seed sowing in former agricultural land has become a common conservation tool to return a diversity of native prairie species to landscapes where prairie species are rare. However, a range of factors may influence establishment, including management decisions, site conditions, and exotic species invasions. Here, we summarize our efforts to understand how these factors affect the plant communities that develop in restored prairies. In 2011 and 2013, we sampled plant community diversity, abundance, and composition in 29 prairie restorations in southwest Michigan. We also collected data on likely drivers of these outcomes – management variables such as seed mix composition and fire history; and environmental variables such as soil properties, land-use history, and surrounding landscape composition. Seed mix composition and richness were the strongest drivers of native plant diversity and composition. Sites sown with more species and a greater density of total forb seed also had higher native richness and better prairie species establishment, leading to a greater diversity of sown species. However, exotic species richness was positively correlated with native richness across sites, and more strongly linked to environmental conditions than management. Importantly, the establishment of invasive species, a subset of exotic species with the greatest potential for negative impacts, was largely facilitated by a recent history of perennial (e.g., hay or pasture) vegetation. While certain management decisions (e.g., diverse seed mixes, prescribed fire) can establish diverse communities dominated by prairie species, controlling exotic species remains a challenging but important aspect of successful prairie restoration.

Bauer, Jonathan T.*[1], Liz Koziol[2], and James D. Bever[3]. **Ecology of floristic quality analysis: testing for correlations between coefficients of conservatism, species traits, and mycorrhizal responsiveness**. [1]Indiana University, Bloomington, Indiana, [2]Kansas Biological Survey, Lawrence, Kansas, [3]University of Kansas, Lawrence, Kansas. Email:jonathantbauer@gmail.com

Coefficients of conservatism (C values) were developed as indicators of a species' sensitivity to anthropogenic disturbance, and these values are used in floristic quality analysis as a means of assessing natural areas and ecological restoration. However, assigning of these values is subjective and improved quantitative validation of C values is needed. To determine whether there are consistent differences in life histories between low and highly conservative plant species, we grew 54 species of

tallgrass prairie plants in a greenhouse, and we measured traits associated with variation in life-history, including relative growth rates, leaf, seed and reproductive traits, and root:shoot ratio. We also grew plants with and without mycorrhizal fungi as a test of these species' reliance on this mutualism. We compared these traits and mycorrhizal responsiveness to C values. We found that six of the nine traits we measured were correlated with C values, and together, these traits predicted up to 50% of the variation in C values. Plants with traits of early-successional species tended to have lower C values than plants with traits associated with a late-successional life history. Additionally, plants with high C values and late-successional traits are more dependent on mutualisms with mycorrhizal fungi. Overall, our results provide a better ecological foundation for C values, indicating that high C value species tend to share traits of late successional plants. Moreover, our results imply that late successional plant species are often targets of conservation.

Behrens, Eric G.* and Timothy L. Dickson. **An experimental survey of edge effects in tallgrass prairie reconstructions adjacent to remnants**. University of Nebraska at Omaha, Omaha, Nebraska. Email: ebehrens@unomaha.edu

Management paradigms that incorporate principles of spatial ecology have been implemented in conservation land as a method of preserving species diversity and ecosystem function. In Nebraska and Kansas during the summer of 2016, we examined the spatial ecology of native and non-native plant species in remnant prairies and prairie reconstructed from row-crop agriculture. We also examined the outer and inner edges of these remnants and reconstructed prairies to determine the differences between the outer edges which were alongside roads, crop fields, and forests and the inner edges alongside the remnant / reconstructed boundary. We used a transect sampling method that spanned distances between inner borders of remnant and restored prairies and distances from the outer edge boundaries with non-tallgrass prairie vegetation. We used a three-way analysis of variance (ANOVA) to analyze the effects of distance from edge, outer versus inner edge, and remnant versus reconstructed prairies. We found that remnant prairies contained significantly more native plant species than restored prairies and significantly fewer non-native species than restored prairies, especially alongside the outer edge. We also found plant compositional changes that suggest non-prairie plant species are entering from the outer edge whereas the restoration and remnant prairies are largely preventing non-prairie species from moving across the inner edge. Overall, these results suggest that completing reconstructions alongside remnants can help buffer remnants from non-prairie plant species invasion, and that remnants can also help buffer reconstructions.

Boleman, Patrick J.* and Rebecca M. Swab. **Tree seedling survival after planting under varying treatments on reclaimed mine land**. The Wilds, Cumberland, Ohio. Email: pboleman@thewilds.org

Reforestation of previously mined lands is essential for improving ecosystem services and restoring forest ecosystems in the Appalachian region of the United States. At *the Wilds*, a wildlife conservation facility in southeast Ohio, forests historically dominated the landscape. Reclamation of the previously strip mined land occurred in the mid to late 1900s. Initial reclamation involved reforestation, however after federal regulations in the 1970s reclamation primarily involved grassland establishment. Reforestation projects in these grassland areas have had limited success due to factors such as soil compaction, low nutrient availability, and competition from invasive grasses. To increase tree seedling survival rate, an experiment was designed to test multiple planting treatments: fertilization, Terra-Sorb® root dip, post-planting herbicide application, and a control. In the spring of 2016, roughly 5,000 tree seedlings were planted representing five native hardwood species. By October of 2016, white oaks (*Quercus alba*) had the highest survival rates for the species planted while tulip poplar

(*Liriodendron tulipifera*) had the lowest. Survival rates also varied by treatment method, with fertilized plots showing the highest survival (94.8%) and herbicide plots having the lowest (88.1%). Chi-squared tests showed a significant relationship between both tree species and treatment method with seedling survival rates. Survival results from treatment methods were unexpected as they run contrary to contemporary tree planting protocol, where sites are typically not fertilized at establishment and are often sprayed with herbicide to reduce vegetative competition. Herbivory was observed to be higher in plots with less vegetative cover, thus reducing seedling survival rates. This suggests herbicide application could have increased mortality through increasing herbivory. Further investigations will survey mortality by herbivory to determine if treatment method affects herbivory and survival. The results from this study will help guide future reforestation projects at *the Wilds* and on other reclaimed mine lands in the Appalachians.

Bowman, Reena P.*, and Mathew E. Dornbush. **The influence of multiple ecosystem stressors on the restoration of upper Midwest forest understory communities**. University of Wisconsin-Green Bay, Green Bay, Wisconsin. Email: bowmrp01@uwgb.edu

The composition of North American forest understories has changed significantly in recent years due to increasing herbivore pressures, invasion by non-native species, and altered habitat conditions. However, the relative importance of these multiple stressors remains unclear, and few studies have examined how these interacting factors affect efforts to restore native understory plants. Focusing on species establishment, we investigated the interactive contributions of herbivory from white-tailed deer (*Odocoileus virginianus*) and exotic slugs (*Deroceras reticulatum* and *Arion circumscriptus*), and competition from the exotic herb (*Alliaria petiolata*) on the abundance and richness of seventeen native understory species restored from seed. Our study was conducted at nine field sites spanning from northeastern to southeastern Wisconsin where we factorially manipulated the abundance of *A. petiolata*, and altered access of exotic slugs and white-tailed deer. We hypothesized that slug access and the presence of *A. petiolota* would most reduce the abundance and richness of restored seedlings. These hypotheses were tested using a linear mixed effect model. In partial support of our hypothesis, we found that exotic slug presence had the largest and most detectable effect on restored species abundance and richness, while *O. virginianus* access had no detectible effect. Surprisingly, *A. petiolata* removal did not significantly restore restoration success when analyzed using all sites. However, *A. petiolata* removal was marginally significant when we restricted our analysis to sites with relatively higher *A. petiolata* cover. Our results provide strong support that exotic slugs are significantly reducing native plant regeneration in deciduous forests across eastern Wisconsin by consuming emerging or very young seedlings, highlighting the need for restoration strategies that address limitations during various plant demographic stages.

Brown, Kelly H.[1]* and Amber J. Rollings[2]*. Hidden assets: **Addressing Indianapolis' poorly perceived waterway landscape**. [1]Reconnecting to Our Waterways, Indianapolis, Indiana. [2]Indiana University Purdue University Indianapolis, Indianapolis, Indiana. Email: kelly@current-consulting.com and arolling@umail.iu.edu

Indianapolis contains a landscape that includes abundant waterways. Unfortunately, these natural assets have become contaminated from urban stressors, such as combine sewer overflows, and were considered abandoned assets that were negatively perceived within the Indianapolis community. In order to address the poor perceptions and raise environmental and waterway awareness, Indianapolis' neighborhoods, private and public organizations, and civic leaders came together to form the Reconnecting to Our Waterways (ROW) collective impact initiative. A mode of engagement, ROW is

investigating and installing temporary and permanent environmental artwork along the waterways. These art installations' objectives are to help recreate a connection to the waterway landscape and inform on the challenges the waterways face from mistreatment by individuals. Extant literature has shown that an individual's place attachment to local resources can also affect other important personal realms, such as environmental behavior. As a means to assess the ability of environmental artwork to achieve the aims of reconnecting and creating awareness around waterways, surveys were developed and administered to the community members at events where the environmental artwork was on display within close proximity to a waterway. The pilot data from two community events show emerging themes of a particular piece of artwork producing waterway attachment, environmental awareness, and potential perception and behavioral change both towards the waterways and environment as a whole. This research is important as it analyzes the usage of art to promote community awareness and education on waterway issues with the goal of fostering stewardship of Indianapolis' waterways.

Catchpole, Floyd B.*. **Analyzing original public land survey data to better determine natural community changes**. Forest Preserve District of Will County, Joliet, Illinois. Email: fcatchpole@fpdwc.org.

The Forest Preserve has entered all of the Original Public Land Survey Data into an ArcMap format and extensively analyzed the data to determine the original landscape condition. Will County contains three natural sections consisting of the Northeastern Morainal section, Grand Prairie section, and the Kankakee Sands section. By combining countywide, section and preserve focused analysis; we have been able to better determine original conditions to guide landscape restoration activities. We will discuss what worked well, and our findings.

Cortes, Forrest[1]*, and Karen Tharp[2]*. **Restoring nature, building community**. [1]The Nature Conservancy and the Chicago Park District, Chicago, Illinois. [2]The Nature Conservancy, Chicago, Illinois. Email: forrest.cortes@tnc.org and ktharp@tnc.org.

Today, more than 80 percent of the U.S. population lives in cities, and this number is projected to continue rising in coming decades. Many cities hold important habitat for native plants and wildlife, but these areas need care and management by people to thrive in the urban fabric. Preserving and restoring health back to natural areas within cities is critical for pollinators, migratory birds and other urban wildlife and can provide an opportunity for city residents to connect more deeply to these spaces and each other through the act of stewardship and citizen science. Connecting and empowering local residents is essential to promote a healthy lifestyle and provide the opportunity for residents to become more informed and engaged decision makers. At The Nature Conservancy, we are working with various partners across the county to change the relationship between cities and nature. In Chicago, the third most populous city, we already have a strong history and connection with nature. Situated on the doorstep of Lake Michigan, Chicago connects the Great Lakes to another essential freshwater resource: the Mississippi River, and is also a critical stop for thousands of migratory birds moving along the Mississippi flyway. Spanning from the lakefront to the outermost city limits, we have access to a range of parks, lakefront views, and open spaces thanks to the 1909 Plan of Chicago, a vision for Chicago's parks, roads, and civic buildings led by architect Daniel Burnham. Through a partnership with the Chicago Park District, we are increasing volunteer opportunities across the city, building support for conservation, and connecting communities to the nature in their neighborhoods. Volunteers assist with restoration, conservation, and monitoring activities, including planting native plants, building trails,

removing of invasive species, and monitoring birds, plants and other wildlife in the Chicago Park District's 60-plus natural areas.

Davies, G. Matt*[1] and P. Charles Goebel[2]. **Novel disturbances for novel ecosystems: restoring conifer plantations to provide multiple ecosystem service**s. [1]The Ohio State University, Columbus, Ohio. [2]The Ohio State University, Wooster, Ohio. Email: davies.411@osu.edu

Conifer plantations are primarily designed to provide important provisioning services (e.g., timber supply for pulp, construction and biomass energy) but their supply of other ecosystem services can be more limited. Their biodiversity is depauperate, they can alter soil carbon dynamics and wildfire hazard and they are associated with water quality issues such as acidification. There has been growing discussion about how plantation management can become more sustainable by developing "old-growth" conditions with greater structural complexity and biodiversity and shifting from clearcutting to retention or continuous-cover forestry. Such approaches may also provide a stepping-stone to restoration of native forest ecosystems. Management to emulate the outcomes of natural disturbances might be beneficial, but differences in disturbance regimes between tree species' native and introduced range could pose difficulties in identifying targets for restoration. We argue that ideas associated with two key concepts in restoration: i) novel ecosystems, and ii) ecological forestry, can be combined to offer insight into how plantation management can balance production with other services. Plantation ecosystems can be viewed as blending structural and ecological properties from tree species' home range, pre-plantation native vegetation and potential "climax" forest conditions. "Natural" disturbances associated with plantation ecosystems will be driven by novel interactions between species traits, stand structures, edaphic characteristics and human land-use. We should not expect desirable forest structures in our novel system to reflect those of individual natural systems, rather we should focus on maximizing potential structural complexity. Ecological forestry suggests a range of tools, including novel disturbances, can be used to maintain structural complexity at the stand and landscape scale but also that management intensity can vary spatially depending on landscape setting and the balance between different desired ecosystem services. We explore how such ideas could be implemented in contrasting conifer plantation ecosystems in Ohio and Scotland.

DeLisle, John* and Seth McRobb. **Private site-scale ecological design- lessons learned.** Natural Community Services, West Bloomfield, Michigan. Email: j_delisle@hotmail.com

Understanding the environmental and ecological functions and site conditional variables encountered in residential green infrastructure enables selection of the right native plants for local habitats, but designers must also communicate functionality and appearance to private homeowners. We try to determine which native plant assemblages can tolerate urban stressors, facilitate cues-to-care/public acceptance, and be maintained, given a particular client's involvement-level. Though private clients who seek ecological landscape designs are typically environmentally-motivated, other critical conceptual planning considerations must be assessed. Education about urban wildlife and optimizing design specifications (plant selections layouts, and management regimes) which cover both ecological and aesthetic client interests make or break your client's perception and interest in future use of native plants on referred projects. Homeowners often have little idea how to maintain native plantings, so maintenance plan composition, and developing ongoing relationships is mutually beneficial. In this presentation, I relate case examples of our experiences in working with southeast Michigan residents to achieve beauty, biodiversity, and water quality goals using sound ecological principles, tailored native plant selection, and colorful, self-sustaining, goal-targeted landscape designs in places where nature is degraded, or absent, and often misunderstood.

Duke, Shawn T.[1*], and Rebecca A. Norris[2]. **Implementation of successful restoration practices in *Phragmites* invaded wetlands**. [1]Cardno Inc., Novi, Michigan. [2]Cardno Inc., West Olive, Michigan. Email: shawn.duke@cardno.com

Invasive *Phragmites* poses a threat to the structure and function of both coastal and inland wetlands throughout the Great Lakes region. When populations are targeted for removal, it is often the case that a property boundary or geographic feature becomes an end point for ecological restoration. Furthermore, restoration commonly ends after a short period of treatment with no subsequent management or monitoring. The ability of *Phragmites* to aggressively establish new colonies through both vegetative reproduction and seed dispersal can result in rapid re-invasion from nearby areas. A review of *Phragmites* control project results, including data collected within a variety of ecosystems, was performed to establish guidelines for successful wetland restoration. These recommendations are intended to provide practical solutions to achieve long term stability in the establishment of native vegetation and wetland ecological function. The discussion will include treatment timing, post-treatment planting, clearing and restoration across property boundaries.

Evans, Nicole M.*, William P. Stewart, and Craig A. Miller. **The meaning of naturalness in the context of urban ecological restoration: a case study from the Cook County Forest Preserves**. University of Illinois, Urbana-Champaign, Illinois. Email: nevans3@illinois.edu

Many have suggested that, as opposed to a strict preservation model, ecological restoration dissolves the nature-culture dichotomy by allowing people to participate in healthy ecosystems. Important questions arise; What is the meaning and place of naturalness in a practice that often includes elements of design? Furthermore, is the human-free meaning of naturalness still salient? Using evidence from interviews and participant observation among staff and volunteers in the Cook County Forest Preserves, this research shows that the idea of pure, human-free naturalness can accomplish important work in ecological restoration projects. This paper details six specific areas where naturalness was salient, and demonstrates how naturalness functioned as an ethical guide for behavior and management decisions. We show how staff and volunteers combined the meanings on different scales, along with the assumed *ought* of naturalness, to produce imperatives for behavior and management decisions. We also show how practitioners made sense of human involvement in naturalness. This research suggests that meanings for naturalness may be quite different across stakeholders. If managers wish to assemble restoration communities, deliberative platforms should be created that allow the multiple meanings for naturalness held by stakeholders to be made explicit and organizationally relevant meanings to be collaboratively constructed.

Gibson, Dan R.*, Logan Rowe, Rufus Isaacs, and Douglas A. Landis**. Integrating agriculture and ecological restoration: native wildflowers can support natural pest suppression**. Michigan State University, East Lansing, Michigan. Email: gibso124@msu.edu

Agricultural intensification results in the loss of natural habitats in agricultural landscapes. These simplified landscapes lack plant and associated insect biodiversity, leading to reduced insect pest suppression within the crop by wild predators and parasitoids (natural enemies). Habitat management seeks to support natural enemy populations and facilitate their movement across the landscape by strategically re-establishing resources and habitat. Native perennial wildflower plantings can supply essential floral resources and habitat to natural enemies. Because plants differ greatly in the quantity, quality, and availability of nectar and pollen, potential insectary plants should be screened to determine which beneficial and pest insects they attract. This helps to optimize the habitat value to natural

enemies, facilitating economic benefit to the grower via an increase in yield or a reduced frequency of pesticide application. This study examined 54 Michigan native and 2 non-native perennial plant species. Plants were established as seedlings in single-species plots in a randomized complete block design experiment. We sampled the arthropod community associated with the flowers of each species during the summers of 2015 and 2016 by vacuum sampling. Plants differed in total attractiveness to natural enemies and to herbivores, and the community composition also differed by plant species and time. We recommend the most attractive species as seed mix guide for natural enemy habitat plantings. Additional research is needed to refine how mixtures of the most attractive plants can be optimally deployed to enhance biocontrol within specific agroecosystems. Although habitat management for natural enemies is not yet common practice, education and implementation is complementary to pollinator habitat initiatives and could be incorporated into existing state and federal farmland conservation programs.

Glover, Rachael*[1]; G. Matt Davies[1], and Rebecca Swab[2]. **Restoration and management of prairie on a reclaimed strip mine in southeastern Ohio**. [1] The Ohio State University, Columbus, Ohio. [2] The Wilds, Cumberland, Ohio. Email: glover.194@osu.edu

The Wilds, a conservation facility in southeastern Ohio, represents a unique research opportunity as it sits on nearly 10,000 acres of reclaimed strip mine land. Restoration is difficult as the fields left behind by strip mining are in a state of "arrested succession". Prairie offers a great option for restoration of highly degraded ecosystems where reestablishing pre-mining habitats is difficult. The goal of our research was to evaluate a prairie restoration site at the Wilds that was left unmanaged for 8 years following its implementation. Originally, the site was created to evaluate biomass production in 500 prairie plots (10 x 20 m) planted following differing preparation treatments and with five different seed mixes. Following herbicide application and tillage across the whole site, plot preparations consisted of combinations of fertilizer and subsoiling. A variety of seeding treatments were applied including both monocultural and multiple species mixes. Initial surveys found that even after almost a decade, this abandoned prairie maintained some native prairie species but had experienced high-levels of re-invasion by non-native species. Encroachment of non-native woody species such as *Lonicera* spp. and *Elaeagnus umbellata* will create further challenges for future management. Preliminary analysis suggests strong differences in establishment success associated with variation in initial seed mix and fertilizer application. We will use the previous design and the plots' current composition to test how variation in disturbance regimes interacts with the traits of existing and introduced species. Specifically, we will begin restoration of the site with varying fire frequencies and supplemental seeding treatments using species with divergent or convergent traits relative to problematic invasives. Abandoned mineland is essentially a blank slate for testing the restoration potential of disturbed ecosystems. Using studies like this will allow land managers to develop the most successful methods for creating and maintaining ecosystem function in these landscapes.

Hallberg, Karen I.* **Interagency collaboration to establish site selection and restoration criteria and appropriate land management strategies for Indiana bat (*Myotis sodalis*) conservation in Ohio**. U.S. Fish and Wildlife Service, Columbus, Ohio. Email: karen_hallberg@fws.gov

The federally endangered Indiana bat (*Myotis sodalis*) drives the majority of federal agency consultations with the U.S. Fish and Wildlife Service (USFWS) under section 7(a)(2) of the Endangered Species Act in Ohio. With highway infrastructure improvements among the most common project consultations conducted with the USFWS Ohio Ecological Services Field Office, biologists from USFWS and the Ohio Department of Transportation (ODOT) agreed upon a

framework programmatic consultation in February 2016. The goals of this programmatic consultation were to streamline ODOT's project-by-project consultation process and to incorporate advance conservation measures into projects that are likely to adversely affect the species and its habitat. ODOT projects primarily affect the bats' summer, forested habitat, and the availability of that habitat is strongly correlated with land use in the glaciated versus unglaciated areas of the state. Therefore, the agencies agreed that ODOT would establish bat conservation areas (BCAs) in both the habitat limited, glaciated area and the more heavily forested, unglaciated area to serve as advance mitigation for project impacts that occur in each landscape. Specific site selection and restoration criteria were developed and agreed upon by the interagency team during the programmatic consultation to provide ODOT with the flexibility to identify sites and contract restoration work without further negotiation with USFWS. An approximately 2,500-acre site in southeast Ohio was purchased by ODOT to serve as the unglaciated unit's BCA and is being transferred to the Ohio Department of Natural Resources Division of Wildlife (ODOW) for long-term management and protection. The ODOW and USFWS recently finalized a stewardship plan for the site that allows the ODOW to maintain the property as a State Wildlife Area but defines specific management practices that will preserve and improve bat roosting and brood rearing habitat in perpetuity.

Hausman, Constance E. * **Early detection and rapid response: A new forest pathogen affecting beech trees**. Cleveland Metroparks, Cleveland, Ohio. Email: ceh@clevelandmetroparks.com

Early detection of invasive exotic pests or pathogen is critical for effective management. Proactive measures can often minimize the environmental impact or future restoration needs. An unidentified disease affecting beech trees was first observed in Lake County Ohio in 2012 and is spreading throughout northeast Ohio, Pennsylvania and beyond. While the causal agent has yet to be identified, it is generically referred to as Beech Leaf Disease (BLD) based on early symptoms that first appear on the leaves. Very early symptoms include few dark striped bands between lateral veins of normal sized leaves distributed sporadically throughout the lower portion of the canopy, then progress creating greater banding pattern on leaf surface throughout the canopy. Within the last 4 years there has been rapid expansion of symptomatic trees and declining stands. Tree mortality has been identified in young regenerating trees <5cm dbh. Beech-maple forests are a dominate system throughout the entire Eastern deciduous forests and the spread of this diseases poses a significant impact. Various Lake Erie Allegheny Partners (LEAP) have been tracking the disease and are expanding efforts to 1)determine range extent of symptomatic trees through surveys 2) conduct beech tree condition and stand monitoring plots and 3) track seasonal symptom progression through image analysis. While data on severity and expansion of BLD has been collected, cohesive regional efforts are needed to accurately document this phenomenon. Hear the latest developments on pathogen testing and how you can get involved.

Hunter, Tonya* and Alice Bailey. **Protecting your investment: maintaining your restoration projects**. Environmental Consulting & Technology, Inc., Lansing, Michigan. Email: thunter@ectinc.com

A project can be a success from conception to implementation, but without proper maintenance it can result in failure. This presentation will identify and discuss the foundation on which to build an implementable maintenance plan to assure long-term success of a project. The following are highlights that will be covered in this presentation: Planning - In the early stages of a project, it is important to first understand the client's/stakeholders' expectations and project goals for what they define as long-term success. Education and Engagement - It is important to engage the community and partners early

to help them understand why restoration makes sense for our evolving world, and on-going educational outreach opportunities are perfect for this and good relationship building! Many project partners may see implementation as the final step, so it is our responsibility to open their eyes to the forgotten phase of post-construction. Budgeting - All facilities require maintenance. Yet all too often, a budget and detailed maintenance plan to prepare for this stage of a project is not a priority. Restoration projects are no exception and typically require special management considerations in their first few years to ensure long-term success. Maintenance Plan - Maintenance for restoration projects looks very different when compared to other capital improvement projects. Providing owners with specifics on how to implement maintenance plans is critical. Project examples will be shared stressing lessons learned, with specific project examples comparing implementations where maintenance was and wasn't conducted. Other project examples will provide tips on ways to fund maintenance by professionals and ways to engage and educate local groups to be involved in maintenance. All of these considerations will be brought to life through real-world project examples to help the audience think a little differently when considering ecological restoration project planning in the future.

Lincoln, Jesse M.* **The sweet spot: ecosystem restoration and the protection of rare species in a landscape managed for game species**. Michigan Natural Features Inventory, Lansing, Michigan. Email: lincolnj@michigan.gov

Michigan's State Game Areas are home to a variety of important natural communities that support a range of plants and animals. Because managers are tasked with focusing primarily on game species, some of these important natural areas do not receive the attention necessary to maximize biodiversity and protect rare species. Therefore, we developed a restoration project that would identify and protect high-quality natural communities that are both important habitat for game and featured species as well as rare plants and animals. The project was designed to get maximum engagement from partner groups and the community in order to raise the profile of the game area in general but also draw attention to the areas that we were stewarding in order to increase public awareness of stewardship actions. Three sites were selected, each a representative of a natural community: oak-pine barrens, coastal plain marsh, and wet-mesic sand prairie. These imperiled habitat types that are fire-adapted communities that support game species as well as populations of rare animals and plants. Because fire has not recently been a management tool available for these specific sites, woody species were removed and treated with herbicide to let characteristic herbaceous vegetation rebound. Ecological impacts were assessed through photo comparison but the public engagement was quite dramatic. This project served as a proof of concept and based on the results, it seems like a worthy approach to try over a larger area and at multiple game areas. The next steps are to include a monitoring component to determine how actions impact game species and rare taxa that occupy the systems of interest.

Grieser, Jennifer M.* **Activating watershed stewardship for community results**. Cleveland Metroparks, Cleveland, Ohio. Email: jmg2@clevelandmetroparks.com

The primary objective of the Watershed Volunteer Program (WVP), initiated in 2012, at Cleveland Metroparks is to prepare citizens to play an active role in local watershed health and facilitate citizen science opportunities throughout Northeast Ohio. This unique program offers a breadth of experiences, including learning modules, restoration events and monitoring activities, which culminate in watershed stewardship certification. Topics cover a breadth of subjects from model codes and co-benefits of green infrastructure to native and invasive plants and rainwater harvesting. In an effort to foster community engagement, WVP has initiated three citizen science projects: macroinvertebrate monitoring of an ODNR Scenic Rivers site on the Chagrin River, annual streambank erosion

assessments, and cross-section monitoring. As a result of their participation, volunteers develop new technical skills for the workplace, collect valuable data that assists in local planning decisions, and personally connect with their local water resources. After five years of offering this program, the Park District has gained valuable insight into how to effectively recruit, retain and enlist volunteers in the critical work of protecting and restoring our water resources.

Grieser, Jennifer M.* **Benefits of dedicating a center to watershed stewardship**. Cleveland Metroparks, Cleveland, Ohio. Email: jmg2@clevelandmetroparks.com

On Summer Solstice, 2014, Cleveland Metroparks opened the Watershed Stewardship Center at West Creek Reservation in partnership with the Northeast Ohio Regional Sewer District (NEORSD) and West Creek Conservancy (WCC). With a mission to restore urban watersheds, this new public facility annually receives over 25,000 visitors that include middle and high school students, special interest groups, university classes and diverse professionals. To achieve its mission the Center not only hosts watershed-specific programming such as World Water Day, but also sponsors stormwater and green infrastructure research projects as well as an active Watershed Volunteer Program. The Center is also home to the Park District's Natural Resources Division, placing an array of experts as the public's fingertips. The steering committee, led by the Center's partners, guides initiatives, monitors achievement of goals and identifies new opportunities for collaboration. This successful partnership has expanded its outcomes to include offsite results, including support for acquisition of adjacent properties, removal of impervious surfaces. Hosting visitors from around the country and abroad, the Center and its activities have become a model and resource for watershed restoration practitioners.

Grieser, Kevin A.*, Suzanne Hoehne, and Tom Denbow. **A failing dam owner's dilemma: a unique approach to transitioning a pond to a stream**. Biohabitats, Cleveland, Ohio. Email: kgrieser@biohabitats.com

Small to medium-sized privately owned dams are a common occurrence throughout our country and many are poorly maintained and failing. In 2015, landowners of a 75-year old manmade lake in Painesville, OH, in consultation with Ohio DNR and the Chagrin River Watershed Partners, realized that the dam and outlet were failing and decided to drain the pond behind the dam and join with Lake County to restore the natural stream flow. The County received an EPA 319 grant for the design and construction of the restoration project. Biohabitats was hired by Lake County to perform the design/build project and proposed an adaptive management approach due to the low budget, unconsolidated condition of the lake bed, invasive species and leaching of sulfides out of the exposed lake bed. This presentation will focus on the unique approach to restore the system to a stream/wetland complex on the existing lake bed while tying into the new culvert six feet below the accumulated sediment elevation as opposed to removing and dewatering tens of thousands of cubic yards of unconsolidated silt.

Kelleher, Eric*, Julie Kelleher and Young D. Choi. **Arthropod diversity and trophic levels between restored prairie, canary reed grass stand and old-field at Taltree Arboretum**. Purdue University Northwest, Hammond, IN. Email: ekellehe@pnw.edu

We investigated the effects of prairie restoration with native plants on arthropod communities. In doing so, we collected and compared arthropods, using baited pit-fall traps, sweep net sampling and pan traps, from a restored prairie, an old field (abandoned agricultural fallow), and a monospecific

stand of reed canary grass (*Phalaris arundinacea*)in Taltree Arboretum, Valparaiso, Indiana. There was no significant taxa diversity (H' = 2.72, 2.73 and 2.86 for restored prairie, old field and reed canary, respectively) among the three sites. However, our NMS (nonmetric multidimensional scaling) ordination revealed a divergence of arthropod communities. Mean herbivore abundance was significantly higher in restored prairie sites (321 ± 41 individuals) than the reed canary grass stand (142 ± 22) and old field (87 ± 5). Meanwhile, predator abundance was higher in the reed canary stand (635 ± 121) than the prairie (378 ± 28), and the old field (353 ± 38). Alydidae (broad-headed bugs), Chrysomelidae (leaf beetles), Membracidae (treehoppers) were the major herbivores that characterized the restored prairie site, while Cantharidae (soldier beetles), Lycosidae (wolf spiders), and Staphylinidae (rove beetles) were the predators that represented the monospecific reed canary stand. The old field community was best described by predatory carnivore Lampyridae (fireflies) and saprivorous herbivore Miridae (capsid bugs).

Kingsbury, Jo*, G. Matt Davies, Ross Macleod, and Christopher M. Tonra. **Tropical grassland restoration for biodiversity in Beni, Bolivia**. The Ohio State University, Columbus, Ohio. Email: kingsbury.20@buckeyemail.osu.edu

Across the cerrado-grassland transition zone, the combined effects of fire, flooding and grazing disturbances drive woody vegetation dynamics and influence habitat structure. In turn, habitat structure influences bird communities found across these ecotones. We examined how the distribution and habitat use of avian cerrado-grassland specialists is influenced by habitat structure and disturbance. Research was completed in the Beni department of Bolivia in an area previously heavily impacted by livestock grazing and managed burning. Our site is now a protected area that includes gallery forest, cerrado and seasonally-flooded savannah habitats. We focused on three key conservation species: the cock-tailed tyrant, *Alectrurus tricolor*; black-masked finch, *Coryphaspiza melanotis* and wedge-tailed grass-finch, *Emberizoides herbicola*. We found that cock-tailed tyrants specialized on open grassland with very tall grasses and infrequent woody vegetation. In addition, they were associated with habitat features indicative of flooding, specifically tall worm mounds. Black-masked finch and wedge-tailed grass-finch were more generalistic in habitat use but were also associated with tall grass in addition to seeding and fruiting vegetation. Initial results indicate the two declining species are more sensitive to grazing and fire disturbance than the more common wedge-tailed grass-finch. Prescribed burning is likely integral for the conservation of avian communities but scale and frequency are likely to be important considerations. A range of post-burn stages may be required to retain wider avian communities within protected areas where biodiversity conservation is a principal management goal. In developing a deeper understanding of how bird communities are shaped by habitat structure, and how we can better manage disturbances to restore essential habitat for wildlife, we will be able to strengthen restoration protocols for protected areas in this region. Our results will also help towards the development of more sustainable approaches to agriculture here, in light of increasing pressure on wildlife from intensive cattle ranching.

Koziol, Liz[1,2]*, Jonathan T. Bauer[1], Karen Hickman[3], Jacob Hopkins, Geoffrey House[1], Peggy Schultz[2], Gail Wilson[3], Katherine Zaiger[3,4] , and James D. Bever.[2] **Whole prairie soils and prairie mycorrhizae have similar positive effects on the growth and survival of transplanted prairie seedlings across five Midwest restorations**. [1]Indiana University, Bloomington, Indiana. [2]University of Kansas, Lawrence, Kansas. [3]Oklahoma State University, Stillwater, Oklahoma. [4]EcoLogic, Bloomington, Indiana. email: lizkoziol@ku.edu

The plant microbiome, including endophytes, mycorrhizal fungi, beneficial soil bacteria, and other biota can influence plant health and plant community dynamics. As a result, there have been frequent calls to include microbial communities within ecological restoration efforts. Whole soil communities collected from remnant prairies have been found to promote restored prairie plant growth and survival. However, whole soil inoculations present an additional dilemma; in order for whole soils to be included in restorations, they must be harvested from intact reference ecosystems, which are often scarce and small. Thus, we have begun to identify key soil microbes to include in a restoration. Within tallgrass prairies, mycorrhizal fungi are important microbes, as most plant species are responsive to arbuscular mycorrhizal (AM) fungi. For this study, we compare the growth and survival of transplanted prairie plant seedlings to inoculation with locally collected whole rhizosphere soils versus AM fungal communities isolated from these soils. We collected whole rhizosphere soil from remnant old growth grassland communities in Illinois, Kansas and Oklahoma. From these same locations, we also cultured diverse AM fungal communities. In five separate restorations projects in Illinois (1), Kansas (2) and Oklahoma (2), we inoculated mid- and late-successional plant seedlings with either whole rhizosphere soil or AM fungal inocula. Here, we present data from the first three years of restoration where we found that whole soil biota and AM fungi inoculations consistently improved plant survival and growth across our five restoration locations. We found evidence that AM fungi are a keystone guild in the plant rhizosphere, as AM fungi and whole soil inoculations were indistinguishable in their ability to improve plant growth and survival. We suggest that reference ecosystem AM fungi can be used as an alternative to whole soil biota inoculations in disturbed soils that may require rhizosphere amendment.

May, Christopher A.[1]*, Feng Mingmin[2], and Zhou Yaxing[3]. **Designing a restoration and management plan for Xicaohai Wetland, Yunnan Province, China**. [1]The Nature Conservancy, Lansing, Michigan. [2]The Nature Conservancy, Beijing, China. [3]The Nature Conservancy, Heqing, China. Email: cmay@tnc.org

Xicaohai Wetland in Yunnan Province, China is an inland freshwater, shallow lake in an intermountain plateau of moderate-high elevation. The wetland and surrounding landscape have a rich cultural history. Xicaohai provides migratory stopover and wintering habitat for over 10,000 water birds annually. While located in rural China, the 100-ha wetland supports several local communities with a total population exceeding 45,000; competition for water resources is intense. Human uses of Xicaohai include drinking water, agriculture, local handcrafts, and recreation. During 2016 The Nature Conservancy, local communities, and government officials developed a restoration and management plan for Xicaohai in an effort to balance human and natural uses. The plan includes cooperative management of water levels, ecological restoration of degraded areas, data collection and monitoring to document baseline conditions and for future adaptive management, controlling pollution, zoning for recreational and other uses, and developing an environmental stewardship program for local communities.

Nelson, Scott B.[1]*, and John C. Marlin[2]. **Restoring native vegetation in city landscapes to increase urban biodiversity and connect residents with local nature**. [1]Red Bison Ecological Restoration, Champaign, Illinois. [2]University of Illinois at Urbana-Champaign, Champaign, Illinois. Email: snelson9@illinois.edu

Human population growth in the late 20th Century led to dramatic expansions of agricultural and urban areas, precipitating steep declines in biodiversity, ecological functioning, and ecosystem services. These changes are perhaps most visible within city limits, where frequent disturbances eliminate and

fragment native habitats, and remaining native habitats are subsequently invaded or intentionally replaced with non-native species—primarily turf grasses and ornamental plants of limited ecological value for native wildlife. Simultaneously, urban residents are increasingly disconnected from nature. These challenges drive the central mission of Red Bison, a student organization at the University of Illinois at Urbana-Champaign and a student program of the University YMCA, dedicated to ecological restoration. To combat biodiversity loss and disaffiliation from nature, we restore native plant communities in Urbana and Champaign—particularly near the campus, to bring Central Illinois' ecological heritage to the university community. I will discuss our organization's many restoration projects, including a network of small patches of prairie and woodland plants spread across the university campus, a 2.3-acre tallgrass prairie restored from an urban lawn, an abandoned 22-acre research woodland that had been thoroughly infested with honeysuckle, and a nascent collaboration with the Champaign County Forest Preserve to restore plant communities along a local bike trail that will eventually connect Urbana to Danville, IL. In particular, I will focus on the challenges and rewards of running a multi-faceted restoration operation on volunteer time on university-owned land, and discuss the potential for applying our approaches to ecological restoration into routine urban landscaping.

Olson, Eric [1*] and Patrick Goggin [2*]. **Wisconsin's new Healthy Lakes Initiative: technical assistance and funding for lakeshore best practices**. [1]University of Wisconsin-Stevens Point , Stevens Point, Wisconsin. [2]University of Wisconsin-Stevens Point, Rhinelander, Wisconsin. EO Email: eolson@uwsp.edu; PG Email: pgoggin@uwsp.edu

The Wisconsin Lakes Partnership recently implemented a new statewide initiative providing technical assistance and funding for simple and relatively inexpensive shoreland habitat and runoff and erosion control best practices. "Healthy Lakes" is the outcome of a lean government project to streamline the administrative process for grant funding while simultaneously simplifying technical information for lakeshore property owners and lake groups, municipalities, and other partner organizations. Launched in late 2014, Healthy Lakes has already received positive feedback and widespread geographic interest. Public participation and lessons learned from social marketing studies shaped Healthy Lakes and will continue to be the keys to its success. Next steps include refining a user-friendly, autonomous website, program and best practice evaluation, and integrating the initiative into long-term administrative code. Our presentation will share an overview of Healthy Lakes, including the five best practices being promoted.

Overbeck, Will*, Kurt Dreisilker, Megan Dunning, Annalisa Burke, and Carissa Dougherty. **Online learning for volunteer stewards: strengthening resources for ecological restoration**. The Morton Arboretum, Lisle, Illinois. Email: woverbeck@mortonarb.org

Learn how to increase volunteer capacity within your organization by exploring the Woodland Stewardship Program. The Morton Arboretum is developing a new blended learning format to support educational needs of volunteer stewards conducting restoration. The multimedia initiative combines online modules, field experiences and traditional classes which may be useful to your organization. This teaching style allows audiences to access interactive course materials from home computers, which builds capacity for community engagement. Content specialists working with multimedia presentations are developing a comprehensive curriculum, increasing regional resources for ecological restoration education. Author collaborations and audience feedback are proving invaluable to inform this development process. Involving expert instructors and regional stakeholders in the conversation

can focus digital content development to closely complement in-person sessions which enables greater student comprehension and benefits ecological restoration near you.

Palus, James D.*, Erin E. Andrew, P. Charles Goebel, David M. Hix, and Stephen N. Matthews.
**Factors driving forest succession in oak–hickory forests of the Wayne National Forest, southeastern Ohio**. The Ohio State University, Columbus, Ohio. Email: palus.5@osu.edu

Oak–hickory (*Quercus–Carya*) forests of the unglaciated Allegheny Plateau of southeastern Ohio are undergoing a transition to forests dominated by mesophytic species (e.g., *Acer rubrum*). This transition has been attributed, in part, to the suppression of wildland fires following Euro-American settlement. Changes brought about in this transition (including mesophication) result in shifts to both biotic and abiotic ecosystem components that can influence forest developmental processes. While this pattern has been documented, little is known about how landscape factors influence mesophication and forest succession, and we hypothesize that some ecosystem types are more resistant to mesophication than others. To understand this variability, we examined forest succession on permanent plots in the Wayne National Forest (WNF) of southeastern Ohio over a period of 20 years. NMDS ordination analyses comparing the overstory community composition between the early 1990s and 2016 suggest that drivers of forest change over 20 years differ with landscape position. The first axis represents a moisture gradient, demonstrated by the polarization of xeric (e.g., *Quercus prinus*) and mesic species (e.g., *Tilia americana*). While white oak (*Q. alba*) remains a dominant species in the overstory, red maple and American beech (*Fagus grandifolia*) have become more established in the understory, and oak regeneration is restricted to xeric sites. Forest community composition is influenced by landscape position, but other factors—such as those controlling soil water holding capacity—are also very important. Such factors may also exert control over the ability of mesophytic species to compete with other vegetation. These forests are increasingly susceptible to novel disturbances (e.g., insects, drought), and their current successional trajectory may exhibit low resilience to conditions predicted under future climate scenarios. This study serves to identify linkages between environmental parameters and community resilience, allowing restoration practitioners to better tailor efforts to particular forest ecosystem types.

Rice, Kelly N.*[1] and Kathy Evans[2]. **Hydrologic reconnection and habitat restoration of former celery fields in the Bear Creek Watershed, Muskegon Lake Area of Concern**. [1] GEI Consultants, Inc., Allendale, Michigan. [2]West Michigan Shoreline Regional Development Commission, Muskegon, Michigan. Email: krice@geiconsultants.com.

Bear Lake and its main tributary, Bear Creek, are part of the Muskegon Lake Area of Concern (AOC). Muskegon Lake was designated an AOC under the Great Lakes Water Quality Agreement in 1985 due to ecological problems caused by industrial discharges, shoreline alterations, and the filling of open water and coastal wetlands. Since 1992, community groups, governmental entities, and nongovernmental organizations have worked collaboratively to remediate contaminated sediments and to restore and protect fish and wildlife species and their habitats within the lake and its tributaries. The subject 36-acre restoration site is located along Bear Creek just upstream of its confluence with Bear Lake. Earthen berms were historically installed between two celery farm ponds and Bear Creek and have prevented surface water and fish passage between these aquatic ecosystems since the 1930's. In 2002, farming practices were completely discontinued and the fields were re-flooded, but the dikes remained intact. Between 2011 and 2014, funding was obtained for both restoration design and construction from NOAA through the Great Lakes Restoration Initiative, and the restoration project began. In order to hydrologically reconnect the abandoned celery pond muck fields and restore fish

and wildlife habitat, many factors and challenges had to be taken into account. Soil contamination, abandoned oil wells, high levels of phosphorus in the muck soils and surface water, multiple and sometimes conflicting stakeholder goals, hydrologic implications of berm removal on the creek, perimeter road structural integrity, and long-term maintenance were all evaluated and integrated into restoration final design. This presentation will discuss the techniques used to design, implement, and monitor the restoration of 36 acres of fish and wildlife habitat and nutrient removal functions of this former natural floodplain through the removal of historic berms and fill, softening of shorelines, and restoration of native wetland communities.

Roos, Robb[1] *, Nicole Staskowski[1], and Alyssa Barrette[2]. **Remnant prairie within Wisconsin DOT Rights-of-Way: using historic and present-day survey data to identify weighted restoration priorities along state highways**. [1]Cardno, Madison, Wisconsin. [2]Wisconsin Department of Transportation, Madison, Wisconsin. Email: robb.roos@cardno.com

As a result of human activities the quality of prairie ecosystems across Wisconsin have been severely degraded. Invasive species introductions, ever-increasing management constraints (i.e., fragmentation, shared rights-of-way, adjacent land uses), and 'created' prairie restorations with introduced seed have let many of these remnants disappear completely. True prairie remnants are an exceedingly rare and special resource to the residents of Wisconsin and the Midwest. Recognizing the importance of regularly maintained rights-of-way, and their responsibility to preserve these rare prairie remnants, the Wisconsin DOT worked with Cardno to review historic literature and field survey data from the late 1990s for known remnant prairies sites that occur within their road rights-of-way. In total, 23 remnant prairie locations spanning across 13 different counties were identified. Present-day assessments were conducted to identify and compare general floristic quality, presence of endangered, threatened, or rare plant species, dominance of both non-native and native invasive species, woody species encroachment, and management constraints posed by shared rights-of-way and adjacent land uses. Wisconsin DOT, along with input from Cardno's prairie restoration experts, developed a weighted matrix to analyze and rank existing remnant prairie site quality and perceived effort to implement and maintain a successful remnant prairie restoration regime. A crucial challenge to the viability of these remnant sites is successful coordination with shared and adjacent land uses within these areas (i.e., railroad, overhead utility lines). Wisconsin DOT, one of Wisconsin's largest landowners, will review this data to assess future restoration management planning and prioritization efforts.

Salas, Dan[1] * and Johanna Sievewright[2]. **Identifying landscape-level pollinator restoration opportunities within electric transmission rights-of-way**. [1]Cardno, Madison, Wisconsin. [2]American Transmission Company, Pewaukee, Wisconsin. Email: dan.salas@cardno.com

Many pollinators are in serious decline in the United States and worldwide (IPBES 2016). As pollinator declines become acknowledged as a conservation concern, public and private entities are equally considering their role in pollinator conservation. American Transmission Company (ATC) has initiated its own pollinator protection program to address these concerns along the approximate 10,000 miles of rights-of-way they operate. As part of this program, ATC worked with Cardno to define priorities for landscape conservation across ATC's transmission footprint. In doing so, ATC is adding to the conservation science of pollinator conservation by developing a better understanding, through models and field studies, of how landscape structure influences pollinators. This need for modelling and continued study is identified as a critical need for ecosystem service management (Kremen et al. 2007 as cited by Lonsdorf et al. 2009). To help ATC achieve their goals, Cardno developed the Pollinator Opportunities Within Rights-of-Way (POWR) model to help identify priority areas for

pollinator conservation and provide a tool to inform future conservation decisions related to pollinators. The focus of this effort was to identify and prioritize which areas of rights-of-way can both be enhanced and create a landscape connection to other suitable habitat. The findings of this landscape conservation analysis yielded spatial priorities for restoration opportunities and helped define the roles of various transmission work activities in supporting pollinator habitat restoration.

Swab, Rebecca M.[1*], Nicola Lorenz[2], Shana Byrd[3], and Richard Dick[2]. **Native vegetation in reclamation: improving habitat and ecosystem function through using prairie species in mine land reclamation**. [1]The Wilds, Cumberland, Ohio. [2]Ohio State University, Columbus, Ohio. [3]The Dawes Arboretum, Newark, Ohio. Email: rswab@thewilds.org

In the Appalachian region, coal mining has impacted 600,000 hectares historically. While a return to forest would be a preferable postmining land use, due to the difficulty and higher costs of reforestation, many sites are reclaimed into non-native grasslands. The typical seed mix for these grasslands is low diversity and consists of exotic, cool season grasses and forbs. For this study, we combined several species in standard reclamation mixes with prairie species native to North America to create a higher diversity planting on three mine sites in southeastern Ohio. Vegetation and soil microbial properties were assessed within two years after site establishment. Results were encouraging. The mix that included native plants met reclamation standards of ground cover two years after planting, indicating these alternative mixes can be successful. The first year species richness and diversity were higher in native planted areas when compared with traditional, the second year they were equal between treatments. Soil beta-Glucosidase activities tended to be lower or higher in the native planted areas, in contrast to soil organic matter, which was generally higher under native prairie mix. Microbial biomass, Actinobacteria, and gram negative bacteria estimated by ester-linked Fatty acid methyl esters occasionally appeared to be higher under native prairie mix indicating that the experimental mix may have a positive effect on soil microbial biomass after almost two years of establishment. Incorporating hardy native prairie plants into reclamation seed mixes can increase the value of the ecosystem for pollinators and wildlife, and potentially improve soil conditions more quickly than non-native plantings alone.

Thomforde, Stephen L.* **What are the benefits of grazing grassland communities?** Dakota County Technical College, Rosemount, Minnesota. Email stephen.thomforde@dctc.edu

This presentation reveals multiple benefits of grazing in grassland biomes. I begin by describing the emergence and evolution of grazing from the cretaceous to present. During this time the vegetation changes from forest to grassland-savanna and becomes increasingly more edible, while herbivores become increasingly more efficient at biomass harvest. Eventually biomass harvest by herbivores becomes the primary intermediate disturbance regime that maintains earth's grassland-savannas. The coevolution between the herbivore and vegetation results in a codependence upon one another. Humans show up recently and employ fire to maximize herbivory, and by the end of the Pleistocene, the grassland-savanna-grazing biotic community becomes the dominant, most functional and productive terrestrial ecosystem ever. Benefits associated with herbivory are discussed and include: 1) casting mega-herbivores as keystone species, 2) concepts of intermediate disturbance, pulsing, and trophic levels to demonstrate positive feedbacks between grazing, diversity, integrity, resilience, and function, 3) introducing a group of plant and animal species obligate to grazing, 4) modeling the importance of grazing over nutrient regulation, 5) modeling the importance of game trails for landscape connectivity, 6) linking dung piles to foodwebs, 7) modeling the importance of grazing on spatial temporal community structure and organization, and 8) introducing a successional model where grazing is removed to see how the vegetation devolves from grassland to woodland, nutrient regulation

is lost, and trophic cascades facilitate declines in diversity, function and service. The presentation ends by describing two primary grazing objectives and providing two different plans to achieve these objectives.

Tonietto, Rebecca K.*[1,2] and Daniel J. Larkin[3]. **Habitat restoration benefits wild bee communities: a meta-analysis**. [1]Saint Louis University, St. Louis, Missouri. [2]Society for Conservation Biology, Washington D.C. [3]University of Minnesota, St. Paul, Minnesota. Email: toniettork@slu.edu

Pollinator conservation is of increasing interest in light of managed honeybee (*Apis mellifera*) declines, and declines in some species of wild bees (e.g., *Bombus affinis*). Much work has gone into understanding the effects of habitat enhancements in agricultural systems on wild bee abundance, richness, and pollination services. However, the effects of habitat restoration in natural systems on wild bees are less commonly investigated and of growing importance for bee conservation to combat habitat loss. We completed a meta-analysis to determine the overall effects of habitat restoration and the effect of specific restoration techniques (e.g., grazing, burning) on wild bee abundance and richness; focusing on unmanaged bee outcomes in natural systems or non-production agricultural settings. We evaluated thirty-five studies that met our selection criteria, representing 8 habitat types and 9 restoration techniques. Nearly all restorations were carried out without explicit consideration of bees' or other pollinators' habitat needs; the majority of restorations targeted plant community outcomes. Habitat restoration had an overall positive effect on wild bee abundance and richness across multiple habitat types. Our findings indicate ecological habitat restoration of natural lands can significantly benefit wild bee conservation; especially considering habitat loss is indicated as a leading factor in pollinator declines.

Umek, Lauren* and Byron Tsang. I**ntegrating recreation and restoration in a post-industrial landscape on Chicago's south side**. Chicago Park District, Chicago, Illinois. Email: lauren.umek@chicagoparkdistrict.com

Heavy industrial activity in Chicago's far southeast side played a vital role in the development of one of the largest cities in the United States and left the landscape severely impacted. An old industrial property, 278-acre Big Marsh is the region's largest inland wetland. Despite extensive slag and fly dumping, altered hydrology, and invasive species dominance, the ecological potential of the site is substantial. In recent years, the Chicago Park District has begun to redevelop the site into a safe, open, and inviting park space for Chicago residents, visitors, while supporting local biological diversity, including rare flora and fauna. Approximately 45 acres of the site was developed with specialized bicycle features integrated into a native landscape. The remainder of the site is in the process of being restored to a mosaic of hemi-marsh, emergent marsh, sedge meadow, wet prairie, prairie, savanna, and woodland ecosystems. This presentation will highlight the history and industrial legacy at Big Marsh, and how this influenced the integration of active recreation and ecological restoration into the largest natural area in the Chicago Park District's nearly 1,700 acre system. Unique plant community assemblages associated with the landscape and the initial plant and animal responses to restoration activities be presented as well as potential future research collaborations exploring soil amendments and seed mixtures for this and other post-industrial landscapes. The recent work at Big Marsh will be presented as a case study demonstrating the challenges and opportunities associated with integrating ecological restoration and recreation in a post-industrial, highly urban area.

Warners, Dave*, Deanna Geelhoed*, and Patrick Jonker. **Assessing native plant survivorship and performance in curbcut rain gardens**. Calvin College, Grand Rapids, Michigan. email: djg27@calvin.edu

Plaster Creek is known as West Michigan's most degraded waterway due to decades of mistreatment and neglect. Stormwater runoff and the extreme fluctuations in flow volume it produces is a major contributing factor that triggers several other problems including thermal pollution, dangerously high *E. coli* levels, excessive erosion, and nutrient contamination. To help reduce stormwater runoff, Plaster Creek Stewards installed 13 Curb-Cut Rain Gardens during the summer of 2015 in the Alger Heights neighborhood of Southeast Grand Rapids. These plantings collect storm water runoff from street gutters, promoting infiltration and evapotranspiration instead of directly introducing stormwater into the creek. The plants used in this project are all native perennial species grown in Calvin's greenhouses from locally collected seeds. We will be reporting on a first-year assessment of this project, the goal of which is to understand what factors are influential in determining health and success at both a garden and species level. Our results allow us to begin developing guidelines of best management practices for improving and expanding urban native rain gardens like these in the future. We are also learning which native species grow well and provide valuable environmental services in these rather unnatural conditions. This research is ongoing and will include a 2017 2-year assessment of these 13 rain gardens, along with another 1-year assessment of an additional 20 gardens that were planted in the summer of 2016.

Williams, Evelyn W.*[1], Rebecca Barak[1], and Daniel J. Larkin[2]. **Competing to keep out invasive species in prairie restorations**. [1]Chicago Botanic Garden, Glencoe, Illinois, [2]University of Minnesota, St Paul, Minnesota. Email: ewilliams@chicagobotanic.org

Non-native and invasive species have negative impacts on restored prairies, and we spend a lot time and money removing them. Extensive previous research has found that high species diversity can repel invasive species. However, the amount of evolutionary, or "phylogenetic", diversity may play an important role in decreasing invisibility as well. Increasing evolutionary lineages in a restoration may allow for better competition against invasion. Closely related native and invasive species may compete strongly, effectively keeping out the invasives. Here, we test the hypothesis that closely related prairie species compete more than distantly related species using a greenhouse study. We use traits and above- and below-ground biomass to calculate competition at different phylogenetic distances. We then relate these results to observations in the field through surveys at 18 restored prairies in the Chicagoland region. At the plot level, we found that native species richness and phylogenetic distance to invasive species predicted invasion. At the site level, species richness and site soil characteristics predicted invasion. Our findings show how pairwise competitive interactions could impact invasion resistance in prairies, and how these patterns relate to existing prairie restorations.

Zettlemoyer, Meredith A.* and Jen A. Lau. **Do functional groups predict local species loss?** Michigan State University, East Lansing, Michigan. Email: zettlem2@msu.edu

Anthropogenic land alterations such as urbanization and agriculture produce high local extinction rates and are a primary cause of decreasing biodiversity. However, we still lack a predictive framework for understanding species loss, a process that restoration often seeks to reverse. Although rare species and habitat specialists may be at greater risk due to localized disturbances, we have a limited understanding of how habitat types and functional groups influence local extinctions. Examination of a large sample of species can reveal the traits that influence the distribution of taxa across habitats and inform their

vulnerability to local extinction. We use historical botanical data from Kalamazoo County, MI, to develop a model testing the effects of community (the habitat type a species is most commonly found in), rarity (the number of MI counties a species is found in), family, and various functional groups on the current status of local species (extinct or present). First, we find that extinction varies across plant families, suggesting that evolutionary history and traits influence responses to human disturbance. We also find that certain habitats, namely prairies, have experienced high rates of extinction. Finally, we examined extinction rates for several functional groups and found that native species, forbs, and species with limited niches or at the edge of their native range are more vulnerable to local extinction. This nonrandom distribution of extinction reflects the idea that certain species attributes are beneficial or detrimental in the face of anthropogenic change and land use. Understanding spatial and taxonomic patterns of local extinctions will aid in the identification of species and habitats that are most in need of conservation attention.

# POSTER PRESENTATIONS – ALPHABETICAL ORDER

Berke, Kelsey D.*, Brendan D. Carson, Andrew M. Monks, Shane C. Lishawa, and Nancy C. Tuchman. **Nutrient removal in Great Lakes wetlands through harvesting of the invasive cattail (*Typha x glauca*)**. Loyola University Chicago, Chicago, Illinois. Email: kberke@luc.edu

Nutrient enrichment poses a threat to water quality and ecosystem biodiversity and function in the Laurentian Great Lakes. Increased nutrient levels in wetlands have resulted from intensive agricultural practices and land-use changes, enriching these coastal systems. Excess nutrient levels in the Great Lakes have been linked to changes in plant community structure and composition within coastal wetlands, contributing to a loss of species diversity. Increased wetland nutrient levels have led to invasive hybrid cattail (*Typha x glauca*) dominance in many Great Lakes coastal wetlands. *Typha* has a high productivity rate compared to native wetland vegetation and can directly uptake and store substantial quantities of nutrients. The removal of the *Typha* biomass and litter has been shown to stimulate native plant species recovery. Additionally, because *Typha* takes up substantial quantities of nitrogen and phosphorus, cutting and removing (harvesting) *Typha* biomass results in the removal of nutrients from the coastal wetland system. While this removal should theoretically result in a net decrease of nutrients in the wetland ecosystem, it is not yet known how the amount of N and P being removed relates to the amount that is stored in wetland sediments. I am investigating the potential of mechanical harvesting of invasive *Typha* biomass to remove nutrients from an enriched wetland ecosystem and stimulate native plant species recovery through the application of several restoration treatments. I also want to identify and quantify crucial differences in nutrient conditions and plant community composition between a high-quality, low-nutrient and a low-quality, high-nutrient wetland. Understanding how to best achieve the desired goal(s) of increased biodiversity and/or nutrient removal in degraded wetlands will help improve the functioning of coastal systems.

Bryant, Allison G.* and David P. Benson. **Does the removal of dead turf or the use of seed blankets improve vegetation coverage in a steep slope prairie restoration in central Indiana?** Marian University, Indianapolis, Indiana. Email: abryant359@marian.edu

Ecological restoration on steep slopes that are currently turf grass can be problematic and costly. This study examined whether the removal of dead turf and installation of seed blankets affect initial spring cover crop growth as well as first fall growth of planted natives on a 33.0% average slope. Of the 30 total plots 17 had dead turf grass removed. The other 13 plots retained dead grass averaging 8 cm in height. Ten plots received no blanket, the others had either coir or straw blanket installed. A native low stature prairie seed mix including an annual rye cover crop was hand seeded evenly on all 30 plots in the fall (2015) prior to data collection. We found significantly higher coverage of the annual rye cover crop in the first growing season (May 26, 2016) where the turf was removed (x = 52.2% +/- 32.5) than where it was retained (x = 14.5% +/- 21.5; $P = 0.001$). In the following fall (2016) we found 48 species, 25 being native. Of the 33 species we planted, 12 were identified in our study. There was a non-significant coverage trend found in plots with turf removed in both planted species (not removed x= 21.7% +/- 9.1; removed x = 27.4% +/- 20.3; $P = 0.32$) and native species (not removed x= 59.5% +/- 15.6; removed x = 69.0% +/- 15.3; $P = 0.11$) coverage. We found no impact of blanket on planted vegetation coverage. Our findings indicated that plots with turf removed before seeding experienced greater growth in rye cover crop than those that retained turf and that there may be a trend toward better native and planted species coverage when turf is removed. Our results may justify the labor cost of turf removal but not blanket installation in this situation.

George, Isabelle G.* and Mathew E. Dornbush. **Effects of diversity, nitrogen fertilization methods, and harvest schedule on phosphorus removal in a native perennial biofuel grassland**. University of Wisconsin-Green Bay, Green Bay, Wisconsin. Email: georgei@uwgb.edu

The accumulation of excess phosphorus in agricultural lands subject to intensive agricultural practices produces lasting and unintended environmental challenges. For example, excessive soil phosphorus leaches or erodes from agricultural fields into adjacent streams and lakes, driving aquatic eutrophication. The sedimentary nature of P assures that legacy effects persist even following conversion into perennial vegetation, and negative relationships between soil nutrient levels and restorable soil and plant biodiversity are well established. We evaluated the potential use of native perennial graminoid plantings for soil phosphorus mining through plant uptake and subsequent removal by harvest. Specifically, we explored the effects of planting diversity (mixed perennial graminoids vs. switchgrass (*Panicum virgatum*) monoculture), nitrogen fertilization method (interseeded legumes vs. synthetic nitrogen application), and harvest frequency (two cut harvest in mid-summer and fall vs. a single fall harvest), on above and below plant biomass and P content to estimate phosphorus sequestration and export potential from enriched soils. Our study site is a field-scale experimental grassland established in 2012 on a farm on the Oneida Indian Reservation located in Brown County, Wisconsin, USA. The study site contains four replicate blocks, each supporting four 0.5-acre treatment plots. Within each plot we measured aboveground and belowground plant biomass, and plant tissue phosphorus over two growing seasons. Preliminary results support significantly higher yields in switchgrass plantings fertilized with synthetic N in 2015, but suggest no notable differences among plantings or fertilizer method in 2016. Single and double cuttings produced similar total biomass harvests, but double harvests removed more P than single harvest approaches. Our results provide preliminary estimates of P sequestration potential in perennial roots and P removal potential via harvests in native graminoid dominated grasslands in an attempt to develop strategies for reducing the impact of legacy soil enrichment on water quality and restorable diversity.

Goggin, Patrick*. **Developing and Sustaining a Lakeshore Habitat Restoration Training for Professionals in Wisconsin, USA**. University of Wisconsin-Stevens Point, Rhinelander, Wisconsin. Email: pgoggin@uwsp.edu

The Wisconsin Lakes Partnership embarked on offering a three-day certification program on "Lakeshore habitat restoration training for professionals" in 2014. One hundred+ people have been certified in the program over the first three years as part of Crews 1, 2, & 3. Participants experienced a two-day classroom session that reviewed state standards and regulations, permitting, designing and implementing conservation practices, strategies for forming partnerships and working effectively with lakefront property owners on projects, and basics of restoring habitat along lakeshores including soils ID, native plant selection, and other site analysis steps. Cost-share funding and grant resources that support lakeshore restoration were featured as well, as were business and county partner profiles, monitoring and maintenance strategies, and a primer on erosion control assessment and techniques. The third day of the training involved taking an exam and participation in a field day as part of the North American Stormwater and Erosion Control Association-Wisconsin Chapter's fall field day at the American Excelsior lab in Rice Lake, Wisconsin. Field day participants were taken through assorted field stations that demonstrated erosion control products and allowed attendees to speak with product representatives. Partakers also were shown various bmp's properly and improperly installed and other habitat restoration techniques in hands on forum. Future directions of the program include refining the course materials, widening participation by landscapers and tribal partners, and bolstering web resources that support practitioners of lakeshore habitat restoration in Wisconsin.

Gordon, Brad* and Christian Lenhart. **Comparing nitrate reductions in a reed canary grass monoculture, switchgrass monoculture, and wet prairie community in wetland mesocosms**. University of Minnesota, St. Paul, Minnesota. Email: gordo402@umn.edu

As states throughout the Midwest seek to reduce nitrogen in surface water and groundwater, many wetlands are being constructed and restored to remove nitrogen in the form of nitrate from agricultural surface runoff or tile drainage. Many of the design considerations for these wetlands pertain to hydrology and incoming concentrations. If seed mixes are considered, they are often chosen for animal habitat or restoration of native communities. Nitrate reduction potential of each plant community is not often a factor when choosing seed mixes. However, in many wetlands, invasive species outcompete the planted communities. If weed control is not part of the management routine, it is important to know if these wetlands will lose nitrate reduction effectiveness as invasive species become dominant. This study evaluates nitrate reductions in nine 100-gallon wetland mesocosm tanks located in the Biosystems and Agricultural Engineering lab at the University of Minnesota St. Paul campus. Mesocosms were planted with reed canary grass (*Phalaris arundinacea* L.), switchgrass (*Panicum virgatum* L.), or a wet prairie mix. Tanks were filled with water at a concentration of 8.0 mg/L $NO_x$-N. Concentrations were measured on the surface and at the bottom of the tanks over 10 days. All plants were transplanted from a constructed tile drainage treatment wetland located in southern Minnesota. Results thus far indicate that wet prairie mixes reduce nitrate concentrations as much as 30% more than both reed canary grass and switchgrass. Soil samples will be analyzed using qPCR to determine if a higher reduction in wet prairie mixes is due to higher denitrifying microbial populations among the roots of wet prairie mixes versus grass monocultures. This study could aid restoration ecologists and others involved when determining the importance of choosing the right seed mix and managing the plant community years after construction or restoration of wetlands.

Johnson, Yari*[1], Craig Maier[2], Thomas Bragg[3]. **Fire frequency and burn season—opportunities for coordinating research across the Tallgrass Prairie region**. [1]University of Wisconsin-Platteville, Platteville, Wisconsin. [2]Tallgrass Prairie and Oak Savanna Fire Consortium, Madison, Wisconsin. [3]University of Nebraska Omaha, Omaha, Nebraska. Email: johnsony@uwplatt.edu

How does fire frequency and burn season affect restored prairies across the tallgrass prairie region of the United States? Land managers indicated in the 2011 Tallgrass Prairie and Oak Savanna Fire Consortium (TPOS) start up survey that answering this question was one of the greatest needs in the region. Long-term studies started in 1978 at the University of Nebraska Omaha show strong differences among vegetation and soils in plots with different burn season and frequencies. We propose creating a research network to gather data on the effects of different burn regimes on prairies across variations in soil, weather, climate, and plant communities. Numerous colleges, universities, and biological field stations currently use prescribed fire to manage remnant prairies and restore degraded prairies. Research and data collection at some sites (e.g., the Green Oaks Biological Field Station at Knox College) has led to publications. While other sites (e.g., University of Wisconsin-Platteville), despite putting much effort into managing prairies, have not begun to collect data. Creating a research network would enable isolated field sites to be part of a larger research endeavor, which could yield more robust datasets and greater opportunities for funding.

Lemke, Michael J.[1]*, Keenan Dungey[1], and Luiz Felipe M. Vehlo[2]. **Comparing restoration ecology and conservation of the Illinois River and the Rio Parana: a course exploring two rivers of international importance.** [1]University of Illinois Springfield, Springfield, Illinois. [2]Universidade Estadual de Maringá, Maringá, *Paraná,* Brazil. Email: lemke.michael@uis.edu

The University of Illinois Springfield (UIS) and the Universidade Estadual de Maringá (UEM) are collaborating to offer a course series focused on one flood-pulsed river system each in the U.S. and Brazil. The U.S. study focus will be the middle reach of the Illinois River, which has undergone over 125 years of mixed degradation, conservation and restoration. The area of focus in Brazil will be the Upper Rio *Paraná* that has the last reach of river free of impoundments While prolific and significant scientific studies have been conducted on the aquatic ecosystem of the *Paraná*, it remains one of the most important rivers in South America because it is located in the most populous regions in Brazil and has been greatly altered by the construction of dams for hydroelectricity. Part of this educational effort will be the repeat offering of a one-semester online, bilingual course that explores conservation biology and restoration ecology. Particular attention will be given to the conservation approach to maintain and protect existing biodiversity and critical habitat and contrast this approach with that in restoration where goals are often to reverse ecosystem degradation. Thus a dynamic where one river (Illinois) is showing efforts towards restoration while the other (*Paraná*) endures continued degradation, offers a platform where the science, politics, stakeholders, proposals and outcomes of efforts will be probed, debated, and researched. A second, independent effort will be a student exchange to each university's field stations to gain hand on experience about the river ecology. The online course will be offered for credit in the spring at both universities with details on how to enroll provided.

Lyndall, Jen* and Bethanie Walder. **SER Certification program for ecological restoration practitioners**. Society for Ecological Restoration, Washington D.C. Email: certification@ser.org

Over the last several decades, the relatively new field of ecological restoration has rapidly grown, both in number of projects and in number of practitioners. However, professional standards for practitioners are minimal at best, resulting in inconsistent project quality. As one way of addressing this problem the Society for Ecological Restoration (SER) recently launched a new practitioner certification program to create a high professional standard for ecological restoration practitioners and practitioners-in-training throughout the world. The program offers two types of certification: Certified Ecological Restoration Practitioner (CERP) and Certified Ecological Restoration Practitioner-in-Training (CERPIT). Certification is based on a combination of knowledge and experience, and also requires adherence to the SER code of ethics and an understanding of SER's foundational documents. Certification is valid for five years after approval and can be renewed if sufficient continuing education credits are earned. The continuing education requirement will encourage practitioners to regularly engage in and actively contribute to the advancement of the field of ecological restoration while also enhancing their skills and knowledge. By promoting practitioner standards, SER hopes to improve ecological restoration and the associated benefits on the ground. Certification will also have numerous other benefits: 1) individuals can improve their professional status through formal recognition of their training and experience, 2) academic institutions with ecological restoration degree programs can use the knowledge requirements to evaluate curricula so that graduates will have the core competencies specific to the field; and 3) employers, agencies, organizations, and the general public will benefit by easily being able to identify those practitioners who meet the high standard set by SER. You can find out more about the program benefits and requirements at SER's certification webpage (http://www.ser.org/page/certification).

Mandi, Alex*, Zachary Moss*, Evelyn Kammeyer, Katelyn Miner*, Dane Salow, and Russ Benedict. **Plant bullies: assessing the aggressiveness of species used in prairie reconstructions**. Central College, Pella, Iowa. Email: mandid2@central.edu.

The Prairies for Agriculture project is examining the benefits of incorporating tallgrass prairie into the agricultural landscape via prairie restorations in un-farmable areas. As part of this long-term project, we assessed aggressiveness of 64 species of plants seeded into our research plots, each measuring 9 X 9 meters and surrounded by a two meter-wide mowed buffer. We recorded presence / absence and estimated abundance of each species in 32 un-planted plots interspersed among seeded plots. Five species that we seeded, Black-eyed Susan (*Rudbeckia hirta*), False Sunflower (*Heliopsis helianthoides*), Partridge Pea (*Chamaecrista fasciculata*), Sawtooth Sunflower (*Helianthus grosseserratus*), and Tall Boneset (*Eupatorium altissimum*) were the most aggressive, appearing in at least 80% of un-planted plots. Additionally, Canada Goldenrod (*Solidago canadensis*/*altissima*), which we did not plant but is abundant in surrounding areas, was present in 97.5% of un-planted plots. We also conducted these same counts in six plots that were planted with five species of prairie grasses but no forbs, and the results were very similar. This knowledge can assist future prairie reconstructions by identifying which species are most likely to spread beyond areas where they are planted. But given the valuable functions performed by these species, they are important to include in reconstructions. Therefore, future work will address reducing the quantity of seed of these species in plantings and delaying their seeding for one or two years while other plants get established.

Miller, Jason A.[1], Rachel K. Goad[1], Lauren Umek*[2], and Byron Y. Tsang[2]. **Plants of Concern's development of a rapid floristic quality assessment for the Chicago Park District**. [1]Chicago Botanic Garden, Glencoe, Illinois. [2]Chicago Park District Department of Cultural and Natural Resources, Chicago, Illinois. Email: byron.tsang@chicagoparkdistrict.com

The Plants of Concern (POC) program housed at Chicago Botanic Garden and the Chicago Park District (CPD) Natural Areas Program have partnered to develop a new, volunteer-friendly, rapid floristic quality assessment for the Park District. The goal of this effort has been to create a standardized, replicable protocol that can provide long-term vegetation monitoring data on CPD's Natural Areas while engaging volunteer stewards and other interested non-professionals in a new citizen science project. This protocol allows CPD to track floristic quality change in Natural Areas over time, thus informing future management decisions to more efficiently allocate limited operational resources. POC's methods of development and the new monitoring protocol are presented.

Munson, Steven W.* and Neil W. MacDonald. **Initial alteration of soil nitrogen influences competition between spotted knapweed and Indian grass**. Grand Valley State University, Allendale, Michigan. Email: munsons@mail.gvsu.edu

A greenhouse experiment was conducted at the *Barbara Kindschi Greenhouse at* Grand Valley State University which used Indian grass (*Sorgastrum nutans*), a native warm-season grass, and spotted knapweed (*Centaurea stoebe*), an invasive forb. The goal of this experiment was to compare the differences in biomass of Indian grass and spotted knapweed when different amendments were used to alter the initial levels of available nitrogen in the soil. This experiment used a multifactorial design, with three levels of initial nitrogen (low, normal, and high) and three levels of plantings (Indian grass only, spotted knapweed only, and both spotted knapweed and Indian grass). The nine treatment combinations were repeated in five randomized complete blocks. The aboveground biomass of the two species and the final available soil nitrogen concentrations were compared using correspondence

analysis, a multivariate statistical technique. The ordination of the correspondence analysis showed a trend that suggests high soil nitrogen favors spotted knapweed biomass and lower nitrogen favoring Indian grass. This trend implies reducing soil nitrogen as a restoration effort in spotted knapweed infested areas should promote native grass dominance.

Murphy, Shane*, Joseph Buckho, Emily Melton, Bryce Chancellor, Kaylee Brandon, and Young D. Choi. **Effects of emerald ash borer (*Agrilus planipennis*) infestation on benthic macroinvertebrate communities in Coffee Creek watershed, Chesterton, Indiana**. Purdue University Northwest, Hammond, Indiana. Email: murph262@pnw.edu

The emerald ash borer (*Agrilus planipennis*), an invasive species of insect from Asia has girdled ash tree (*Fraxinus* spp.) populations all across the Midwest in North America. The infestation of this beetle created gap openings in the forest Canopy and increased solar radiation to the water of the Coffee Creek located in Valparaiso, Indiana. In this study, we investigated the impacts of gap openings on the assemblages of macroinvetebrates in the creek's benthic community. The canopy clearing has increased solar radiation (gaps 787 $\pm$ 103 µmol quantums $m^{-2}$ $s^{-1}$ shades 62 $\pm$ 21 µmol $m^{-2}$ $s^{-1}$) but not dissolved oxygen and water temperature. Here was no statistically significant difference in the total abundance between the gaps (97 $\pm$ 25) and shades (94 $\pm$ 15), and the opposite was true in the riffles (gaps 118 $\pm$ 27 shades 61 $\pm$ 21). Within the riffles, Baetidae (small minnow mayfly) and Heltagenidae (flathead mayfly), Asellidae (aquatic sow bug), and Gammaridae (scud) were the families that characterize the riffles under gap. The family only found within the shade riffles were: Dryopidae (long-toed water beetle), Perlodidae (perlodid stonefly), Planorbidae (Ram's horn snail), and Pleuroceridae (pleucerid snail). Within the shade pools, Calopterygidae (broad-winged damsel fly) and Leuctridae (rolled-winged stoneflies) were exclusively found. Families Ameletidae (combmouthed minnow mayflies) and Lestidae (spread-winged damselflies) were only observed in gap riffles. The gap pool exclusive families include Chloroperlidae (green stoneflies) and Polycentropodidae (tube maker caddisflies).

Pavisich, Hailee B.* and Charlyn G. Partridge. **Development and characterization of microsatellite markers for invasive Baby's Breath *Gypsophila paniculata***. Grand Valley State University, Muskegon, Michigan. Email: pavisich@mail.gvsu.edu

Baby's breath (*Gypsophila paniculata*) is an invasive, herbaceous perennial that forms monotypic stands in the perched dunes along Lake Michigan. It is capable of growing a 4 meter long taproot, and producing 14,000 seeds annually, effectively crowding out threatened and endemic species. The goal of this project is to examine the population connectivity and dispersal patterns of baby's breath in the northwest Michigan dune system, so as to inform resource professionals of how best to approach its invasion. We are using a combination of nuclear and chloroplast microsatellite markers to estimate levels of genetic diversity, population connectivity, and patterns of seed dispersal for populations along the Lake Michigan shoreline. Presently we have developed and characterized 15 polymorphic nuclear microsatellite loci that are specific baby's breath. These data will be used to identify populations with a high potential to contribute to the reinvasion of managed areas, and to continuing spread. This will allow The Nature Conservancy, the National Park Service at Sleeping Bear Dunes National Lakeshore, and other resource professionals to maximize their resources by targeting removal of specific populations of baby's breath.

Pham, Sophia and Hua Chen*. **Soil organic carbon and total nitrogen storage in two restored Tallgrass prairies at Emiquon in Illinois: the potential for C sequestration**. University of Illinois Springfield, Springfield, Illinois. Email: Hchen40@uis.edu

Terrestrial ecosystems play important roles in carbon (C) and nitrogen (N) cycle. The loss of prairies for croplands results in a release of significant amount of C from soil organic matter (SOM) into atmosphere. Prairie restoration from croplands has potential for C sequestration. The overall goal of this study was to quantify C and N storage of SOM of two restored tallgrass prairies at Emiquon in Illinois and explore the C sequestration potential of these two tallgrass restored prairies. Emiquon #18 site was restored in 2007 while Emiquon Fish and Wildlife (FW) site was restored in 2001. Soil samples were collected along a 60-m long transect in summer of 2008. A CHN Elemental Analyzer (PerkinElmer 2440) was used to determine the SOM C and N concentration. In addition, SOM C and N concentration and soil bulk density data of 31 sites of native tallgrass prairies in Midwest (Fierer et al. 2013) were used to estimate soil C and N storage of these native tallgrass prairies. With the increase of restoration age, the average SOC storage of top 20 cm soils increased from 22.89 Mg/ha at Emiquon #18 site to 32.44 Mg/ha at Emiquon FW site. The average SOC storage of the top 20-40 cm soils increased from 16.5 Mg/ha at the younger restored prairie site to 34.88 Mg/ha at the older restored prairie site. Our study further indicated that the SOC storage and TN storage at top 20 cm soils on these native tallgrass prairies averaged at 85.82 Mg/ha and 7.15 Mg/ha, respectively, suggesting both restored tallgrass prairies have a potential for C sequestration.

Rice, Emma K.* and James N. McNair. **Phenology of seed maturation and the effect of glyphosate on *Gypsophila paniculata* (baby's breath) seed maturation**. Grand Valley State University, Muskegon, Michigan. Email: riceemm@mail.gvsu.edu

*Gypsophila paniculata* was recently listed as a priority invasive species in Michigan's northern lower peninsula and is a problem invasive in much of the northern US and southern Canada. Due to its high potential for seed dispersal, removal efforts during the summer are often ended prior to seed maturation, which is thought to occur in early-mid August. However, the phenology of seed maturation is poorly known, as is the efficacy of glyphosate spraying in preventing seed maturation. We conducted a study of populations within Sleeping Bear Dunes National Lakeshore to determine percent germination of seeds collected approximately weekly between July 22 and August 23, 2016. The results show that percent germination increased markedly in seeds collected between July 22 and July 28 and increased to 99% in the Aug 23 collection. To assess the efficacy of glyphosate in preventing seed maturation, we conducted a second study to determine whether herbicide-sprayed plants produce germinable seeds and, if so, how percent germination is related to the timing of glyphosate spraying during the growing season. Seeds from plants sprayed over a three-week period in July 2016 showed up to 20% germination, with the lowest percent (0%) in seeds from plants treated in early July and the highest in seeds from plants treated in late July. In 2016, herbicide treatment would have been most effective if spraying had been completed by mid July. If managers can estimate the timing of seed maturation on an annual basis, perhaps using growing degree days, this would aid in limiting the number of germinable seeds deposited per year and allow them to optimize use of management resources.

Slater, Julie M.*, G. Matt Davies, Virginia I. Rich, Gil Bohrer, Yushan Hao, and A. Camilo Ray-Sanchez. P**roposed research: a comparison of plant communities in intact and damaged Ohio peat bogs**. The Ohio State University, Columbus, Ohio. Email: slater.150@osu.edu

Ohio contains some of the Midwest's southernmost temperate bogs, whose plant communities combine non-northern species with those characteristic to northern bogs. In a 1976-1991 field inventory, only 2% of surveyed historical Ohio peatlands remained, in large part due to conversion to agricultural production. Many remaining sites are damaged from impacts such as drainage, mining, development, water level changes, agricultural runoff, and invasive species. Previous studies have compared intact peatlands or characterized individual sites, but none have compared plant communities in intact and damaged sites, leaving a large gap in our understanding of the state of Ohio's bogs and the potential for their restoration. We plan to compare plant communities and soil and water chemistry along an impact gradient at 10-15 peat bogs throughout the state. Historic maps, historic records, and scientific literature have been used to identify site locations, and herbarium records will be accessed to locate more potential sites. Where prior studies exist, site descriptions will be compared with the bogs' current states. The results of this study will include information on the state of Ohio's bogs, drivers of plant community composition in Ohio's bogs, and recommendations for the restoration of ecosystem function at degraded sites. In addition, the data will be used in interdisciplinary investigations of Ohio peat bog carbon cycling and microbiota, to advance a wholistic understanding of these ecosystems.

Smiley Jr., Peter C. [1]* and Kevin W. King. **A decade of evaluating the ecological effects of grass filter strips on channelized agricultural headwater streams.** USDA Agricultural Research Service, Columbus, Ohio. Email: rocky.smiley@ars.usda.gov

Grass filter strips are a widely used conservation practice in the Midwestern United States for reducing nutrient, pesticide, and sediment inputs into agricultural streams. Previous studies have documented the effectiveness of grass filter strips in reducing the input of agricultural pollutants, but the influence of this practice on the structure and function of agricultural streams has not been evaluated. Additionally, it has been predicted that vegetative practices like grass filter strips will require at least 10 years before they mature and begin to affect the ecosystem. We hypothesize that if grass filter strips are an effective practice then over time ecosystem structure of channelized agricultural headwater streams with grass filter strips should become more similar to that of forested unchannelized streams than channelized agricultural headwater streams without grass filter strips. We began evaluating the ecological effects of grass filter strips on channelized agricultural headwater streams in 2006. Our long term research involves annual sampling of riparian habitat and geomorphology and seasonal sampling of instream habitat, water chemistry, fishes, and amphibians from three channelized headwater streams without grass filter strips, three channelized headwater streams with planted grass filter strips, and two unchannelized headwater streams with forested riparian habitats in central Ohio. The results of our initial assessments conducted within eight to nine years after planting indicated that planting grass filter strips simply widens the riparian habitats and does not alter the ecosystem structure and function of these small streams. We will present new results on the trends in riparian habitat, instream habitat, water chemistry, and fish community structure among the three riparian habitat types over a ten year period from 2006 to 2015. Our presentation will conclude with recommendations on the restoration implications of the findings from the first decade of this research effort.

Troy, Jennifer* and Robert Gillespie. **Comparisons of aquatic communities in traditional and two-stage ditch segments of streams in Northeast Indiana**. Indiana University-Purdue University, Fort Wayne, Indiana. Email: troyjl02@students.ipfw.edu

Although two-stage ditches have been shown to reduce nutrients and suspended solids in receiving streams, there is little published research on the ecological effects of the two-stage design. We predicted that aquatic communities of two-stage ditch segments will have greater diversity, richness, and abundance than those in traditional ditches. We surveyed fishes and macroinvertebrates over a two-year period among 12 traditional segments and 7 two-stage segments in the Creel Ditch and West Branch catchments of the Fish Creek Watershed. Additionally, physiochemical data, and QHEI scores were recorded, and nutrients and total suspended solids were analyzed. Preliminary analyses show that macroinvertebrate abundance was significantly greater ($p<0.05$) in two-stage ditch segments than in traditional-ditch segments of Creel and West Branch ditches. However, macroinvertebrate diversity and richness were greater (16-30%) in two-stage segments only for Creel Ditch. In contrast to results for macroinvertebrates, diversity of fish assemblages was similar for two-stage and traditional-ditch segments in Creel Ditch. However, fish abundance and richness in two-stage segments of Creel Ditch were 2.5 and 1.5 times greater, respectively, than those in traditional segments. All fish assemblage metrics were similar for two-stage and traditional segments in West Branch. Interestingly, mean QHEI scores for all segments of West Branch were 20% greater than that for Creel Ditch. The greater habitat quality of traditional segments in West Branch may explain the lack of differences in fish community metrics between two-stage and traditional segments. Although our results suggest that two-stage segments have the potential to improve integrity of aquatic communities, more study is warranted. It is important to know what characteristics of habitat were improved (e.g. flow, substrate) by the presence of the two-stage system. A more targeted study design could also help exclude certain confounding factors, such as physicochemical variables and water chemistry as contributors to aquatic community integrity.

Vujanovic, Michael* and Jennifer Slate. **Diatom algae and sediment organic content reveal long-term presence of *Sphagnum* mat in Volo Bog Nature Preserve**. Northeastern Illinois University, Chicago, Illinois. Email: m-vujanovic@hotmail.com

As the only quaking bog in Illinois with a floating mat of *Sphagnum* moss, Volo Bog Nature Preserve is unique due to the low level of nutrients and naturally acidic water. *Sphagnum* moss sequesters nutrients from water and increases acidity by releasing hydrogen ions into its environment. These conditions decrease decomposition, allowing organic content to accumulate in sediment. Because management strategies for Volo Bog may depend on its history, we collected a sediment core from the bog. Radiocarbon data revealed that the sediment was deposited over the past 6,300 years. We determined percent organic content through the use of loss on ignition by drying the sediment and then burning the organic matter at 550°C. We determined the abundance of diatom algae by examining diatoms that were preserved over time due to having siliceous cell walls. Some diatom algae are able to thrive in acidic conditions and others are not. The percent organic content below 7.5 m was low, with an average of 36%. Above 7.5 m, the percent organic content increased to an average of 77%. Acidophilic diatoms (e.g. *Eunotia*) were more common above 7.5 m and alkaliphilic diatoms (e.g. Fragilariaceae) were more common below 7.5 m. This change from alkaliphilic to acidophilic diatoms, along with the increase in organic content in the sediment, suggests that the *Sphagnum* moss has been present for approximately 5,300 years, and should continue to be preserved.

Wylie, Sean P.* and Todd A. Aschenbach. **Response of Pennsylvania sedge (*Carex pensylvanica*) to fire and herbicide treatments in a degraded sand prairie**. Grand Valley State University, Allendale, Michigan. Email: wylies@mail.gvsu.edu

Sand prairie was expansive throughout lower Michigan in the 19th century, yet has been severely fragmented by agriculture, reforestation, and fire suppression. Existing sand prairie is an important remnant of Michigan's historic oak-pine barrens ecosystem. Our research focuses on the native species Pennsylvania Sedge (*Carex pensylvanica*), which has formed monocultures in sand prairies. The objective of our research is to determine how to effectively reduce Pennsylvania Sedge dominance on degraded sand prairie in the Manistee National Forest, MI. Our study includes five treatments involving prescribed fire and/or herbicide application: fire only, fire followed by herbicide, herbicide, herbicide followed by fire, and a control (no fire or herbicide). Results will show how these treatments differentially reduce Pennsylvania Sedge and impact overall plant diversity, which can be used to effectively restore sand prairie throughout lower Michigan.

# OFFSITE FIELD TRIP ABSTRACTS

Helinga, Justin*[1], Jesse Lincoln*[2], and Priscilla Nyamai*[3]. ***West Michigan Oak Savannas: Protection, Restoration, and Research***. [1]Land Conservancy of West Michigan, Grand Rapids, Michigan. [2]Michigan Natural Features Inventory, Lansing, Michigan. [3]Grand Valley State University, Allendale, Michigan. JH Email: justin@naturenearby.org

This field trip will depart from Grand Valley State University's DeVos Center at 9:00 am and the on-site field trip begins at Huckleberry Hill at 9:30 am. Oak savannas were once prevalent in West Michigan, but now are one of the most imperiled natural communities in the state, with less than 1 percent of the original habitat remaining. The area around Lowell, Michigan, contains several oak savanna remnants that are in various stages of restoration. This field trip will give participants an in-depth look at two such remnants: Huckleberry Hill owned by Lowell Township and Bradford Dickinson White Nature Preserve owned by the Land Conservancy of West Michigan. At Huckleberry Hill, we will walk through a relatively intact and high-quality remnant that has responded readily to recent shrub and tree clearing. At the Bradford Dickinson White Nature Preserve, we will explore a more severely degraded remnant in the beginning stages of restoration, and discuss a long-term study on the site to identify plant community changes in response to thinning and burning. The trip will conclude with an optional stop at Gravel Bottom Brewery in Ada, where we will have an open discussion to share experiences and ideas regarding oak savanna protection, restoration, and research. This field trip will be outdoors, so dress accordingly for the weather and anticipated conditions.

Majka, Brian*[1] and Rick Rediske*[2].***Lake Michigan Coastal Wetlands and Dune Restoration***. [1]GEI Consultants, Allendale, Michigan. [2]Grand Valley State University, Allendale, Michigan. BM Email: bmajka@geiconsultants.com

The field trip will begin with a brief tour of Grand Valley State University's brand new Kindschi Hall of Science, followed by visits to two restoration sites. The Muskegon Lake Area of Concern (AOC) was designated by the EPA as an AOC for various reasons, including the loss of fish and wildlife habitat. To work toward the goal of restoring fish and wildlife habitat and eventual de-listing of the AOC, AOC stakeholders have combined resources and talent to implement over 20 restoration projects. The first site visited on this field trip will be the recently constructed Bear Lake hydrologic reconnection and wetland restoration. At this site, 0.15 $km^2$ of former celery fields adjacent to Bear Creek were disconnected from the creek, Muskegon Lake, and Lake Michigan by levees that were constructed to facilitate farming operations. To restore the wetlands, the site was dewatered and excavated in a manner that will maximize wildlife habitat. The levees were scheduled for removal in December, 2016, but the onset of winter has delayed removal and final reconnection until Spring 2017. The second site will be the Kitchel-Lindquist Dunes Preserve, owned by the City of Ferrysburg. This site, with views overlooking Lake Michigan, is managed as a public preserve and is a prime example of a dune that exists with a semi-urban interface. While the dune has been structurally intact, invasive plants species have begun to inhabit the site in recent years. Restoration efforts have involved primarily invasive species removal, although future efforts may include trail reconfiguration to minimize public impacts on the dune. The trip will conclude with an optional stop at Trail Point Brewery in Allendale for further discussion. This field trip will be outdoors, so dress accordingly for the weather and anticipated conditions.

Manion, Melanie*. ***Ottawa County Parks Dune and Riparian Restoration Field Trip***. Ottawa County Parks and Recreation Commission, West Olive, Michigan. Email: mmanion@miottawa.org

Ottawa County Parks manages nearly 26 $km^2$ of natural land. This field trip will compare the management strategies used by Ottawa County Parks in a highly intact ecosystem (Rosy Mound Natural Area) to those used on a lower quality property (Eastmanville Bayou) that requires extensive restoration efforts. The field trip will begin with a visit to the brand new Kindschi Hall of Science on Grand Valley State University's Allendale Campus. Following the campus tour, participants will travel 48 km to a Great Lakes Dune System at Rosy Mound Natural Area to observe a high quality site that has required minimal restoration efforts. This stop will include a strenuous 1.1 km hike to the Lake Michigan lakeshore. Our second site visit will be Eastmanville Bayou. This site contains 2.8 km of Grand River frontage, wetlands, bayou, and floodplain forest. Although Eastmanville Bayou exhibits high quality components, including a state endangered species, it is primarily a highly disturbed site that requires extensive restoration efforts. Restoration and management efforts include the use goats and student volunteers for invasive species control. The field trip will conclude with an optional stop at Trail Point Brewery in Allendale for further discussion. This field trip will be outdoors, so dress accordingly for the weather and anticipated conditions.

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- Fire Ecology and Management
- Watershed and Wetland Management
- Principles of Soil Science
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Corey Kapolka
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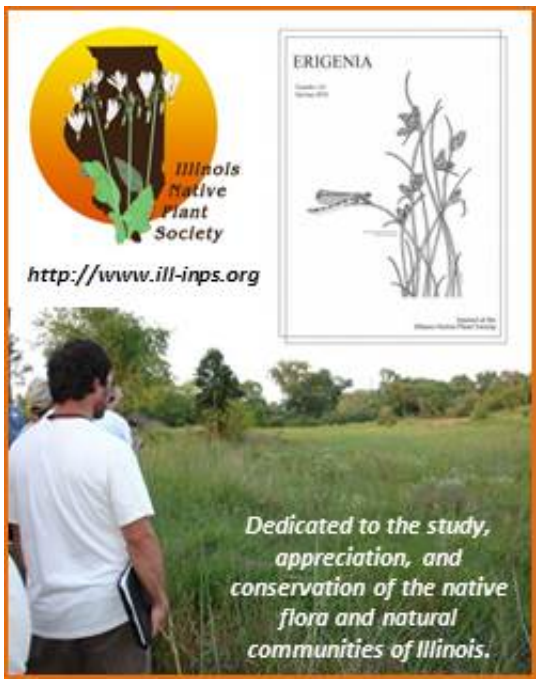
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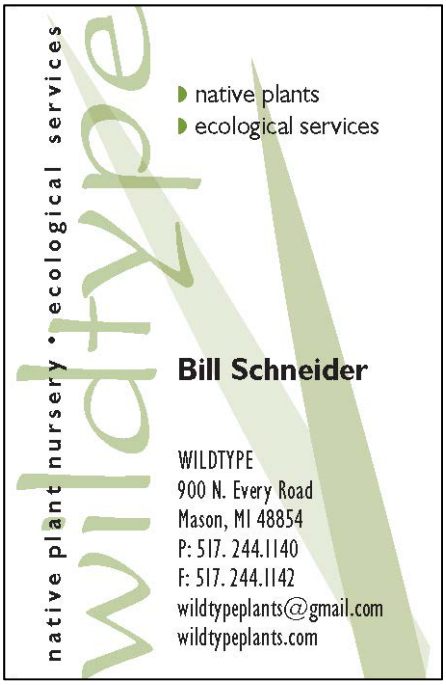


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- We are a non-profit organization that was recognized by SER as a regional chapter in March 2008. The Chapter serves a seven state region of Ohio, Indiana, Michigan, Illinois, Wisconsin, Minnesota, and Iowa.
- **Mission***:* To promote the science and practice of ecological restoration to assist with the recovery and management of degraded ecosystems within the Midwestern and Great Lakes regions.
- **Membership Benefits**
  - *Opportunity to network with colleagues and showcase your work at annual chapter meetings and state level events held throughout the year*
  - *Reduced chapter meeting registration rates*
  - *Chapter communications consist of the Restoration News Midwest blog and other social media streams that highlight regional ecological restoration issues, news, projects, and practitioners*
  - *Opportunities to promote ecological restoration-related events and discuss ecological restoration-related issues though the chapter social media*
  - *Webinars on relevant restoration topics in the region*
  - *Student members eligible to apply for research and practice grants through our Student Grant Program*
  - *Membership within our international parent society*
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