

4/11/2018 DRAFT ABSTRACT BOOK
TENTH SER MIDWEST-GREAT LAKES CHAPTER MEETING
April 20 to April 22, 2018
Stevens Point, Wisconsin



College of Natural Resources
University of Wisconsin - Stevens Point



WELCOME

Welcome to Stevens Point and the Tenth Annual Meeting of the Society for Ecological Restoration's Midwest-Great Lakes Chapter. Our meeting goal is to explore how to promote the call to expand restoration efforts and partnerships beyond the typical site scale to larger spatial scales encompassing multiple ecosystem types. Our scientific agenda for this three day meeting features a plenary presentation, two symposia, four workshops, 19 contributed poster presentations, 36 contributed oral presentations, three offsite field trips, and two volunteer work days on a range of topics that reflect our meeting theme and goal. This year's meeting is being held in conjunction with the 40th Annual Wisconsin Lakes Partnership Convention and Water Action Volunteer Symposium. As a result our scientific agenda includes a keynote presentation and 37 contributed oral presentations from the Wisconsin Lakes Convention. Our Meeting Hosts (University of Wisconsin-Stevens Point's (UWSP) College of Natural Resources and Extension Lakes) will offer a special plenary session that will provide an overview of the applied nature of the UWSP College of Natural Resources' Forestry program and how it engages students in ecological restoration in Wisconsin. Additionally, this is the third year we are able to offer meeting attendees continuing education credits. We hope you will enjoy another outstanding chapter meeting.

2018 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 Tenth Annual Chapter Meeting: *Rocky Smiley (Chairperson), Todd Aschenbach, Mary Damm, Mathew Dornbush, Steve Glass, Chris May, 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 (*Eric Olsen (Chairperson), Kim Becken, James Cook, Michael Demchik, Maud LaMarche*) who assisted with planning the meeting and provided onsite help. We thank Maud LaMarche for her help with setting up the online registration page. We thank Martha Holzheuer for her work in enabling us to offer continuing education credits through SER, the Society of American Foresters, and the International Society of Arboriculture and Lara Roketenetz for reviewing the registrations and confirming membership status. We also thank Island Press, SER, Steve Glass, Mike Lemke, Chris Lenhart, and Keith Summerville for their donations in support of our student grant program. We are also thankful for the participation of the meeting presenters, moderators, tour leaders, field trip leaders, volunteers, and attendees at our Tenth Annual Meeting.

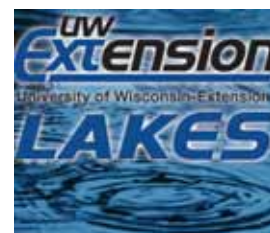
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Enjoy drinks and snacks while examining poster presentations, viewing sponsorship exhibits, and socializing with colleagues.

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KEYNOTE PRESENTATION ABSTRACT

Carpenter, Stephen*. **Past and future change in the Yahara Watershed: a social-ecological experiment.** University of Wisconsin-Madison, Madison, Wisconsin. Email: steve.carpenter@wisc.edu

My talk will present the Yahara 2070 project (<http://Yahara2070.org>) to evaluate potential futures of the Yahara watershed near Madison and its four lakes. This innovative project began with public input through interviews and workshops, leading to stories and art about the evolving future of Yahara. Four diverse stories became the basis for computer simulations of changing climate, human population, land use change, hydrology, soil and water biogeochemistry, and limnology of the lakes from 2010 to 2070. Throughout the process the public was engaged through discussions, presentations, workshops, a writing contest, a 30-minute TV special, and social media. The model results showed how human choices determined the natural capital of the watershed: capabilities to generate food, clean water, support biodiverse landscapes, mitigate floods, and so forth (<http://wsc.limnology.wisc.edu>). One sequel of the project is broad conversations about how best to address severe nitrogen and phosphorus pollution of Yahara's ground- and surface water in the face of climate change and growing demand for land.

PLENARY PRESENTATION ABSTRACT

Hames, Tracy*. **Landscape-scale wetland restoration in Wisconsin: there's more to it than just good science.** Wisconsin, Wetlands Association, Madison, Wisconsin. Email: wwa222@wisconsinwetlands.org

Over the past 150 years, Wisconsin has lost half of its original 10 million acres of wetlands to human development. This level of wetland loss has resulted in statewide impacts to the health of our watersheds, our waters, our fish and wildlife populations, and our economic and community well-being. Landscape level wetland restoration is needed to meaningfully reverse the impacts of wetland loss in Wisconsin. There are no formulas to guide the development and implementation of such efforts, but there are certain elements and considerations shared by successful large-scale wetland restoration projects. Opportunities and roadblocks influencing project success involve technical, policy-related, economic, and human aspects. This presentation will examine the elements and considerations, and the opportunities and roadblocks affecting successful large-scale wetland restoration actions using examples from across the varied landscapes of Wisconsin and other regions. Though incredibly challenging, large-scale wetland restoration efforts represent some of the most professionally and personally rewarding endeavors we can undertake as natural resource managers.

SYMPOSIA ABSTRACTS

River Floodplain Lake and Wetland Restoration in the Midwest Symposium Abstract

Lemke, Michael J. and Hua Chen. **River floodplain and lake restoration in the Midwest.** University of Illinois Springfield, Springfield, Illinois. ML email: mlemk1@uis.edu; HC email: hchen40@uis.edu

The main drivers of aquatic habitat development and succession within the floodplain of river ecosystems are the timing, duration, and magnitude of floodplain inundation. Because rivers are dynamic ecosystems composed of the river, wetlands, and shallow lakes within the floodplain, alteration of ecological drivers presents unique challenges to those who attempt to restore these ecosystems. Yet, the effort to restore these ecosystems brings with it exceptional opportunities to understand river ecology. Our symposium explores the importance of floodplain aquatic habitat restoration at different spatial scales and emphasizes the value of river-lake-wetland connections, floodplain habitat to wildlife, and intensive planning of restoration efforts in a series of large-scale projects along the Illinois River. The symposium presentations will feature how cooperative work with partners leads to better implementation of management plans and advancement of ecological theory.

River Floodplain Lake and Wetland Restoration in the Midwest Symposium Presentation Abstracts

Benjamin, Gretchen L*. **Tools for restoring the Upper Mississippi River Floodplain.** The Nature Conservancy, La Crosse, Wisconsin. Email: gbenjamin@tnc.org

Humans have altered the Upper Mississippi River for centuries. Alterations to the land and water have impacted the floodplain characteristics including increased sediment and nutrients from the land, discharge of pollutants, channelization of the river and impoundment for commercial shipping. Concerned scientists and river users observed a severe decline in habitat and species within the river and fought for a return of the historic river conditions. The result of the fight is a large river restoration program now known as the Upper Mississippi River Restoration program (original legislation WRDA 1986). Over 30 years of large river restoration has provided many lessons learned but most importantly shows habitat and species recovery can be achieved on a large scale. Over 100,000 acres has been improved through backwater dredging, island creation, floodplain forest regeneration, and off channel flow management. Long term monitoring also funded by the program has provided extensive mapping capabilities to measure land cover trends, as well as document water quality, fisheries and aquatic vegetation through extensive data collection. Restoration success from some of the projects is measured in 100s of thousands of migratory birds, fisheries monitoring that shows a 400X catch per unit increase from pre-project monitoring, the return of threatened and endangered species, and extensive fishing and hunting in areas that were devoid of use. Strong partnership with state, federal and NGOs communities has also enabled other restoration tools to be considered along with the UMRR projects. Partners have worked with the Corps of Engineers to manage the locks and dams to provide conditions that mimic summer seasonal variability in water levels. Changes in summer dam operations at 7 different locks and dams on the Mississippi River have

demonstrated that water levels can be maintained slightly lower to expose river mudflats to create optimum conditions for aquatic vegetation growth without impacting commercial shipping. These techniques are under consideration for additional dams on the system (29 locks and dams on the UMR) and to become routine practice for dam operations.

Chen, Hua*¹, Mike Lemke¹, Heath Hagy², and Andrew Casper³. **Values and lessons of floodplain lake restorations on the LaGrange Reach of the Illinois River.** ¹ University of Illinois Springfield, Springfield, Illinois. ² U.S. Fish and Wildlife Service, South Stanton, Tennessee. ³ John G. Shedd Aquarium, Chicago, Illinois. Email: hchen40@uis.edu

Floodplain wetlands in the Midwest have been lost or significantly degraded over the last century as a result of altered hydrology, sedimentation, and land use conversion. Networks of levees were erected in the early 20th century that isolated many floodplains from rivers to allow for development and agriculture. There is nowhere in the United States a system of lakes and wetlands on a river floodplain that has been so extensively studied, manipulated, and restored to different levels than along the middle, or LaGrange, reach of the Illinois River. Altered hydrology of floodplain is mainly achieved via changing the river-floodplain connectivity that may be characterized as open, partial, and limited. Open connections (e.g., Peoria Lake) are those where surface water moves between the river and floodplain wetlands at normal river elevations. Partial river connections (e.g., Chautauqua National Wildlife Refuge) occur at river levels intermediate between open and limited connections. Limited connections (e.g., Banner Marsh State Fish and Wildlife Area) typically characterize floodplains isolated behind large levees where water exchange does not occur between floodplains and the main river channel. Here, we give brief summaries of several case studies of floodplain restoration along LaGrange reach of the Illinois River using restored floodplain wetlands that are open hydrologically connected, partially connected, and limited connected. We will focus on the values and lessons we learn from these studies. By evaluating how well theory predicts the biotic responses (e.g., pattern of floral and faunal succession) to practical application of manipulating floodplain hydrology, we are better able to use theory for future restoration efforts.

Lemke, Maria^{1*}, Douglas Blodgett¹, and Jeffery Walk². **The Emiquon Preserve as a case study in Restoration Ecology.** ¹The Nature Conservancy, Lewistown, Illinois. ²The Nature Conservancy, Peoria, Illinois. Email: mlemke@tnc.org

The Nature Conservancy acquired the Emiquon Preserve along the Illinois River, Illinois, with the primary objective of restoring ecological floodplain processes and habitats that promote and sustain native species and communities. The Conservancy convened an Emiquon Science Advisory Council prior to restoration implementation that identified key ecological attributes (KEAs) for riverine and backwater targets, KEA indicators, and acceptable ranges for those indicators. Intensive monitoring of conservation targets (e.g., waterfowl, fishes) has been conducted since 2008 and used to assess restoration status as defined by the KEA framework. Alignment of the KEAs and indicator ranges with long-term monitoring provided significant insight into the roles of water level management and river connectivity for migratory waterfowl and fishes related to backwater habitat restorations. Current status assessments represent the time period prior to river reconnection and provides an important baseline for development and testing of hypotheses pertaining to ecological responses of these targets to future water management and riverine connectivity. Recent completion of a water control structure represents a critical intervention that provides potential to improve conservation status of those floodplain and riverine targets that depend on water management and river connectivity. However, the establishment of a river–floodplain connection should be managed to achieve a balance between

establishing hydrology that mimics natural flood pulses while minimizing contemporary threats such as excessive nutrient and sediment loads and invasive species. Continued review and modification of the KEA model in conjunction with a strategic monitoring program will provide critical information to guide relevant management decisions and testable hypotheses to reduce potential threats and achieve future restoration goals.

Lemke, Michael J.¹, Sara F. Paver², Keenan Dungey¹, Luiz Felipe M. Velho³, Angela Kent⁴, Luzia Cleide Rodrigues³ and A. Maria Lemke⁵. **Succession and success: monitoring pelagic microorganism communities in a newly restored river floodplain lake.** ¹ University of Illinois Springfield. ² University of Chicago, Chicago, Illinois. ³ Universidade Estadual de Maringa, Maringa, Brazil. ⁴ University of Urbana-Champaign, Urbana, Illinois. ⁵The Nature Conservancy, Lewistown, Illinois. Email: mlemk1@uis.edu

While the success of restoration efforts frequently depend on reconstructing ecological communities, time series observations of community structure over the course of restoration are rare. The primary objective of this line of study was to frequently sample and measure the diversity and abundance of the planktonic microorganisms (i.e., bacterioplankton, phytoplankton, planktonic protozoa, and zooplankton), as well as select physical and chemical parameters during five years of ecological restoration of Thompson Lake; a lake on the Illinois River floodplain lake recovering from 80 years of row-crop agriculture. The results show how ~~bacterio~~**bacteria**- and phytoplankton respond to changes in lake ecology and how initial instable conditions give way to what appears to be a stable state in a 2.5 year period. Observations on flood perturbations are given to help grasp how duration and extent of flood is absorbed by ecosystem dynamics. The microbial dynamics in a lake recovering from decades of agriculture reflect the instability associated with early stages of ecological restoration and have potential to serve as indicators for other restoration projects.

Richardson, William*, Lynn Bartsch, and Rebecca Kreiling. **Reconnecting floodplains with rivers to restore water quality ecosystem services.** U.S. Geological Survey, La Crosse Wisconsin. Email: wrichardson@usgs.gov

Ecosystem services provided by floodplains include removal of nitrogen, phosphorus, and sediments, and sequestration of carbon. Effectiveness of floodplains in providing these services is dependent on flood frequency, extent and location of the connection between floodplain and river. Tributary loading of sediments, nitrogen, and phosphorus to the Upper Mississippi River (UMR) contributes to the development of river and coastal eutrophication as well as hypoxic conditions in the Gulf of Mexico. Recent research has shown that management of river connectivity of channels to floodplains and backwater lakes and channels is an effective mitigation strategy to remove nutrients, sediment, and carbon from rivers. In this talk we discuss highlights of 2 studies measuring aspects of nutrient and sediment loss following some form of reconnection of flowing channels to backwaters or floodplains. The study sites include: 1) a recently reconnected floodplain of the Maquoketa River, IA, near the confluence with the UMR; 2) Halfway Creek, UMR tributary, Holmen, WI. At the Maquoketa River site there was one inundation event during the 2014 – 2015 study. Load of nitrate was also estimated during this 50 week period. Relatively large quantities of sediment, nitrogen and phosphorus were removed during flooding. Yet, relative to the total load, the total quantity of material retained was small. We will discuss highlights of sediment and nutrient load retention and nitrogen cycling at this site after flooding. The Halfway Creek Marsh Complex was recently reclaimed by the US Fish and Wildlife Service from agricultural use for water fowl habitat and sediment retention. We evaluated loads of nutrients and sediments over a 3 year period to determine retention by both types of wetlands.

We will discuss sediment and nutrient load retention and nitrogen cycling, as well as mitigation actions regarding accumulated nutrient and sediment mass after flooding.

Yetter, Aaron P.^{*1}, Heath M. Hagy^{1,2}, Christopher S. Hine¹, and Joseph D. Lancaster¹. **Waterbird abundance in relation to floodplain connectivity and wetland habitat restoration in the Illinois River Valley.** ¹ Illinois Natural History Survey, Havana, Illinois. ²U.S. Fish and Wildlife Service, Stanton, Tennessee. Email: ayetter@illinois.edu

Floodplains of large river systems in the Midwest are often disconnected or partially disconnected from flood waters for the benefit of agriculture, urban development, and natural resource management. Many of these rivers are drastically altered from their natural hydrology to allow for commercial navigation, recreation, and managed flows. In these altered systems, tradeoffs in ecosystem services exist between connected and disconnected floodplains. We will present data from the Illinois River of central Illinois that illustrates the tradeoffs in biotic communities, especially waterbirds, using floodplain wetlands that are hydrologically connected, partially connected, and isolated behind levees. Wetland birds, fishes, and vegetation all respond differently to floodplain connectivity and management objectives should be considered carefully prior to restoring hydrologic connections in floodplains of highly altered river systems.

Advancing Like a Fire Through the Understory – Progress and Perspectives in Oak Savanna Restoration Symposium Abstract

Bassett, Tyler. **Advancing like a fire through the understory – progress and perspectives in oak savanna restoration.** Michigan State University, East Lansing, Michigan. Email: basset17@msu.edu

Oak savannas, open-canopied forests characterized by an herbaceous ground layer, were historically common in the upper Midwest. Since European settlement, Midwestern oak savannas have been displaced by agriculture, development, and succession to closed-canopied forest following fire suppression. Restoration of oak savannas is a vital component of returning biodiversity and function to Midwestern landscapes, but faces several unique challenges. Savannas are structurally complex and variable by definition. Complex landscape level processes structured historical savanna communities, including fire, large mammalian grazers, and patterns of seed dispersal. These processes likely function differently in the small restorable patches that remain, and in the degraded landscapes in which they are found. As a result, restoration strategies likely require a combination of both historical (e.g., fire) and novel (e.g., tree thinning, seed additions) processes, and it is important to identify how these strategies influence both the trajectory and outcome of oak savanna restoration. Creative methods are also needed to facilitate the transfer of information between scientists and practitioners, in order to efficiently capitalize on our evolving understanding of the restoration process. Finally, savanna restoration often occurs in landscapes with a patchwork of land uses and stakeholders, including private and public landowners, hunters, and conservationists. The valuation of oak savannas for maintaining regional and global biodiversity vs. other ecosystem services varies among these stakeholder groups. The future of Midwestern oak savannas depends upon bridging the gaps between the research on how oak savannas function and how implementing that understanding can be accomplished in ways that address the needs of all stakeholders. In this symposium, the presentations will focus on the effectiveness of management strategies, as well as how these strategies are implemented by engaging citizen scientists, hunters, researchers, and a range of other stakeholders in collaborative efforts.

Advancing Like a Fire Through the Understory – Progress and Perspectives in Oak Savanna Restoration Symposium Presentation Abstracts

Bassett, Tyler*¹, Lars A. Brudvig¹, Ralph Grundel², and Noel B. Pavlovic². **A regional scale assessment of oak savanna restoration: the impacts of prescribed fire and thinning on groundlayer diversity and composition in the southern Great Lakes Basin.** ¹Michigan State University, East Lansing, Michigan. ²U.S. Geological Survey, Chesterton, Indiana. Email: basset17@msu.edu

Oak savannas are a globally-threatened biome and one of the most endangered ecosystems in the Midwestern United States and Canada. While progress has been made in understanding what constitutes effective restoration of degraded oak savanna, most studies to date have been limited in geographic scope, spanning one site to a single landscape. As a consequence, we lack understanding of regional-scale variation in approaches to oak savanna restoration, a generalizable understanding of how this variation might affect restored structure in oak savannas, or how the impacts of restoration compare to influences of regional-scale environmental gradients, such as soil conditions, light availability, land-use history, and landscape context. We present initial results in the development and testing of a model that assesses how variation in management history (burn only, thin only, burn and

thin, unmanaged controls) differentially influences understory plant communities across the southern and western Great Lakes Basin. We focus on how understory plant communities respond to restoration because they comprise the majority of plant biodiversity in oak savannas, and are therefore indicators of habitat quality. Differences among management histories had large effects on the structure of oak savannas. Notably, thinning significantly reduced canopy tree basal area, increasing light availability, and all management histories reduced litter cover above unmanaged controls. We found strong biogeographical influences on understory composition and diversity, but when controlling for biogeographical differences, composition and diversity varied along both edaphic and management gradients. Importantly, understory plant communities were sensitive to the same structural components, light availability and litter, that responded to management. For example, diversity was negatively correlated with both litter and stand basal area. Given these promising initial results, our goal is to collect additional data, to refine our model and further clarify effective and efficient methods for managing understory oak savanna plant communities.

Lincoln, Jesse M.*. **Seeing the savanna through the trees: a multifaceted approach to savanna restoration on public lands in southern Michigan.** Michigan Natural Features Inventory, Lansing, MI. Email: lincolnj@michigan.gov

Before European settlement, southern Michigan was characterized by over one million acres of savanna habitat. Less than one per cent of this community type remains as a result of agriculture, development, and fire suppression. The Michigan Department of Natural Resources owns nearly 400,000 acres of State Game Areas (SGA) across the southern part of the state and that land is managed for a myriad of interests, primarily habitat for game species. Remnant savannas on those public lands often persist in a relatively degraded state within a fragmented landscape and their condition can be difficult to assess with little to compare to. Michigan Natural Features Inventory ecologists conducted vegetation surveys across SGAs to identify and prioritize remnant savanna communities to incorporate these stewardship of these imperiled ecosystems into wildlife management plans.

Maier, Craig*. **Crowd-sourcing uncertainty - connecting practitioners' questions to research and research needs.** Tallgrass Prairie and Oak Savanna Fire Science Consortium, Madison, Wisconsin. Email: cmaier2@wisc.edu

Accelerating the awareness, understanding, and application of research is central to the Joint Fire Science Program's Fire Science Exchange Networks. Since 2012, the JFSP-funded Tallgrass Prairie and Oak Savanna Fire Science Consortium has held field days, workshops and conferences from Toledo to Omaha and many points in between. Despite the variation in landforms, climate, hydrology, soils, and species across this range, the science, restoration tools, and lessons learned shared at these events suggests land managers across the region share many similar challenges to using prescribed fire for oak ecosystem restoration and management. In 2015, we collected over 200 questions from 80 participants at the 2015 Midwest Fire Conference. The group included researchers and land managers, and participants varied widely in their length of experience and number of sites they have worked with—from many decades managing multiple sites to early career professionals and private landowners working with one or two sites. All participants shared one or more responses to the prompt, “What questions do you have, that if answered, would reduce your uncertainty about restoring or managing an oak ecosystem site that you work on?” The questions shared by this crowd have helped the consortium leadership and advisory board prioritize our work in oak ecosystems. Priority topics for improved knowledge included: mitigating the effects of invasive plant species; protecting rare wildlife

species; and improving understanding of the oak ecosystem fire regime (including seasonality, frequency, fuels, and severity). The consortium's objectives for 2018-2020 include supporting peer-to-peer knowledge exchange to increase the rate at which lessons learned are shared and fostering research to increase understanding of fuels, fire behavior, and fire effects.

Mulvaney, Christopher R.*. **Oak ecosystem recovery collaborative: using a collective impact framework to preserve and restore oak communities in the Chicago region.** The Morton Arboretum, Lisle, Illinois. Email: mulvaney.christopher@gmail.com

Oak dominated ecosystems are a critical habitat feature in the Midwest. Yet, in Northeastern Illinois and its surrounding states, they are under intense, combined pressures from a number of threats, including habitat fragmentation, development, direct cutting, invasive species, changing climate, and lack of management. In addition, oak populations are suffering from severe reproductive failure. Very old trees characterize many of the region's oak stands with an understory almost completely lacking in new recruits, giving way to more shade-tolerant species such as sugar maple. To counter these challenges, several organizations and agencies are working together, using a collective impact framework, to protect and restore oak ecosystems across the Chicago Wilderness Region - a landscape spanning Southeastern Wisconsin, Northeastern Illinois, Northwestern Indiana and Southwestern Michigan. In 2014, these partners completed a spatial analysis of oak ecosystems across Northeastern Illinois over the last 150 years. This study, based on a similar analysis for McHenry County, Illinois completed in 2005, documented the extent of oak dominated communities during three points in time: 1) pre-Euroamerican settlement; 2) 1930s; and 3) 2010. This analysis has since been expanded to include Southeastern Wisconsin, which is expected to wrap up in early 2018. The information gleaned from this mapping effort is being used to advance a number of goals identified in the Oak Ecosystems Recovery Plan for the Chicago Wilderness Region. In addition to helping convey the story of the region's oak heritage, it provides a solid baseline of information that can guide the preservation, restoration, and expansion of these important natural communities. This presentation will include an overview of the remnant oak mapping project and discuss the various ways partners are working together to develop a collaborative, regional framework to preserve and recover the remaining oak ecosystems across the Chicago Wilderness landscape.

MEETING HOST PLENARY SESSION ABSTRACT

Demchik, Michael C. *, James E. Cook*, and Eric R. Olson. **Applied learning through practice, research and reflection: engaging University of Wisconsin-Stevens Point College of Natural Resources students in meaningful ecological restoration in central Wisconsin.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: Michael.Demchik@uwsp.edu

This plenary session will focus on the applied nature of the University of Wisconsin-Stevens Point's (UWSP) College of Natural Resources Forestry program and how faculty, staff, and students work together to carry out a shared mission. Specifically, the mission of the UWSP College of Natural Resources Forestry major is to provide interdisciplinary, application-based educational programs that develop ethical, employable forestry professionals with the expertise to manage resources sustainably. For a program to be successful, much of the learning is carried out in the field: faculty and students use UWSP properties, public land, and some private property for hands-on instruction. Being situated in the central Wisconsin tension zone, there is considerable variety of community types near Stevens Point. This variety allows students to experience restoration and management projects that involve prairie, savannah, and northern forests all within a short drive of the main campus. The major provides a solid understanding of ecological process and function, and students are trained in an interdisciplinary framework. Within the forestry major are four options, one of which is Ecosystem Restoration and Management. This option includes a broader biological foundation for students, and management concepts focus on conservation biology, restoration, and large scale ecosystem management.

ORAL PRESENTATIONS – ALPHABETICAL ORDER

Aschenbach, Todd A.*¹ and Pat Ruta McGhan². **Sand prairie restoration at the Newaygo Prairies Research Natural Area, Manistee National Forest, Michigan.** ¹Grand Valley State University, Allendale, Michigan. ²Manistee National Forest, Baldwin, Michigan. Email: aschenbt@gvsu.edu

Sand prairies, once an integral part of Michigan's oak-pine barrens ecosystem, have been degraded mainly due to fire suppression and agriculture. Although restoring sand prairie can increase biodiversity and improve ecosystem function, restoration success may depend on site preparation. At the Newaygo Prairies Research Natural Area, *Carex pensylvanica* (*C. pens.*), a native, but invasive sedge, dominates targeted restoration sites. This study evaluates five site-preparation treatments that were implemented in 2013 to decrease *C. pens.* dominance: fire; herbicide; fire followed by herbicide; herbicide followed by fire; and no treatment (control). Following site preparation, plots were seeded with native species. Data on resident and seeded species richness, cover, and biomass from 2014 to 2017 will be presented. Results will be used to determine the most effective site preparation method in areas targeted for sand prairie restoration in the Manistee National Forest, Michigan.

Barak, Rebecca^{1,2,3*}, Zhao Ma¹, Kay Havens², and Lars Brudvig³. **Linking decision-making for seed mix design to restoration outcomes in midwestern restored prairies.** ¹Purdue University, West Lafayette, Indiana. ²Chicago Botanic Garden, Glencoe, Illinois. ³Michigan State University, East Lansing, Michigan. Email: barakreb@msu.edu

Studying the relationship between restoration actions and outcomes (i.e, between seed mixes and plant communities) can help land managers design more effective restorations. However, the process of ecological restoration begins long before seeds are sown, in the decision-making process of land managers and other stakeholders in the restoration process. Land managers face multiple, potentially confounding, objectives and constraints as they make decisions for restoration. While restoration ecologists tend to focus on biological considerations for restoration, managers must also consider social and economic drivers. In this presentation, I will report results from a two-part social-ecological survey of restoration land managers working in the tallgrass prairie ecosystem. Through this project, I am working to determine how decisions are made during seed mix design and how aspects of this decision-making process are reflected in plant community outcomes in restored prairies. To do this, I first conducted semi-structured interviews with a small group of prairie restoration land managers, seeking to understand the decision processes they use to design seed mixes. In addition, I wanted to understand the range of biological, social, and economic constraints managers face while designing seed mixes. Next, I surveyed managers to determine how they made decisions regarding the diversity and composition of seed mixes used to restore particular prairies in Illinois, Indiana and Michigan. These were prairies for which we had collected data on the realized plant community through field surveys and compiled information on restoration actions, such as fire frequency. The goal for this work is to tie managers' decision-processes for seed mix design through plant emergence and establishment, and into realized restored plant communities, and biodiversity outcomes.

Blume, Louis^{1*}, Craig Palmer², Brick M. Fevold², Molly M. Amos², Adam Bucher², and Judy Schofield². **Scaling the application of QA/QC strategies in ecological restoration projects.** ¹ U.S. Environmental Protection Agency, Chicago, Illinois. ² CSRA, LLC, Alexandria, Virginia. Email: blume.louis@epa.gov

Project managers responsible for ecological restoration projects are often under intense pressure to deliver results within a short timeframe and with a fixed budget. When concerns exist on whether the project can be accomplished on time and within budget, managers may be tempted to reduce effort and costs by eliminating or reducing investment in quality assurance (QA) and quality control (QC). Such an approach to meet short-term needs is ill-advised and can lead to long-term problems that include: 1) project setbacks due to insufficient planning; 2) an inability to achieve project goals and objectives; 3) an inability to describe data quality essential to support effective decision making; 4) regulatory non-conformance; 5) higher risk to personnel safety; and 6) ultimately inflated project costs. Quality planning and oversight in ecological restoration projects should be commensurate with the factors contributing to the project scope. These factors include the project goals and objectives, risks associated with decision errors, administrative or programmatic resources, project schedules, and as importantly, the temporal and spatial ecological scale at which restoration actions are predicted to impact. How can project managers gauge the level of application of QA/QC strategies in their projects? This presentation provides guidance on key elements of quality planning and ways to consider how each can be appropriately scaled when defining a project's scope.

Brown, Carrie L.* and Shana Byrd. **Seeing is believing: engaging the conservation community in a network of native plant demonstration sites regionally and throughout the U.S.** The Dawes Arboretum, Newark, Ohio. Email: clbrown@dawesarb.org

The “National Seed Strategy for Rehabilitation and Restoration 2015-2020,” developed by the Plant Conservation Alliance, chaired by the Bureau of Land Management, in cooperation with Federal and non-Federal partners, is coordinating efforts to ensure the right seed is in the right place at the right time. A nationwide network of seed collectors, farmers, growers, seed banks and restoration ecologists will assist in acquiring appropriate plant materials for restoration efforts. To reach this goal, it is necessary to develop tools that enable land managers to make timely, informed seeding decisions for ecological restoration. During the 2017 National Native Seed Conference, a task force was formed to publicize the use of native plants across the United States, also known as Action 3.1.2 in the National Seed Strategy. This call to action for restoration practitioners forms a network of demonstration sites to serve as living models, assisting in decision-making by showing how to restore habitat with native seed and plant materials across multiple ecoregions. Case studies using locally sourced native plant materials include the restored 0.28 km² Dutch Fork Wetlands and 0.03 km² Reforestation Reserve at The Dawes Arboretum in Newark, Ohio. To survey these types of demonstration sites, a three-pronged approach was developed in order to create a Native Plant Demonstration Site Network: 1) compile existing native plant demonstration sites through surveying arboreta, botanical gardens, universities, nurseries and others demonstrating native plants in landscape restoration; 2) form a national network of accessible native plant demonstration sites; and 3) identify underrepresented ecoregions and develop partnerships to ensure their representation. Coordinating with multiple agencies, The Dawes Arboretum led the development of this initiative that is now gathering the information needed to lend insight for practitioners on best management approaches to native seed conservation.

Carlson, Jason, Todd Polacek, and Will Overbeck*. **Bridging the gap between innovation/technology and restoration in the fight against invasive *Phragmites*.** Applied Ecological Services, Inc., Brodhead, Wisconsin. Email: Will.Overbeck@appliedeco.com

The invasive phenotype of *Phragmites australis* (Cav.) Trin. Ex Steud. continues to spread and invade new areas, having numerous and diverse deleterious effects on Great Lakes shorelines, coastal marsh habitats, inland wetlands, and even transportation/transmission corridors used as vectors of invasion. Management approaches by natural area land managers vary dramatically, depending on location and land manager capability. A cross-disciplinary team of natural resource professionals have developed new technology, field management techniques, and ecological responses for adaptive management (prioritization, logistics, treatment, and monitoring) on *Phragmites* infestations within ecological restoration sites, based on years of experience and data collection. New aerial imaging technology and remote sensing approaches are contributing to efficiencies of *Phragmites* monitoring in Lake Michigan's Green Bay, Lake Huron's Saginaw Bay, and elsewhere, with significant agency, academic and NGO collaboration.

Catchpole, Floyd B.* **Observations on the response of sand savanna under management with fire, thinning and invasive species control.** Forest Preserve District of Will County, Joliet, Illinois. Email: fcatchpole@fpdwc.org

The Forest Preserve District has been actively managing sand savanna in the Kankakee Section of the Grand Prairie Natural Division of Illinois since the 1980's. Early management dependent on fire at approximately three year intervals failed to control native woody species. Canopy closure of dry-mesic sand woodlands (formerly savannas) continued. Mesic to wet sand prairies became increasingly shrubbed over during this time and many mesic prairies converted to oak woodlands. About 10 years ago, fire frequency was increased to two-year intervals, deer culling began, aggressive control of native woody plants began, subsurface drainage pipes were disabled and ditches closed. These activities have resulted in partial recovery of dry-mesic sand savanna, increase in rare plants, and recovery of some wet sand prairies. Hydrologic changes and native colonizing species entering more disturbed wetlands have made it difficult to get fires to burn through these areas. Herbicided girdle control of oaks appears to produce the best results with the least impact on native communities. Associated increases in fire intensity and difficulty traversing heavily thinned areas do require adequate burn control resources in the heavy fuels.

Chien, Eric M.* and Susan M. Galatowtisch. **Resilience-based site assessment tool to guide and prioritize restoration practice.** University of Minnesota, Twin Cities, Minnesota. Email: chien072@umn.edu

Assessing ecological resilience has the potential to provide insights that are fundamental to making restoration outcomes more predictable. What constrains ecosystem recovery? How will a site respond when stressors are ameliorated? What is the likelihood restored site conditions will persist over time? Despite the intuitive theory-practice link and increasing reference within academic and popular literature, ecological resilience still has little formal application in restoration practice. Development of operational tools to assess ecological resilience that remain within the bounds of theoretical understanding has lagged behind the rise in interest to incorporate resilience in restoration practice. The specific content of resilience assessments for restoration need to be tailored to specific regional ecosystems, and support decision-making around broadly relevant and significant challenges within restoration practice. The resilience tool we are developing seeks to: 1) identify if there is a hierarchical

structure of resilience processes, and link them to associated intervention pathways for achieving restoration objectives, 2) indicate how and to what degree landscape level resilience processes have an effect on restoration project success and persistence over time, 3) identify if the presence of certain resilience processes within a given restoration context indicate that a project is likely to be infeasible, and 4) prioritize project selection by characterizing the relative likelihood of restoration success between restoration projects based on the resilience of those project sites. Challenges with generating certain quantitative measures of resilience notwithstanding, ecological resilience provides a framework for assembling a synoptic resilience assessment tool with useful restoration applications. The effectiveness of this resilience assessment tool will be determined through a field validation process for sufficient accuracy and consistency across real world restoration projects.

Cook, James E.* **Can our restoration efforts in sedge meadows be too successful?** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: jcook@uwsp.edu

The restoration of sedge meadows typically involves the introduction of wetland-associated species. Managers often need a specific level of wetland obligates on the site within 5+ years. However, it is seldom asked if there might be ecological ‘losses’ associated with heavy seeding. To address this question, we documented compositional dynamics and dominant species from 2011 to 2015/2017. Intense restoration measures were employed, and 23 species were seeded on this site. In September 2011 a systematic array of 103 sample points along 23 transects was established. Cover by species was ocularly estimated in fall of 2011, 2012, 2014, 2015, and mid-summer, 2012 and 2017. Species dominance, species density, and percent wetland obligate were determined. The fate of the five most common species in 2011 and 2012 was assessed to indicate structural and habitat changes. To evaluate overall compositional change, non-metric multidimensional scaling (NMS) ordination was used. From 2011 to 2014, total fall cover increased from 35 to 75%, and then declined in 2015. Concurrently, cover contributed by wetland obligates increased from 36 to 96%. In contrast, species density declined from 7.2 to 3.0 species/quadrat ($p < 0.01$). The relative abundance of the top two dominants ranged from 49% in summer 2012 to 80% in the fall 2015. The dominant species shifted rapidly to wetland obligates (wool grass and common rush) and one of the two was dominant in 90% of the quadrats by 2015. Several relatively common species in 2011 and 2012 declined precipitously by 2015. NMS ordination indicated strong convergence over time. Thus, by year four the ecosystem had two ‘super dominants’, a loss in species density, and homogenization of species composition. This accelerated succession probably has important implications. The simplification may have eliminated habitat for insect specialist and open-habitat vertebrates. I suggest that all ecological functions deserve consideration when seeding density and composition are decided.

DeLaundreau, Maria^{1*}, Rebecca Montgomery¹, William Kiser², Tim Schlagenhaft³, and Meredith Thomsen². **Tree sapling responses to reed canary grass treatments across four floodplain sites in southeast Minnesota.** ¹ University of Minnesota, Saint Paul, Minnesota. ² University of Wisconsin, La Crosse, Wisconsin. ³ Audubon Minnesota, Saint Paul, Minnesota. Email: dela0271@umn.edu

Many forested wetlands in the Upper Mississippi River floodplain have been converted into monocultures of invasive reed canary grass (*Phalaris arundinacea*; RCG), and forests cannot regenerate once these monocultures form because tree seedlings are unable to compete. Native floodplain forest communities are a restoration priority because they are habitat for many species, including neotropical migrating birds, and provide valuable ecosystem services. To reverse conversion of forest to RCG, we need to establish best management practices for RCG control and tree restoration treatments. Here, I present results on first year growth and survival of two stock types of four tree

species planted into two RCG treatments. We selected four sites dominated by RCG in active floodplains and treated half of the RCG plots with Rodeo (glyphosate), and half with Oust XP (sulfometuron methyl). In 2016 we implemented RCG treatment followed by spring 2017 plantings of small bare root and large containerized cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), swamp white oak (*Quercus bicolor*), and hackberry (*Celtis occidentalis*). Preliminary results suggest greater growth and survivorship of trees when RCG has been treated with Rodeo, but the advantage is not large so land managers have flexibility in their herbicide choices. With greater growth in bare root stock, especially cottonwood and silver maple, land managers may want to densely plant cottonwood and silver maple bare roots to promote fast growth tree species to shade out RCG.

Demchik, Michael C.^{*}, Kevin Burns, and Tom Quinn. **Restoration forestry at the Central Wisconsin Environmental Station: the plan and early initiation.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: mdemchik@uwsp.edu

The forests on the Central Wisconsin Environmental Station main facility and the adjacent Minister Lake property were both predominantly even age forests with a limited history of management and developing forest health issues. For these forests, there was a desire to: 1) promote and develop large diameter, long-lived trees; 2) promote user safety in high-use areas but to promote snag development in low use areas; 3) promote regeneration of native species and diversify the species composition; 4) diversify the age structure of the forest; 5) increase coarse woody debris; and 6) provide demonstration ecosystems (i.e. savannas, aspen coppices, gap regeneration, etc.). The first steps of meeting these goals have been completed in fall 2017. These first steps included: 1) timber marking and site planning; 2) commercial timber harvest; 3) timber harvest completed by students as part of their natural resource education; 4) invasive species control; and 5) community outreach to adjacent landowners. Activities planned for spring 2018 include: savanna grass seeding/plug planting, invasive species control and seedling planting in gaps. Steps and processes will be discussed during this presentation.

Ehlinger, Timothy,^{1*} Alice Thompson², S. Andrew McGuire¹, and Aaron Menke². **From cabbages to cordgrass; Pike River restoration in an urban context.** ¹University of Wisconsin-Milwaukee, Milwaukee, Wisconsin. ²Thompson and Associates Wetland Services, South Milwaukee, Wisconsin. Email: Ehlinger@uwm.edu

Beginning in the 1880s, the Pike River was dredged and straightened to improve agricultural drainage, which resulted in: 1) the channel becoming disconnected from its floodplain; 2) wetlands being drained and filled; 3) prairies were plowed; and 4) fish passage was blocked. Towns and villages grew up alongside an altered, low functioning river with flashy flows, poor water quality and degraded fisheries. Accelerating urban development in Mt. Pleasant since the 1970s resulted in increased flood frequencies and magnitudes, impacting the village, downstream communities, and ultimately Lake Michigan. The Mount Pleasant Pike River Restoration Plan (1998) was the result of a year-long facilitated discussion among a wide range of stakeholders including the Village of Mount Pleasant, Wisconsin Department of Natural Resources, engineers, university scientists, and community leaders. Implementation of the 9-Phase plan, made possible by a unique multi-year Chapter 30 permit, began in 2002 and has created a newly restored river corridor from its headwaters on Old Spring Street downstream approximately 9 km to the county line in 2016. Using an adaptive, phased approach, the Pike River restoration has evolved as each reach was restored and monitored. Techniques of using coir logs, constructed fabric wrapped banks, fish structures, and native plantings have been integrated with

the construction of an expanded floodplain bench and new channel meanders. The successes and challenges of this restoration include managing water quality and restoring river biota, creating fish habitat in a newly graded river, and establishing native vegetation in an urban setting.

Evans, Bryn E.^{1*}, Timothy R. Van Deelen², and Shawn S. Crimmins³. **Assessing semi-aquatic mammal status following habitat restoration: cost effectiveness and recommendations.**

¹University of Maine, Orono, Maine. ²University of Wisconsin-Madison, Madison, Wisconsin.

³University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: bryn.evans@maine.edu

Estuaries and riparian areas are frequent targets for remediation work and the effort required to restore physical, chemical and biotic components of these areas is often high. In many cases one goal is to restore populations of native wildlife species, but directly assessing this goal is not always explicit and incurs additional costs. However, knowing whether it has been met is important for understanding remediation success and for correctly assessing next steps in an adaptive management framework. We used two approaches to assess the status of native semi-aquatic mammals following extensive restoration work in the St. Louis River Area of Concern (AOC) located between Duluth, Minnesota, and Superior, Wisconsin. Over eight months from May 2015 to January 2016, we deployed trail cameras along waterways within the AOC and two reference areas to detect river otter, mink, beaver and muskrat. In fall, winter, and spring, we also flew aerial surveys for sign of beaver, otter and muskrat. Despite seasonal variation in estimated rates of occupancy, results from both approaches indicate population status of target species within the AOC were comparable to the less-impacted reference sites. From camera surveys, river otter were the most frequently detected, suggesting that bioaccumulation issues at the AOC may be negligible. Placing sites very near the water improved detection probabilities, though we recommend frequent revisits to maintain sites and obtain accurate estimates of occupancy. Aerial surveys were less consistent between study areas due to weather limitations, and generated coarser data. However, they did confirm beaver presence in one study area when cameras could not, and newer aerial survey technologies may improve cost effectiveness and logistic flexibility. Our results suggest that remote cameras can be reliably used to monitor the recovery of wildlife species after remediation efforts, and benefit managers by collecting data on numerous species continuously.

Fevold, Brick M.^{1*}, Judy Schofield¹, Rob Sutter¹, Craig Palmer¹, Elizabeth Benjamin¹, Molly M. Amos¹, and Louis Blume². **A data management plan template for ecological restoration and monitoring.** ¹CSRA, LLC, Alexandria, Virginia; ²U.S. Environmental Protection Agency, Chicago, Illinois. Email: brick.fevold@csra.com

Data management planning is a fundamental component of managing ecological restoration projects. For federally funded projects, data management planning is mandated by executive order, effectively placing the burden of data management planning on federal agencies and collaborators working on their behalf. However, federal guidance is limited for developing a data management plan (DMP) that can serve as both a comprehensive yet practical planning tool for ecological restoration projects. A variety of DMP templates are available but they often reflect the needs of a specific program or institution and lack essential standard elements for comprehensive data management planning. In this presentation, a working concept of a DMP template is proposed for ecological restoration projects. Template elements are based on best practices instituted in policies by select academic and government sources, and include those necessary to meet U.S. EPA requirements for quality documentation (i.e., quality assurance project plans). The order of template elements loosely follows a workflow of a generalized project data lifecycle and addresses key topics such as: 1) project (or program) description

and administration; 2) data acquisition and collection; 3) organization, storage and security; 4) data processing and analysis; 5) quality assurance; 6) documentation and content standards; 7) preservation and archiving; 8) sharing and reuse; and 9) policy-based legal and ethical requirements.

Gordon, Brad*, Olivia Dorothy, and Eileen Shader. **Floodplain restoration in the Upper Mississippi Basin: connecting the dots between floodplain management and water quality.** American Rivers, Washington, D.C. Email: bgordon@americanrivers.org

Naturally functioning floodplains offer numerous benefits. These benefits include fish and wildlife habitat, flood storage, groundwater recharge, and recreation. Another benefit that needs to be discussed more is nutrient reduction and water quality. The 2017 ‘dead zone’ in the Gulf of Mexico was the greatest on record. This ‘dead zone’ and other algal blooms throughout the country are caused by excess nitrogen and phosphorus. In order to address the excess nutrient runoff that causes these algal blooms, states began developing nutrient reduction strategies in the Mississippi River basin. Implementing conservation practices to filter nutrients from surface runoff and tile drainage has made some progress. However, the practices currently included in state strategies consist mostly of on-field and edge-of-field practices. More practices are needed which can make significant reductions of nutrients that have already reached streams and rivers. One such practice that could be very effective is floodplain restoration. We conducted a literature review of over 100 articles and reports assessing the effectiveness of floodplains at reducing nutrients. Average floodplain reductions of nitrogen and phosphorus are comparable to those of other conservation practices, but their variability causes hesitation for inclusion in nutrient reduction strategies. As more studies have been completed on floodplains removing nutrients, there should now be enough confidence in their effectiveness and role in improving impaired waters and reaching state nutrient reduction goals when restored or designed correctly. This presentation will compare the nutrient removal effectiveness of floodplain restorations to other conservation practices, describe some of the design features of floodplains that enhance nutrient removal, and discuss ideal placements for restorations meant to reduce nutrients.

Grieser, Jennifer M.*. **Setting achievable goals for urban stream restoration utilizing stream functions pyramid.** Cleveland Metroparks, Parma, Ohio. Email: jmg2@clevelandmetroparks.com

In 2013 Cleveland Metroparks developed an Ecological Restoration Master Plan for Acacia Reservation – a former private golf course including a portion of the mainstem of Euclid Creek. Despite several grant applications, the Park District was initially unsuccessful in garnering appropriate funding to implement the Plan’s highest priority recommendations. In addition to ongoing conversations and site visits with potential funders, Cleveland Metroparks used the Stream Functions Pyramid to succinctly communicate project goals and expected ecological outcomes. This led the way to successfully receiving grants from Ohio EPA’s Water Resources Restoration Sponsor Program and Surface Water Improvement Fund to restore 274 m of Euclid Creek. In 2016 and 2017, the Park District implemented the project using a design-build approach with design by Biohabitats and construction by Meadville Land Service. The project focused on floodplain reconnection, increased bed form diversity, improved channel geometry, and riparian buffer establishment. This presentation will describe the use of the Stream Functions Pyramid for setting achievable restoration targets, share pre-restoration data and early post-restoration results.

Herron-Sweet, Christina*, Ian Lane, and Dan Cariveau. **Similarity of bee communities in remnant vs. restored tall grass prairie fragments.** University of Minnesota, Saint Paul, Minnesota. Email: cherrons@umn.edu

Agricultural development of North America's tall grass prairies has made it one of the most threatened habitats in the United States. Not only has prairie been lost through agricultural activity, but the remaining habitat fragments are often isolated. Dispersal of prairie fauna from remnant habitats to restorations face many potential barriers, and it is unclear whether fauna is characteristic of remnant prairie communities or of the surrounding agricultural matrix. One group that is likely impacted by these challenges are bees, which are of particular interest due to their ecological importance and potential declines. Using bees as a model system we asked how agriculture influences the community colonizing prairie restorations from prairie remnants. We selected five restorations in Clay County Minnesota and paired them with nearby remnant sites ranked with high to excellent plant biodiversity by the Minnesota Department of Natural Resources. We sampled bee and plant communities at all sites in 1 ha sections every three weeks beginning in May and ending in September 2017. We collected over 4,000 bee specimens and recorded 120 different flowering plants. Remnant prairies had higher plant species richness, but usually lower overall floral abundance compared to restored prairies. Restored prairies also had higher bee abundance compared to remnants and did not always share the same suite of bee species. The results of our study indicate that current efforts at tallgrass prairie restorations, although they provide habitat to large abundance of bees, may not support bee communities equivalent to remnant prairies.

Johnson, Wade A.* and Gina L. Quiram. **A restoration evaluation program for Minnesota.** Minnesota Department of Natural Resources, St. Paul, Minnesota. Email: Wade.A.Johnson@state.mn.us

In 2008 the Clean Water, Land and Legacy Amendment was passed in Minnesota. This Amendment allocates significant funding for restoration activities in the State for 25 years. Since 2008 nearly 4,000 restoration projects have been completed using Legacy funds. In 2011 a legislative requirement was enacted to evaluate habitat restoration projects funded by the Legacy Amendment. The goal of the Restoration Evaluation Program is to improve the quality of restorations throughout the State. The Agencies charged with implementing this evaluation program, the Minnesota Board of Water and Soil Resources and Department of Natural Resources, have designated program staff to facilitate third party reviews of restorations relative to the law, current science, and stated goals of the projects. They have also seated a panel of restoration experts to review project plans and field assessment reports. More than 100 evaluations have been conducted throughout the State in a variety of habitat types, including wetlands, prairies, forests, rivers, streams and lakeshores. Based on findings from the first five years of project evaluations, the panel has made five recommendations for improving restoration practice. These recommendations include improved restoration training, improved project documentation, and multidisciplinary project teams. Efforts are underway to support adoption and implementation of these recommendations as well as track the impact of the Restoration Evaluation Program on work done throughout the State. Moving forward it is anticipated that at least 30 restoration evaluations will be conducted annually. Program staff will continue to work to use the results of the evaluations to promote the science and practice of high quality ecological restoration.

Kearns, Kelly*. **Catch them before they spread: identification of new invasive terrestrial and wetland plants coming to a natural area near you.** Wisconsin Department of Natural Resources, Madison, Wisconsin. Email: kelly.kearns@wi.gov

Invasive plants are a significant impact to the quality of natural areas. Often a substantial amount of restoration time is spent on controlling invasives. Yet frequently ecologists, crews, and volunteers are not familiar with the plants that are spreading in the next county or state. Learning to spot these new

invaders before they reproduce and spread is critical to efficient and effective restoration and management efforts. This talk will cover the identification of a few dozen of the lesser known trees, shrubs, vines, forbs and grasses most likely to wreak havoc in natural areas of the upper Midwest in the near future. Habitats covered will include wetlands, riparian areas, prairies, savannas, barrens and forests.

Knosalla, Lori^{1*}, Rebecca Montgomery¹, Lee Frelich¹, Charlotte Roy², Lindsey Shartell², and Annie Hawkinson¹. **Investigating seasonal variation in prescribed burn impacts to lowland brush ecosystems.** ¹ University of Minnesota, St. Paul Minnesota. ² Minnesota Department of Natural Resources, St. Paul, Minnesota. Email: knosa003@umn.edu

Prescribed burning is a tool often employed by natural resource professionals to manage fire dependent plant communities such as lowland brush ecosystems. These plant communities are dominated by willows, alder, dogwoods, bog birch, Labrador tea, leatherleaf, and a broad diversity of grasses, sedges, and other herbaceous wetland plants. To maintain a patchwork of brush and open grassland/sedge habitat for wildlife within these ecosystems, natural resource managers use prescribed fire to reduce the encroachment of woody shrubs and trees. While prescribed burns are frequently conducted in the spring, historically, fires occurred throughout the spring, summer, and fall seasons. Studies in other plant communities show that the season in which a fire takes place impacts the variability in fire severity and how plant communities respond. In partnership with the Minnesota Department of Natural Resources, we are investigating how lowland brush ecosystems in northern Minnesota respond to burns in different seasons. The findings of this research will be applied to management practice to inform management objectives for lowland brush ecosystems. To date we have conducted two spring burns, two summer burns, and two fall burns. This presentation will include some of our preliminary findings, innovative approaches to monitoring fire severity, and what's coming in 2018.

Leimbach-Maus, Hailee B.*, Syndell A. Parks, and Charlyn G. Partridge. **Genetic analysis of invasive baby's breath (*Gypsophila paniculata*) populations in a northwest Michigan dune system.** Grand Valley State University, Muskegon, Michigan. Email: hailee.leimbachmaus@gmail.com

Biological invasions have become a major threat to biodiversity worldwide, and restoration practices often focus on invasive plant management as a way to begin restoring ecosystem integrity. 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 structure and dispersal patterns of baby's breath in the northwest Michigan dune system, so as to identify how this invasion is spreading throughout the region. We are using microsatellite markers to characterize genetic diversity and structure for six populations along the Lake Michigan shoreline. Our results demonstrated a high degree of genetic structure between southern-most and northern populations of baby's breath (F_{ST} value = 0.26, p -value < 0.0001). In a southern population at Zetterberg Preserve, which anecdotally is considered the origin of the infestation in northwest Michigan, individuals demonstrated higher levels of genetic diversity relative to a northern site at Petoskey State Park. In addition, the population at Zetterberg Preserve exhibited a higher observed heterozygosity (H_O = 0.649) compared to the Petoskey population (H_O = 0.315). Current analyses are continuing to assess how genetic variation changes across this north-south gradient. These differences could suggest a reduction in genetic diversity as this species spreads north (i.e. through founder effects) or separate colonization events could better describe the genetic variation

observed. These results will be used to inform The Nature Conservancy and the National Park Service of baby's breath populations with a high potential to contribute to further spread and reinvasion of managed areas, likely leading to a more targeted management approach.

May, Christopher A.*, Gust M. Annis, and Douglas R. Pearsall. **Western Lake Erie Coastal Conservation Vision – landscape scale planning for nature and people.** The Nature Conservancy, Lansing, Michigan. Email: cmay@tnc.org

Conservation planning provides a process for identifying and prioritizing lands for allocation of limited resources. Such efforts are often conducted by individual organizations with little coordination or involvement among other conservation entities, and rarely consider social or human values such as providing drinking water and recreation opportunities. The Nature Conservancy developed a Western Lake Erie Coastal Conservation Vision, which provides a mechanism to coordinate and optimize limited resources to meet both ecological and human well-being (i.e., socioeconomic) goals for a large (>11,913 km²) landscape, including portions of Michigan, Ohio, and the Canadian province of Ontario. The process involved: 1) multiple engagement events for partner organizations and other stakeholders; 2) identification and refinement of ecological targets and human well-being values and associated goals; 3) identification of costs or barriers to conservation; and 4) collection of GIS data representing all targets ($n = 13$), values ($n = 13$), and costs ($n = 7$). GIS data were analyzed and optimized using Marxan software. The effort culminated in an online, spatially-explicit decision support tool, which is available for stakeholders to use in planning protection and restoration projects, as well as estimating how much a project contributes towards overall landscape goals for both nature and people. Most priority areas are along the Lake Erie coast and adjacent to existing conservation lands.

McGuire, S. Andrew* and Timothy Ehlinger. **The social-ecological dynamics of linked surface-groundwater governance in Wisconsin.** University of Wisconsin-Milwaukee, Milwaukee, Wisconsin. Email: smcguire@uwm.edu

Governance of water resources cannot solely rely on scientific understanding to inform policy. Social and economic processes operating at multiple scales have the potential to push water systems across thresholds into undesirable alternative biophysical states. A recent and relatively unexplored example is the governance of linked surface-groundwater (LSGW) resources. A conflict over a high capacity well in southeastern Wisconsin was examined to explore why these conflicts emerge. Using the threshold matrix method, document analysis and open-ended key stakeholder interviews identified a total of 16 subsystems as linked to surface-groundwater use on scales ranging from individual property owners to the state level and across biophysical, economic and social domains. The analysis reveals that the dynamics of conflict originate from a lack of governing ability across state and watershed level interests concerning LSGW resources. The conflicting parties, in turn, use divergent pathways for resolution of these conflicts. Lack of meaningful participation at the scale of occurrence prompts watershed actors to enter the court system to further define state authority under the Public Trust Doctrine. In response, current powers at the legislative level are influencing surface-groundwater policy through placing limits on court rulings affecting state-wide issues such as oversight and evaluation of cumulative impact. Based on the current conditions, conflicts of this nature will continue to emerge unless steps are taken to integrate surface and groundwater governance.

McPherson, Brady*. **Function-based stream mitigation and its implications for ecological restoration.** Stantec. Louisville, Kentucky. Email: brady.mcpherson@stantec.com

Interest in providing replacement of aquatic resource function lost due to unavoidable impacts was brought to the forefront of mitigation in 33 C.F.R. PARTS 325 and 332, otherwise known as the “2008 Mitigation Rule”. Some of the most significant changes within the new compensatory mitigation guidance require documentation of functions lost and replaced as a result of permitted activities. Performing successful mitigation with functional considerations requires a deliberate mindset and has provided an opportunity for practitioners to implement more ecologically meaningful mitigation through optimized site selection, design approaches, and monitoring performance standards. Selection of mitigation sites with the purpose of connecting varying habitat at a watershed scale, improving instream habitat structure, incorporating large woody debris, and indexing biotic integrity are all examples of project components that can help optimize a project’s ecological improvements – particularly when compared to more traditional methods and metrics. Implementing mitigation with a functional directive on a broad scale can also foster discussion regarding shortcomings and provide a feedback pathway to the academic and practicing communities to improve understanding and provide practical solutions to identified challenges. The potential ecological benefits of characterizing stream function will be discussed to showcase the decision-making process that is necessary to optimize the ecological improvements of stream mitigation projects and their long-term success.

Melchior, Marty*, Ben Lee, and Ben Swanson. **Re-naturalization of a domesticated creek in the Midwestern United States.** Inter-Fluve, Inc., Madison, Wisconsin Email: mmelchior@interfluve.com

During the 1960s and 1970s, following significant industrialization throughout the Midwest United States creeks and rivers were altered for flood management purposes including lining channels with concrete, channel widening and realignment, and the installation of concrete drop structures. This talk is a case study of a local, recently completed, re-naturalization of an altered system that will look at the process, challenges, and lessons learned. Underwood Creek in Wauwatosa, Wisconsin is part of a large network of streams, rivers and wetlands that drain to the Milwaukee Estuary (designated an Area of Concern [AOC] in 1987) and was historically an important regional resource habitat for native fish and Native American trading. Inter-Fluve was contracted by Milwaukee Metropolitan Sewerage District (MMSD) to help enhance 1341 m of the downstream end of the Underwood Creek that extends to the confluence of the Menomonee River to improve instream habitat and connectivity for native fish species and increase species diversity and abundance. The project also provides connectivity to MMSD’s upstream restoration projects and create synergies with other estuary projects. This project includes providing fluvial geomorphology, ecology, fish passage assessment, and engineering support related to removal of the existing concrete channel and replacement with a rounded stone grade control base, riffle-pool channel morphology, and multi-stage channel and floodplain designs.

Murphy, Shane M.*, Darryl A. King, and Young D. Choi. **Effects of deer barrier and grass-specific herbicide on the growth of native ash seedlings (*Fraxinus* spp.).** Purdue University Northwest, Hammond, Indiana. Email: murph262@pnw.edu

The native ash tree (*Fraxinus* spp.) populations across the Midwestern United States have been greatly reduced due to infestation by emerald ash borer (*Agrilus planipennis*). This invasive beetle is responsible for the large forest canopy gaps observed in the Coffee Creek Watershed located in Valparaiso, Indiana. Promising regeneration of ash seedlings have taken hold in these gap openings. However local biotic factors such as deer browsing and competition against exotic reed canary grass

(*Phalaris arundinacea*) for soil resources may pose challenges for the seedlings to overcome. In this study, we tested whether releases from such challenges could promote the growth of ash seedlings. A total of 60 naturally recurring seedlings were selected in a gap of the Watershed and divided into three treatment groups: 1) control; 2) barrier to exclude deer browsing; and 3) grass-specific herbicide to remove competition with reed canary grass. Mean height increment of the seedlings under barriers (31 ± 5 cm) was >4 times greater than the control (7.5 ± 2 cm, $p < 0.01$) during 2015-2016. Leaf size dimension (length x width) also increased under the barriers ($+34 \pm 11$ cm²), and the opposite was true for the control (-23 ± 8 cm², $p < 0.01$). Herbicide application had no statistically significant effect on the seedling height and leaf size. Although marginally significant, the grass-specific herbicide reduced leaf chlorophyll content index from 2.34 ± 1.24 (control) to -0.96 ± 1.30 ($p = 0.08$), suggesting a toxicity to ash seedlings. There was no measurable effect of both barrier and herbicide on the stem diameter. We recommend place barrier-tubes around the ash seedlings to protect from deer browsing. Meanwhile, the grass-specific herbicide appears to be ineffective to promote growth of and likely harmful to the ash seedlings.

Orlofske, Sarah A.* and Robert C. Jadin. **Testing parasites as potential biological indicators of wetland health through food web models.** University of Wisconsin – Stevens Point, Stevens Point, Wisconsin. Email: Sarah.Orlofske@uwsp.edu

Wetland management and restoration efforts require tools for monitoring ecosystem conditions. The use of biological indicators has the potential to provide specific and reliable information of environmental stressors. Recently larval trematode (flatworm) parasites have been proposed as potential biological indicators of community abundance, diversity and trophic (feeding) links. Our research objective was to use a combination of field surveys and food web analysis to contribute to the development of parasites as potential biological indicators of wetland health. For three summers (2014 to 2016), we measured the abundance, distribution, and diversity of aquatic and semi-aquatic organisms in two cattail marshes to create food webs across a land use gradient. One site in northeastern Illinois is part of a nature preserve surrounded by restored upland habitat, while the second site in southeastern Wisconsin is in a mix of agricultural and suburban habitat. Importantly, our research included surveys of trematode and cestode (tapeworm) parasites that are transmitted by consumption to their hosts. Therefore, we gain information about predator-prey interactions that may be difficult to directly observe or quantify from gut contents. The wetland in the more intact ecosystem had a total of 36 free-living and 4 parasite taxa connected by 615 interactions, while the wetland in the more disturbed habitat had 31 free-living and 4 parasite taxa connected by 389 interactions. The species interactions at the sites also differed in terms of how species connect to one another and the relative importance of species in interactions based on several standard metrics including: 1) graph density (0.78 vs. 0.65); 2) alpha centrality (0.31 vs. -2.26); and 3) betweenness centrality (16.12 vs. 15.22). Management implications include understanding the presence and the interactions of species contributing to stability and resilience to disturbance such as land use change and offering managers a novel tool for ecosystem assessment.

Pitman, Zachery T.* and Todd A. Aschenbach. **Effects of fire season and temperature on a spotted knapweed (*Centaurea stoebe*) infested grassland.** Grand Valley State University, Grand Rapids, 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 it produces, (±)-catechin. We conducted our experiment in part of a restored prairie ecosystem at Pierce Cedar Creek Institute in Barry County, Michigan between May and August of 2016, with continued monitoring in the 2017 season. 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. 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 prescribed burning in the summer season may be an effective tool for removing spotted knapweed. Further research will focus on direct measurements of soil catechin using High Performance Liquid Chromatography.

Rice, Emma K.* and James N. McNair. **Assessment of baby's breath (*Gypsophila paniculata*) removal in the northwest Michigan dunes.** Grand Valley State University, Muskegon, Michigan. Email: riceemm@mail.gvsu.edu

Baby's breath (*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 United States and southern Canada. Baby's breath readily out-competes native plants in sandy, well-drained soils due to its deep taproot (up to 4 meters), allowing access to scarce resources. Baby's breath is of particular concern in the dunes because the areas where it is most dense are also where many endemic and threatened species are found. The current removal methods used are foliar application of glyphosate and severing of the taproot by manual removal. Although these methods have worked well in the past, baby's breath is spreading quickly and management efforts are slowed by the need for retreatment. To help address this issue, our research assesses current removal methods by measuring density and frequency over a large spatial scale before and after treatment, determining the regrowth frequency of treated plants, identifying environmental variables associated with high versus low density areas, and investigating how timing of treatment affects regrowth and germination. Ultimately, this information will contribute to the creation of an adaptive management plan specific to baby's breath that can be used in areas of North America and Canada where infestations of baby's breath occur.

Roberts, Summer*. **Lessons learned: five years of adaptive invasive species management at a corporate headquarters.** Environmental Consulting and Technology, Inc., Ann Arbor, Michigan. Email: sroberts@ectinc.com

Invasive species wait for no one. Although data collection, site assessment, and research on current removal methods are important in determining an action plan, managers face potentially dire ecological outcomes if action is postponed indefinitely due to uncertainty. In addition, managers often have limited, time-sensitive financial and human capital with which to complete their lengthy list of desired tasks, making expediency and efficiency extremely important. Adaptive management, or "learning by doing," is an iterative decision making process with the goal of reducing uncertainty over time by monitoring and adjusting actions based on previous outcomes. At ITC Holdings (ITC) corporate headquarters in Novi, Michigan, voluntary treatment of invasive species is an extension of ITC's dedication to environmental stewardship, and since 2013, ECT has been charged with practicing adaptive management to meet ITC's long-term environmental goals. Emphasis has been placed on removing invasive species from the following areas: 1) highly visible and well-trafficked public spaces, such as along the entrance drive and footpaths and 2) high quality habitats, such as a mature mesic hardwood forest with vernal pools. When invasive species are removed, weedy aggressive

species are often the first plants to recolonize. Hence, treated areas adjacent to or in high quality habitat have been planted with native species to further enhance the habitat and native plant diversity. Habitat enhancement timing, plant selection, and the potential for future treatments of resprouting invasive species add to the convoluted decision process behind invasive species treatment. ECT will present lessons learned over five years of using adaptive management to control invasive species and enhance habitat at ITC's Headquarters.

Rothfeder, Robin^{*1}, Sarah Hinnners², Diane Pataki², and Stephen Goldsmith². **Building multi-institutional capacity for watershed management and restoration: lessons from the Mountain West.** ¹University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. ²University of Utah, Salt Lake City, Utah. Email: rrothfed@uwsp.edu

While the climate, geology, and other biophysical and ecological characteristics in the U.S. Intermountain West differ greatly from the Midwest, the challenge of building multi-institutional capacity for managing and restoring watersheds is much the same. The case of Red Butte Creek (RBC) in Salt Lake City, Utah offers one compelling example. Over just a few miles, RBC exits the pristine conditions of a protected USFS Research Natural Area, flows through the University of Utah campus, enters the fully urbanized environment of Salt Lake City, and is piped underground to its outlet at the Jordan River. In its urban reaches, RBC has a long and all-too-familiar history of neglect and degradation. Recently, however, there has been growing interest in revitalizing the creek to improve its social-ecological potential for environmental quality, aquatic and riparian life, stormwater management, recreation, aesthetics, education, and original research into best watershed management practices for the arid West. University faculty, administrators, and students have partnered with local businesses, municipalities, residents, non-profits, community leaders, and others, initiating several restoration and enhancement projects at multiple sites and multiple scales along RBC. Examples include the Red Butte Creek Revitalization Project, the Williams Landscape Lab, and the Three Creeks Confluence Reactivation & Riparian Restoration Project. The authors of this presentation have played a central role in conceptualizing and initiating these efforts. Our presentation distills key lessons we have learned, including both successes and challenges. These lessons extend well beyond the Mountain West. Indeed, they indicate valuable strategies for collaborators in a variety of settings to: 1) merge science, policy, and urban design; 2) test presumed best practices in-situ; 3) create new knowledge; and 4) build multi-institutional capacity for managing and restoring watersheds.

Schultz, Rachel E.* and Jacob Straub. **Associations between marsh bird occupancy and wetland characteristics in the Glacial Habitat Restoration Area of Wisconsin.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: Rachel.Schultz@uwsp.edu

To reverse wetland loss and to regain essential habitat for wetland specialists such as waterfowl and marsh birds, numerous partners have joined to implement landscape-level restoration projects such as the 2262 km² Glacial Habitat Restoration Area (GHRA) in southeastern Wisconsin. We sought to assess the presence of marsh birds in these restored wetlands and to use multivariate techniques to evaluate how wetland characteristics at various spatial scales were associated with different species. In spring 2017, we used the Standardized North American Marsh Bird Monitoring Protocol to survey marsh birds on 28 randomly selected restored wetland properties, and 10 reference sites within the GHRA. We categorized wetlands based on hydrologic modification and included two separate reference groups: Waterfowl Production Areas (WPAs) and sites not modified with basins. Marsh bird presence was recorded in the morning and evening during three sampling periods starting the first week of May and concluding in early June. We used the Wisconsin Department of Natural Resources'

timed meander protocol to determine floristic quality of all wetland plant communities on the properties during July and August. We recorded 12 marsh bird species considered either primary or secondary target species at 34 of the sites and found that Wilson's snipe, swamp sparrow, lesser bittern, and Virginia rail were associated with wetlands embedded in a landscape that had greater than 40% wetland cover in a 1 km radius of the survey point. These species were also associated with wetlands that were restored using ditch modification or not modified with basins. Forster's terns were associated with the WPAs. Our preliminary results indicate that wetland characteristics associated with different methods of restoring hydrology in addition to landscape context could influence marsh bird composition and diversity.

Smiley Jr., Peter C.* and Kevin W. King. **Headwater fish population responses to planting grass filter strips adjacent to 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. Only a limited amount of information is available on the ecological effects of planting grass filter strips adjacent to channelized agricultural headwater streams. Our previous studies evaluating the ecological effects of grass filter strips indicate that widening the riparian habitats of channelized agricultural headwater streams by planting grass filter strips will not alter fish community structure. In this study we expand upon our previous evaluations of fish community responses by evaluating the population responses of five headwater fish species [blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), green sunfish (*Lepomis cyanellus*), johnny darter (*Etheostoma nigrum*), orangethroat darter (*Etheostoma spectabile*)] to planting grass filter strips. Our research question is does planting grass filter strips influence the population structure (abundance, size, age) of these five headwater fish species in central Ohio? We conducted annual sampling of riparian habitat and seasonal sampling of instream habitat, water chemistry, and fishes 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 from 2006 to 2015. Our preliminary results indicated that planting grass filter strips did not influence the abundance of these five fish species. Additionally, the abundance of these headwater fish species was not significantly influenced by riparian width or the vertical structural diversity of herbaceous and woody vegetation. Our preliminary results suggest that fish population responses to planting grass filter strips are similar to fish community responses and that planting grass filter strips will not contribute to the restoration of channelized agricultural headwater streams.

Swaty, Randy L.*, Kori Blankenship, Sarah Hagen, Kimberly Hall, Jeannie Patton, and Jim Smith. **Putting natural areas in context: LANDFIRE sets the stage for restoration, climate science, and landscape conservation.** The Nature Conservancy's LANDFIRE team, Evanston, Illinois. Email: rswaty@tnc.org

No natural area is an island. Each one interacts with the broader landscape and must be managed as such. The LANDFIRE program maps dozens of relevant vegetation metrics representing past and present ecosystem conditions. While designed for landscape scale work, the products can help managers to understand the broader context of their management and planning activities. To understand the ecological potential of a place, LANDFIRE maps historic fire regimes, and develops a concept similar to potential vegetation called "Biophysical Settings" that includes spatial data, descriptions and ecological models. These models represent how a biophysical setting would look and

function under natural disturbance regimes. To help managers understand the current vegetation conditions, LANDFIRE delivers datasets such as existing vegetation type, height and cover. Also, LANDFIRE delivers annual disturbance and fire behavior fuel models spatial data. While LANDFIRE does not deliver “future-looking” data, the aforementioned products combined with LANDFIRE-supported modeling tools allow users to explore potential management activities and climate change. In this presentation, we will discuss the basics of the data, explore some clever uses on real landscapes, present some guidance on what *not* to do with this powerful dataset and highlight the upcoming improvements.

Thomforde, Stephen*. **The benefits of grazing grasslands.** Dakota County Technical College, St. Paul, Minnesota. Email: stevethomforde@gmail.com

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-savanna biomes, and the herbivore and vegetation become codependent 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 and feedbacks between grazing and diversity; 3) introducing a biotic-community obligate to periodic intense 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 main grazing objectives and providing two different plans to achieve these objectives.

Wallace, Tori*, Carrie Brown, Kris Davis, Julie Hussey, and Shana Byrd. **Adaptive management challenges in the short-term: three years of forest restoration monitoring at the Dawes Arboretum Red Barn Reserve.** The Dawes Arboretum, Newark, Ohio. Email: landconservation@dawesarb.org

Restoring land from agriculture to native forest takes time and understanding of best management practices to achieve success. Long-term data to guide management is preferred, but in reality management decisions must be made annually. The Dawes Arboretum sought to evaluate native tree plantings over three growing seasons to determine best approaches in the short-term. Though each site has independent goals exploring reforestation, all sites aim to restore biodiversity and maintain survival. The 2015-site focused on control of vegetative competition and herbivory. The 2016-site compared survival of trees planted at varying ages. The 2017-site compared tree survival to predicted fate under climate stressors. Though based on short-term data, the project aimed to establish adaptive management for annual planning purposes. The 2015-site compared management through hand-weeding, string-trimming, mowing and a combination of techniques and showed mowing alone was least effective. These same trees were evaluated the following year for herbivory deterrence, comparing vegetative cover, tree tubes, natural bloodmeal and a cayenne pepper-based repellent.

Vegetative cover was more effective at deterring damage (62% survived), while tree tubes were least effective (55% survived). Reduced damage from mow equipment in vegetation-cover rows and suppression of re-sprouts from tree tubes influenced survival. In the 2016-site, differences of age at planting (1-3 years) and growth was not substantial. The 2-year-old trees had the greatest survival (100%), though limited species were evaluated. Regardless of species, the 2016-site with all trees tubed had the highest year-one survival among all sites (91% survived). Baseline 2017-site data showed climate adaptation survival to be comparable regardless of species or protection method (77% survived). Adaptive management suggests that growing a diversity of species within the protection of vegetation or tree tubes may reduce mower damage and herbivory, thus increasing survival more than unprotected or individually mowed trees alone. Future data will determine long-term survival trends.

Wenthe, Alex*, Kate McCulloh, and Joy Zedler. **Restoring a wetland gem: applications of current tools and technologies at Waubesa Wetlands State Natural Area.** University of Wisconsin-Madison, Madison, Wisconsin. Email: awenthe@wisc.edu

Meaningful ecological restoration requires the use of appropriate tools and technologies. These terms are often used interchangeably, as they are both a means to an end. However, tools are instruments that aid a task and technologies are the science behind how and why the tool works. In restoration ecology, tools and technology are invaluable when applied correctly, but detrimental and potentially dangerous if used inappropriately. And even when applied correctly, choosing the wrong tool can have long-lasting ill effects on an entire species or ecosystem. This presentation highlights the importance of choosing the correct tool and its safe operation for effective restoration. Ecologists use tools ranging from garbage bags to helicopters. I choose to explore new technologies of common tools (i.e., chainsaws, herbicides, prescribed fire) and new tools like laser transits and unmanned aerial vehicles (UAVs). I completed tasks in four skill categories consisting of: 1) monitoring and assessment; 2) use of tools; 3) use of GIS; and 4) facilitating stakeholder meetings. All tasks were completed at Waubesa Wetlands, in Dunn, Wisconsin and produced many tangible results. Successes of this project include updated vegetation maps, established biological benchmarks, reduced invasive species populations, increased support from adjacent landowners, and potential designation as a Ramsar wetland. New advancements spurred these successes. So as the tools and technologies of restoration continue to improve, so must the practitioners. As restoration ecologists, we are not only responsible for applying the appropriate tools and technologies of today, but also the effects they have long in the future.

POSTER PRESENTATIONS – ALPHABETICAL ORDER

Beal, Maxwell R.^{1*}, Erik R. Olson¹, Randy Lehr¹, and Dan Tyrolt². **Managing invasive aquatic macrophytes using controlled water-level drawdowns in a temperate flowage.** ¹Northland College, Ashland, Wisconsin. ²Lac Courte Orielles Ojibwa Community College, Chief Lake, Wisconsin. Email: bealm786@myemail.northland.edu

The aquatic invasive Eurasian watermilfoil (*Myriophyllum Spicatum*) has become a common problem in Wisconsin lakes. Eurasian watermilfoil outcompetes native species forming dense mats that can impede recreation and outcompete native aquatic plants. Many management strategies have been developed for controlling Eurasian watermilfoil but most struggle to deal with the issue on a large scale. The presence of a dam on a lake creates a unique opportunity for large-scale Eurasian watermilfoil management through controlled water-level drawdowns. In summers from 2005 to 2017, we monitored Eurasian watermilfoil and native aquatic macrophytes through point intercept surveys on the Chippewa Flowage in Sawyer County. Throughout this time, we have been able to compare compositions of aquatic macrophytes communities using the Floristic Quality Index (FQI) with and without water-level drawdowns. Preliminary results suggest that controlled water-level drawdowns greatly reduce Eurasian watermilfoil populations, increase the FQI score of the lake, and benefit species with high coefficients of conservatism more so than plants with low ones.

Burns, Madeline F.*, Hana L. Christoffersen*, Lauren N. Meyers*, Mary R. Parr*, Melanie Manion, and Todd A. Aschenbach. **Service-based learning in Ottawa County, Michigan: the restoration potential of fifty high school students.** Grand Valley State University Chapter of the Soil and Water Conservation Society, Allendale, Michigan. Email: parrm@mail.gvsu.edu

Due to the immense agricultural and commercial nursery industries in Ottawa County, Michigan most local natural areas have been significantly impacted by the introduction of exotic species. Pigeon Creek Park and Riverside Park are no exception. These natural areas have been managed in recent years for the removal of honeysuckle (*Lonicera spp.*), buckthorn (*Rhamnus cathartica*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), and Oriental bittersweet (*Celastrus orbiculatus*) by the Ottawa County Parks and Recreation Commission. As the hemlock woolly adelgid (*Adelges tsugae*) advances north, the expected impact of a new, devastating pest is cause for great concern. The Soil and Water Conservation Society (SWCS), a student organization of Grand Valley State University, initiated a service-based learning project in collaboration with Ottawa County Parks and Ottawa County Careerline Tech Center (CTC). During two service days in Pigeon Creek Park and Riverside Park, we aimed to inspire local youth involvement in the restoration, reclamation, and preservation of surrounding natural areas. SWCS and Ottawa County Park leaders educated fifty high school students about basic ecological processes and mechanisms of invasive species dispersion and survival. Students identified and removed invasive species, implemented novel, early detection techniques for the hemlock woolly adelgid, and dispersed seed at restoration sites. We foresee the potential for a strong, lasting partnership between Ottawa County Parks, CTC, and SWCS and contribution to the mission of the Society of Ecological Restoration-Midwest-Great Lakes Chapter, as Pigeon Creek Park and Riverside Park continue to undergo restoration.

Chipps, Austin*, Rachel Heatwole*, Alex Mandi*, Jack Sytsma*, Evelyn Kammeyer, and Russ Benedict. **Impact of increasing plant richness on pollinator use in Tallgrass Prairie.** Central College, Pella, Iowa. Email: benedictr@central.edu

Pollinators play an important role in the natural world, facilitating plant success. Our research plots located near Pella, Iowa, were seeded in fall 2011 and spring 2012 as part of a larger project examining impacts of increasing plant diversity on ecosystem services. Bees were visually counted monthly in 2017 from May to September in plots of tallgrass prairie varying in plant richness to investigate the impact of plant richness on bulk numbers of pollinators. During our observations, insects were visually separated into three categories: *Bombus* spp., *Apis mellifera*, or “native bee”. Observations of pollinator activity were made in plots of low, moderate, and high plant species richness as well as plots containing only smooth brome (*Bromus inermis*) or Indiangrass (*Sorghastrum nutans*). All plots were located in the same 5.7 hectare research site. Plots containing only grass seldom were used by pollinators. Comparing the three richness treatments, pollinator use varied by month and showed no consistent pattern. However, high richness plots did not support greater numbers of pollinators. All prairie treatments supported more pollinator activity than grass-only plots. An important limitation to our study is that the close proximity of all of our plots to each other may have increased the use of low richness plants by pollinators.

Draeger, Kymberly R.*^{1,2}, Daniel L. Lindner², and Glen R. Stanosz¹. **Forests, fungi, and soil formation.** ¹University of Wisconsin – Madison, Madison, Wisconsin. ²U.S. Forest Service, Madison, Wisconsin. Email: krdraeger@wisc.edu.

Biodiversity is related to ecosystem health. While community studies are often conducted with charismatic bird and mammal species, the microscopic communities have exponentially more diversity. Within forest ecosystems, the biggest organisms may be the fungi underground – causing *Armillaria* root rot, which begin as microscopic spores. Fungi comprise an incredibly diverse kingdom of organisms. Fungal roles are likewise varied, ranging from seemingly innocuous plant endophytes and mutualistic mycorrhizal symbionts to parasitic pathogens that can drive forest succession. Foremost among functions of fungi in healthy forest ecosystems, however, is decomposition. Fungi decompose organic matter into soil humus, and cycle carbon and nutrients. We explored the effects of time, biomass harvesting/thinning treatments, and compensatory soil amendment applications on fungal diversity in coniferous forests. We conducted above-ground fungal biodiversity assays by identifying wood-inhabiting fruiting bodies using morphological examination and DNA analysis. The type of woody substrates significantly affected fungal community analyses and species richness. We also determined the presence of wood-stake-inhabiting fungi using next generation high-throughput sequencing. This research compared the benefits and biases of the different sampling and analyses methods, as well as detailed the community of fungi responsible for the decomposition of woody materials into soil substrates. Our results reiterate that awareness of the fungal communities within forest ecosystems will aid forest managers’ assessments of forest health, sustainability, and general trajectory for succession. Fungal diversity assays can be a simple way to assess the success of forest restoration efforts, as well as predict the future forest.

Gumtow, Jon* and Paige Baker. **Flag River estuary restoration – understanding estuary dynamics and logistical constraints.** Stantec Consulting Services Inc., DePere, Wisconsin. email: Jon.gumtow@stantec.com

The Town of Port Wing and the Wisconsin Department of Natural Resources are collaborating with Stantec Consulting to restore wetland hydrology and habitat in the Flag River estuary. The project area contains two existing settling ponds constructed in 1968 as part of the Town of Port Wing's wastewater treatment system. This facility was decommissioned in 2011 providing a unique opportunity to restore this high quality estuary habitat utilizing Great Lakes Restoration Initiative funding. To understand the dynamic characteristics of the estuary, an analysis of historic records along with detailed physical, biological, and hydrologic studies were completed. This data was critical to developing a project design that restores an ecological gradient from open water to sedge meadow and scrub-shrub habitats that existed prior to 1968. Hydrologic studies helped understand the influence of seiche effects on the estuary's upper reaches. Plant inventories, soil borings, and topographic surveys played an important role in developing a restoration approach that considers the control of non-native invasive species, including reed canary grass (*Phalaris arundinacea*), and hybrid cattail (*Typha spp.*). Stakeholder collaboration during the early stages of this project was critical to understand and manage logistical constraints. Site access, construction techniques, recreational end-use, and beneficial reuse of surplus soil were considered early during the concept design phase to control costs and simplify the regulatory permitting obligations.

Gumtow, Jon*. **Going beyond the minimum with your restoration project.** Stantec Consulting Services Inc., DePere, Wisconsin. Email: Jon.gumtow@stantec.com

Restoration ecology continues to evolve, improving practitioners understanding of natural ecosystems and providing opportunities for continuous improvement. Recent large scale wetland and stream restoration projects completed near the City of Stevens Point and the University of Wisconsin-Stevens Point (UWSP) campus has provided unique opportunities to partner with the local community and engage the scientific and educational communities to increase the functions and values. The Moses Creek and Lost Creek restoration projects were completed to comply with regulatory mitigation requirements. However, early in the planning process it became apparent that the minimum objective to mitigate habitat loss could easily be expanded to include recreation, education, and scientific benefits to the local community. From the beginning, students and faculty participated in baseline studies, community involvement meetings, and design plan reviews which improved recreational (walking, birding) and "touch the water" public access points as well as public awareness of wetland functions. Engaging students to complete field tasks and to tour the sites provided outdoor educational opportunities to understand botany, hydrology, hydraulics, groundwater, soil, wildlife, engineering, regulations, and construction and incorporating these elements into a restoration project. Faculty provide valuable technical support and opportunities to train students and complete detailed science based analysis to critically evaluate the results. Going beyond the minimum requires a shift in our traditional approach to restoration projects. Communication, teamwork, and dedication is required to achieve these multiple goals and enhance the overall site functions. These are also important skills to convey to students looking to become the next restoration ecologists and continually expand our knowledge and understanding of these natural systems.

Hahn, Joseph, Hala Alassaf, Jessica Boyd, and Abbie Schrottenboer*. **Can a suburban campus be a haven for biodiversity?** Trinity Christian College, Palos Heights, Illinois. Email: abbie.schrottenboer@trnty.edu

College campuses can be spaces where fragments of natural habitat have persisted in developed landscapes and can provide opportunities for ecological restoration and management to increase biodiversity. At Trinity Christian College, the campus includes a forested corridor around a small creek and two wildflower basins planted with native plants. Our study aims to assess how these areas provide resources for animal biodiversity. To assess the vertebrate animals using the habitat, we have placed field cameras in the creek corridor. We oriented cameras with views of the creek and analyzed photographs to identify species, numbers of individuals, and timing of activity. To assess resources available to the monarch butterfly, the research focused on milkweed host plants. Host plant locations were located, marked, and documented in the two basins. An effort was made to tag monarchs on campus for the Monarch Watch project, which tracks monarch migration to their overwintering grounds. However, no monarchs were observed during the fall period of 2017. In the period from September to November 2017, we identified 13 vertebrate species in the creek or the surrounding area based on field cameras. Many of these were common species, such as raccoons and mallard ducks, but also species less commonly visible, such as coyotes and wood ducks. In the evaluation of milkweed host plants, plant density was low. As a result, we plan to use this data in a collaborative effort to promote a better monarch waystation that could potentially attract future monarch migrants. Future work will also include continued monitoring of the stream corridor and analysis of photos to understand habitat use. This information can be valuable in assessing how further restoration efforts can provide for local species within a suburban context.

Jensen, Deanne E.*, Tyler C. Shuman, and Robert B. Gillespie. **Effects of two-stage ditch segments on macroinvertebrate assemblages of channelized streams.** Indiana University-Purdue University Fort Wayne, Fort Wayne, Indiana. Email: zeppde01@students.ipfw.edu

Although recent research has shown that two-stage ditches are successful in ameliorating loads of suspended solids and nutrients to receiving streams, few studies have documented the impacts of the two-stage morphology on the communities of aquatic organisms. We predicted that aquatic communities that inhabit two-stage segments and/or downstream reaches of two-stage segments have higher diversity, richness, and abundance than those in channelized segments of headwater streams. Our study area comprised segments of Creel Ditch and West Branch, located in the Fish Creek catchment of the St. Joseph River Watershed in northeast Indiana. We collected data on macroinvertebrate assemblages, water chemistry, physiochemical parameters, and instream habitat quality from 15 segments from 2015 to 2017. Among these sites were 50-m stream segments consisting of Upstream Channelized (2), Upstream Unchannelized (4), Two-Stage (5), and Downstream Channelized (4) habitat. The quality of macroinvertebrate communities was considerably greater at segments in West Branch than in segments of Creel Ditch. It is likely that the more diverse communities of macroinvertebrates in West Branch result from a higher quality of instream and riparian habitat as indicated by the QHEI scores. The highest macroinvertebrate scores within each of Creel Ditch and West Branch came from segments in two-stage old segments. It is likely that the two-stage construction provides higher quality instream habitat for macroinvertebrates than that of channelized ditch morphology, even when riparian habitat is of greater quality. In fact, diversity of macroinvertebrates was greater in two-stage old segments than that of upstream and downstream segments in both Creel Ditch and West Branch where riparian habitat is predominately forested.

King, Darryl*, Shane Murphy, Eva Stein, and Young D. Choi. **The effect of canopy clearing on the herbaceous vegetation in Coffee Creek watershed, Chesterton, Indiana.** Purdue University Northwest, Hammond, Indiana. Email: king195@pnw.edu

During the 1990's, the exotic pest emerald ash borer (*Agrilus planipennis*) had infested ash trees (*Fraxinus spp.*) throughout the eastern and midwestern North America. The effects of the emerald ash borer can be seen in the Coffee Creek Watershed in Chesterton, Indiana where many ash trees were killed due to the infestation and subsequently created canopy openings in the process. The objective of this study was to investigate the effect of canopy opening on the herbaceous vegetation. The canopy clearing created gaps with exposure to solar radiation at $448 \pm 149 \mu\text{mol m}^2 \text{s}^{-1}$. Ground cover by herbaceous plants was >3x higher in the gaps ($249 \pm 53\%$) than the canopy sites ($80 \pm 49\%$) under tree shade with little solar radiation ($52 \pm 49 \mu\text{mol m}^2 \text{s}^{-1}$). Moreover, our Non-Metric Multidimensional Scaling ordination analysis revealed a divergence of the understory herbaceous vegetation between gap and canopy sites. The gaps were dominated by exotic reed canary grass *Phalaris arundinacea* ($21 \pm 18\%$ cover) and Kentucky bluegrass *Poa pratensis* ($10.25 \pm 9.40\%$), whereas the canopy sites were characterized by occurrence of native plants *Parthenocissus quinquefolia* ($14 \pm 9\%$) and *Carex pensylvanica* ($8 \pm 10\%$). In addition, a negative correlation between the reed canary grass cover and Shannon-Weiner Diversity Index ($r = -0.86$, $p < 0.01$) from our linear regression analysis suggests that the expansion of exotic grasses reduces herbaceous plant diversity.

Lamar, Sarah K.* and Charlyn Partridge. **Using herbarium specimens to reconstruct the invasion of Baby's Breath (*Gypsophila paniculata*).** Grand Valley State University, Muskegon, Michigan. Email: lamars@mail.gvsu.edu

Herbarium and museum records serve as untapped mines of survey data for many plant and animal species. Using herbarium records from across North America, the spread of invasive baby's breath (*Gypsophila paniculata*) was reconstructed and plotted by decade. The collection coordinates of over 300 specimens from 65 institutions were mapped using GIS software. These data are being used as a proxy for understanding how these populations have spread over the past century since the first recorded incidence of baby's breath in the wild in Manitoba in the late 1800's.

Loken, Zachary J.*, Rachel Schultz, and Jacob Straub. **Mapping spatial heterogeneity and floristic quality of wetlands in the Glacial Habitat Restoration Area of Wisconsin.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: Zachary.J.Loken@uwsp.edu

The Glacial Habitat Restoration Area (GHRA) is a 2261 km² restoration zone that spans across 24 townships in east-central Wisconsin. From 1990 to 2013, open water, emergent marsh and shrub wetlands increased by 72 km² in the GHRA. In summer of 2017, we used the Wisconsin DNR's timed-meander sampling protocol to assess wetland floristic quality of 38 randomly selected wetlands within the GHRA. We categorized wetlands into 3 groups based on hydrologic modification type and included two reference groups: Waterfowl Production Areas and unmodified sites without basins. Wetland plant communities were: 1) categorized following the Natural Heritage Inventory database; 2) mapped using aerial imagery from Columbia, Dodge, Fond du Lac, and Winnebago counties, Wisconsin; and 3) field checked for accuracy. Field sampling data will be stored in a file geodatabase using ESRI's ArcMap 10.5 software, including relative cover of introduced species and other floristic quality metrics for each property. Habitat heterogeneity will be assessed within each property using an interspersed-juxtaposition index (IJI). Greater percent values of IJI indicate that community types are

more evenly dispersed throughout the wetland than areas with large blocks of similar vegetation. Wetlands with diverse habitat types distributed throughout their basins may be more attractive to waterfowl than those with a homogenous composition. Our results will be used to assess landscape scale factors on dynamics of wetland-dependent bird species as well as provide a spatial representation of plant community characteristics.

Parajuli, Bishal*, Shelja Thakur, Adam West*, and Molly McNicoll. **Woodland community responses to *Rhamnus cathartica* and fire: vegetation, worms, and soils.** Luther College, Decorah, Iowa. Email: mcnimo01@luther.edu

Forest floor communities invaded by *Rhamnus cathartica* (European buckthorn) are typically depauperate in species and % cover. Additionally, the co-occurrence of invasive earthworms in areas of *R. cathartica* make it difficult to determine causal effects. Prescribed fire has the potential to top-kill *R. cathartica* and reduce the effects of competition. In an oak woodland in northeast Iowa, we sampled areas that were: 1) uninvaded or invaded by *R. cathartica*, and 2) unburned or burned (fall burns 2015, 2016). We sampled herbaceous vegetation (x20 plots per treatment), earthworms (x5 plots per treatment), and soils in summer 2017 along permanent transects. We predicted that herbaceous vegetation would respond positively to fire and the reduction of *R. cathartica*, and earthworms would be positively affected by the presence of *R. cathartica*, but reduced with prescribed fire given the loss of leaf detritus. Herbaceous vegetation responded positively to fire in uninvaded areas, but was negatively affected in invaded, burned areas. Baseline sampling determined earthworms were present in all treatments throughout the woodland. Species richness and abundance of earthworms appeared to be influenced by location in the forest (e.g., edge) more than by invasion status. However, earthworm abundance appeared to be negatively affected by prescribed fires. Recovery of vegetation from invasion of *R. cathartica* may take multiple prescribed burns to re-direct the trajectory. Earthworm invasion was more extensive in the sampled woodland than expected, but prescribed fire may provide a way to reduce earthworm abundance.

Peschel, Anna A.* and Ruth G. Shaw. **Restoration in an era of climate change: how will adaptive evolution affect prairie conservation?** University of Minnesota, Falcon Heights, Minnesota. E-mail: pesc0043@umn.edu

Rapid climate change has the potential to suppress plant population mean fitness below replacement such that their persistence will depend on a combination of adaptation and range shifts. In the tallgrass prairie ecosystem habitat fragmentation limits dispersal between habitat patches suggesting adaptive evolution will be necessary for species persistence. To directly evaluate the role of ongoing evolution in maintaining a population as the climate changes, research is needed which measures a population's additive genetic variance (V_A) for fitness, as it represents a population's immediate capacity to adapt to the environment in which it exists. However, the rate at which natural populations increase their fitness through natural selection is not known because few studies have estimated V_A for fitness within natural populations. To gain an understanding of the adaptive capacity of the tallgrass prairie ecosystem to climate change, I imposed a drought treatment in the field on a population of the annual prairie legume, *Chamaecrista fasciculata*. I deployed rain exclusion tents to reduce rainfall by 40 percent over the course of the growing season. For populations to survive under climate change, they must have genetic variability for fitness traits associated with warmer and drier environments, such as specific leaf area (SLA). Preliminary results show no significant difference in specific leaf area ($p = 0.1311$) and biomass ($p = 0.2271$), regarded as a fitness proxy, between treatments indicating no phenotypic plasticity for these traits in response to drought. These results suggest that population

persistence may depend on adaptive evolution of traits important to maintaining fitness under drought. Estimates of V_A for these traits, which indicate adaptive capacity, are currently being estimated. My research will improve our understanding of the response of tallgrass prairies to climate change and will provide an evolutionary lens through which we can examine seed sourcing practices in restoration.

Pyman, Andrew D.* and Charlyn G. Partridge. **Development of rapid assessment methods for harmful algal blooms (HABs) using qPCR.** Grand Valley State University, Muskegon, Michigan. Email: pymana@mail.gvsu.edu

Microcystis is one of the most common bloom forming cyanobacteria genera in fresh water environments. Certain strains are capable of creating harmful algal blooms (HABs) through the production of a toxic secondary metabolite, known as microcystin. HABs can cause many negative effects to the surrounding environment that include hypoxia, scums on surface waters, or unsafe drinking water. The goal of my project is to develop qPCR methods that allow for early detection and quantification of toxic or non-toxic *Microcystis* strains that will aid in the management of water resources to avoid public health risks. We will be using sequence specific primers and probes for qPCR that will assess the abundance and toxicity of *Microcystis*, as well as collecting environmental and nutrient samples to determine what factors are driving algal blooms and contributing to microcystin production. Currently, we have developed standards of our genes of interest for qPCR that will allow us to quantify the toxicity and amount of *Microcystis* present in the water. Furthermore, nutrient analyses have been performed on water samples collected from our study sites: Muskegon and Bear Lakes in Muskegon, Michigan. In tandem, this data will provide a spatial and temporal profile of the bloom status in these lakes, and will help to identify sources of nutrient pollution that can be used to aid future restoration efforts. The development of these qPCR methods will be used as a tool for managers to make informed decisions regarding public and environmental health.

Rice, Alexander C.* and Ande Myers. **An ongoing experiment in scientist-landowner relations and riparian restoration in eastern Montana.** Michigan Technological University, Houghton, Michigan. Email: acrice@mtu.edu

Critical to the success of any restoration project are the institutions and partnerships driving the work to be done. Often restoration is driven by regulation or institutional mandate following damage, degradation, or destruction of the ecosystem to rectify previous harm and restore ecosystem function and corresponding services. This project is an experiment which seeks to determine how much can be accomplished by willing students and scientists and a motivated landowner by leveraging a university-family business relationship in order to restore the riparian areas of spring-sourced streams on an active ranch in northeastern Montana. The project began with conversations between an ecology and an agriculture student at Colorado State University (CSU) about the tendency of their two professional groups towards acting in opposition of one another. This discussion sparked a desire to cooperate which led the Society for Ecological Restoration CSU Student Chapter to seek funding to attempt to revegetate riparian areas on the agriculture student's family ranch outside of Scobey, Montana. Willow and Poplar species had effectively been extirpated from the area following extreme fire and overgrazing in the early 20th century. In the spring of 2017 students from CSU with help from the owners of the U-Bar Ranch planted approximately 1,500 willow shoots and 250 bare root seedlings of various riparian and upland species along spring-fed tributaries of the Poplar River. Graduate Students from Michigan Technological University, now involved in the project, seek to continue restoration activities in a more experimental fashion in 2018 in order to augment the mutually beneficial outcomes of the undertaking. The restoration work will continue annually for as long as both parties are willing

in order to improve relations between the two professional communities as well the function and provisioning services of the agro-ecosystem.

Slater, Julie M.*, Jo Kingsbury, and Rachael E. Glover. **The Society for Ecological Restoration at OSU: a new SER student association.** The Ohio State University, Columbus, Ohio. Email: slater.150@osu.edu

Students at The Ohio State University have founded the Society for Ecological Restoration at OSU, the second student association of the Society for Ecological Restoration (SER) located within the boundaries of the SER Midwest-Great Lakes Chapter. The group currently consists of 34 people, mainly graduate students from an array of related departments: environment and natural resources, evolution, ecology, and organismal biology, landscape architecture, entomology, and engineering. Early meetings have identified members' interests in service through hands-on service projects and public outreach and professional development through visiting speakers, site visits, and interaction with students in diverse fields. Plans for the 2018 spring semester are to hold monthly socials and three events requiring more planning: a site visit in February, an outreach event in March, and a service event in April. SER at OSU is seeking to grow slowly as the group's identity and focus take shape, but enthusiasm is evident in the level of involvement of the group at large (especially considering that most members are graduate students). Members showed a strong interest in community service, and would welcome partnerships with organizations doing ecological restoration in the Columbus area.

Troy, Jennifer L.*, Abhijeet Bisht, and Robert B. Gillespie. **Effects of two-stage ditch segments on fish assemblages of channelized streams.** Indiana University-Purdue University Fort Wayne, Fort Wayne, Indiana. Email: troyjl02@ipfw.edu

Although recent research has shown that two-stage ditches are successful in ameliorating loads of suspended solids and nutrients to receiving streams, few studies have documented the impacts of the two-stage morphology on the communities of aquatic organisms. We predicted that aquatic communities that inhabit two-stage segments and/or downstream reaches of two-stage segments have higher diversity, richness, and abundance than those in channelized segments of headwater streams. Our study area comprised segments of Creel Ditch and West Branch, located in the Fish Creek catchment of the St. Joseph River Watershed in northeast Indiana. We collected data on fish assemblages, water chemistry, physiochemical parameters, and instream habitat quality from 15 segments from 2015 to 2017. Among these sites were 50-m stream segments consisting of Upstream Channelized (2), Upstream Unchannelized (4), Two-Stage (5), and Downstream Channelized (4) habitat. Diversity of fish assemblages was greater in West Branch than in Creel Ditch. However, there was no apparent relationship between abundance, richness, or diversity and ditch characteristics. A greater richness and diversity of fish communities in West Branch suggests a relationship between diversity and quality of habitat, but perhaps at a greater landscape scale than was captured by these segment assessments. Species diversity was slightly greater at two-stage old segments than channelized segments, but were similar to that of downstream channelized segments in Creel Ditch and West Branch. The short distance between segments and mobility of fishes makes it difficult to assess the relationship between fish community metrics and stream characteristics.

Weede, Kelly L.*, and Yari Johnson. **Correlation between wetland characteristics and imperiled Blanchard's cricket frog (*Acris blanchardi*) abundance across southwestern Wisconsin.** University of Wisconsin-Platteville, Platteville, Wisconsin. Email: weedek@uwplatt.edu

Blanchard's cricket frog (*Acris blanchardi*) used to be one of the most abundant frogs in southern Wisconsin. Over the past several decades, abundance has rapidly declined for unknown reasons throughout Wisconsin and the Upper Midwest. State and federal agencies are encouraging wetland restoration practices that also benefit cricket frogs. However, there is a dearth of information regarding what wetland characteristics are correlated with cricket frog abundance. We compared wetland habitat characteristics to cricket frog abundance, determined by frog calling surveys. We used both the Wisconsin Department of Natural Resources' wetland rapid assessment test as well as wetland habitat characteristics estimated using local variables adapted from the literature, *e.g.* pH, water temperature, soil texture, slope of the shoreline, and vegetation cover & species in the water and along the wetland edge. Our initial results show that there is a relationship between cricket frog abundance and the slope of wetland edges as well as a slight relationship between abundance and water temperatures. Sites with higher water temperatures, along with lower slopes had greater frog calling. Functions from the wetland rapid assessment test were not associated with cricket frog abundance. Percent vegetation cover in water, percent vegetation cover on ground, type of plant species present, soil texture, and water pH were not correlated with cricket frog abundance. Our results were based on one field season of data. Further data collection, such as continuous monitoring of water temperatures, could yield different results. Until more conclusive results are available, practitioners should use data from reference wetland with known cricket frog populations to guide wetland restoration.

Weissgerber, Andrea L.*, John Harrington, and David Bart. **The presence and disappearance of *Cypripedium candidum* in the southeast glacial plains of Wisconsin.** University of Wisconsin-Madison, Madison, Wisconsin. Email: weissgerber@wisc.edu

The purpose of this study is to determine what, if any, biotic and abiotic factors influence the presence and disappearance of the white lady's slipper-orchid (*Cypripedium candidum*) in the southeast glacial plains of Wisconsin. *C. candidum* is most commonly found in glaciated regions in calcareous fens and wet prairies. *C. candidum* was once a prevalent species in southern Wisconsin. However, populations have experienced rapid decline due to habitat loss and it is now a state threatened species. The current distribution of *C. candidum* is anecdotal and the last known surveys in Wisconsin occurred in the early 1980s. Currently, its population response to both community and ecosystem level changes is unknown. This species is believed threatened due to habitat loss contributed by land use change, alteration of hydrologic regimes, and woody and invasive species encroachment. Increased herbivory, possibly a result of fragmentation, is also thought to be a potential factor in its decline. I will survey 32 sites in Dane, Jefferson, Dodge, Waukesha, and Walworth counties, Wisconsin in order to determine current population distribution. Four of the survey sites will be studied to explore potential relationships with significant biotic and abiotic factors thought to be associated with *C. candidum* presence and disappearance. We expect woody and invasive species encroachment, alteration of hydrologic regimes, land use change, and herbivory will be negatively correlated with the presence of *C. candidum*.

OFFSITE FIELD TRIP & VOLUNTEER WORKDAY ABSTRACTS

Demchik, Michael*. **Emmons Creek savanna restoration field trip.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. Email: Michael.demchik@uwsp.edu

The focus of this trip will be visiting and discussing sand ecosystems in central Wisconsin: barrens, savannas and scrub oak woodlands/forests. We will visit the state managed Emmons Creek Fisheries Area and Emmons Creek Barrens. The management objectives for these properties are to provide trout habitat in Emmons Creek, provide habitat for barrens-obligate species like Karner blue butterfly, and to restore savanna habitat. Specifically, we will visit sites with younger grassland restorations, aging restorations, shelterwood cuts for oak regeneration, and undergoing proactive management to respond to future invasion by emerald ash borer and other activities. University of Wisconsin-Stevens Point (UWSP) students have been involved in many of the activities on this property. Much of the timber that has been marked and cut in the last seven years was done to support training students in timber marking for a wide-range of land management goals, which part of UWSP's annual marking camp. The monitoring for Karner blue butterfly has been done using student workers and a faculty member at UWSP. This property also hosts an oak reserve tree research unit for a faculty member at UWSP.

Cook, James^{1*} and Jon Gumtow^{2*}. **Moses and Lost Creek wetland restorations field trip.** ¹ University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. ² Stantec, DePere, Wisconsin. JC Email: jcook@uwsp.edu

The guided tour will visit two recently completed wetland restorations in and near Stevens Point. One restoration site is 0.07 km² in size and the other is 1.42 km². Originally, Moses Creek was a channelized stream within the eastern portion of University of Wisconsin-Stevens Point's (UWSP) Schmeeckle Reserve. A major restoration project in summer and fall of 2010 re-created the natural stream meanders and restored the historic wetland floodplain. New trails and boardwalks provide access to the wetland, which has been planted with trees, shrubs, and marsh vegetation. The \$900,000 restoration was funded as a mitigation project by the Wisconsin Department of Transportation. Participants will learn about the technical aspects of the restoration project, benchmarks for measuring success, and research on vegetative development and propagule sources. The second stop of this guided tour will be at UWSP's Schmeeckle Reserve Visitor Center and the Wisconsin Conservation Hall of Fame. Participants will then proceed to the Lost Creek site on the outskirts of Stevens Point. The Lost Creek site includes a diverse wetland complex involving 3.2 km of naturalized stream channel to replace low quality drainage ditch habitat and a landscaping plan that included a diverse mix of riparian, forested wetland, wet meadow, shallow marsh, and upland prairie habitats on retired farmland. The field trip leaders will compare progress at the two sites and draw conclusions about the utility of Wisconsin's wetland mitigation banking program.

Segerson, Peter^{1*} and Matt Salchert^{2*} **Tomorrow River fish habitat restoration field trip.** ¹ Wisconsin Department of Natural Resources (retired), Black River Falls, Wisconsin. ² Frank Hornburg Chapter of Trout Unlimited, Wisconsin. PS email: ps205v@hotmail.com; MS email: MSmattsalchert@yahoo.com

We will visit a range of stream restoration and dam removal projects along the Tomorrow River, a Class 1 and 2 trout stream located 20 minutes east of Stevens Point. We will visit the Nelsonville pond site, where a dam removal project in 1988 created almost a 1.6 km of high quality trout stream. We will also visit the Amherst mill pond site, where the community recently decided to repair a failing dam on the Tomorrow River. In the Amherst case, the pond has not returned exactly as expected and

we will consider the ecological and socioeconomic challenges that the site now presents. We will also view additional restoration sites and places where modified agriculture practices have fostered improved stream habitat and water quality.

Skawinski, Paul* and Jim Buchholz*. **Schmeeckle Reserve restoration project volunteer work day.** University of Wisconsin-Stevens Point, Stevens Point, Wisconsin. PS email Paul.Skawinski@uwsp.edu; JB email jrbuchhol@uwsp.edu

Participants will gain hands on experience with wetland and forest restoration as part of this volunteer workday. Schmeeckle Reserve is a 1.13 km² conservancy area located on the north side of University of Wisconsin-Stevens Point campus and about 10 minutes from the Holiday Inn-Stevens Point Convention Center. The reserve features 8 km of trails and boardwalk, a 0.10 km² lake, and numerous restoration challenges. Recent blow-downs created an opportunity to implement a 0.01 km² forest restoration project at a highly-visible street intersection. A project to eliminate non-native *Phragmites* spp. has also created opportunities to restore native wetland perennials. There are also many other opportunities to address other woody non-native invasives! Participants will work alongside with volunteers from The Friends of Schmeeckle Reserve and UWSP faculty and staff.

Rose, Ryan ^{1*} and Chris Hamerla^{2*}. **Green Circle Trail invasive species management project volunteer work day.** ¹ Portage County Parks, Stevens Point, Wisconsin. ² Golden Sands Resource Conservation and Development, Stevens Point, Wisconsin. RR email RoseR@co.portage.wi.us; CH email Chris.Hamerla@goldensandsrkd.org

The work site is located about 15 minutes from the Holiday Inn-Stevens Point Convention Center. Green Circle Trail is a scenic hiking and biking trail along the Wisconsin River that loops through the Stevens Point area. It represents one of the most popular and highly used recreation resources in central Wisconsin. Participants will gain hands on experience with invasive species removal and management as part of this volunteer opportunity. Additionally, participants will be provided with an overview of the vectors of woody invasive species and the long-term ecological goals for the trail and the nearby river islands. Our restoration work will focus on the removal of woody invasive species that have moved into the understory of a mixed pine and hardwood riparian forest. Participants will work alongside with volunteers from The Green Circle Trail Association.

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This partnership is a statewide, multi-faceted effort that has reaches far beyond the core groups to include regional, county, tribal, non-profit, and federal partners. Our goal is to continue to protect and preserve our state waters and support those meeting the challenges that come with the management and stewardship of Wisconsin lakes.



UW Extension Lakes is a team of educators that train and educate citizens statewide to be effective leaders in protecting and improving our legacy of lakes. We do this through a number of programs, including Clean Boats Clean Waters (limiting the spread of AIS at public landings on lakes) and the Citizens Lake Monitoring Network (empowering citizens to be environmental monitors on nearly 1,000 lakes). We also organize an annual conference, develop and deliver a free quarterly newsletter, and lead a leadership development program through the Lake Leaders Institute. We have collaborated with the Wisconsin DNR and local partners to develop the Wisconsin Healthy Lakes program, a simplified strategy to provide assistance to lakeshore property owners seeking to do the right thing with their shoreline buffers, in-lake habitat, and stormwater runoff. Learn more at www.healthylakeswi.com



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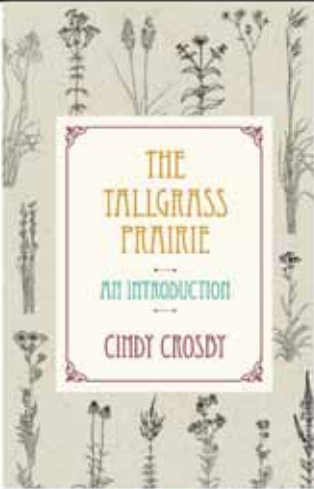
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Ecological Restoration in the Midwest Past, Present, and Future

edited by Christian Lenhart & Peter C. Smiley Jr.

"The editors and authors bring together the history, theory, and practice of ecological restoration in the Midwest into a much-needed resource. There is no comparable book dedicated to the broad range of topics, challenges, and successes of restoration for this region of the United States."—Christopher A. May, the Nature Conservancy



Focusing on six cutting-edge case studies that highlight thirty restoration efforts and research sites throughout the region—Iowa, Indiana, Illinois, Wisconsin, Michigan, Minnesota, and Ohio—editors Christian Lenhart and Peter "Rocky" Smiley Jr. bring together a group of scholars and practitioners to show how midwestern restoration efforts have developed, as well as where they are headed. Whether cleaning up contamination from auto plants in Ohio, or restoring native prairie grasses along the Iowa highway, the contributors uncover a vast network of interested citizens and volunteer groups committed to preserving the region's environment.

This study, intended for researchers, students, and practitioners, also provides an updated synthesis of restoration theory and practice, and pinpoints emerging issues of importance in the Midwest, such as climate change and the increase in invasive species it will bring to the region. Though focusing exclusively on the Midwest, the contributors demonstrate how these case studies apply to restoration efforts across the globe.

Contributors: Luther Aadland, David P. Benson, Andrew F. Casper, Hua Chen, Joe DiMisa, Steve Glass, Heath M. Hagy, John A. Harrington, Neil Haugerud, Constance Hausman, Michael J. Lemke, Christian Lenhart, Jen Lyndall, Dan Shaw, John A. Shuey, Peter C. Smiley Jr., Daryl Smith